BUILDING DEVELOPMENT COST DRIVERS IN THE NEW ZEALAND CONSTRUCTION INDUSTRY: A MULTILEVEL ANALYSIS OF THE CAUSAL RELATIONSHIPS

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BUILDING DEVELOPMENT COST DRIVERS IN THE NEW ZEALAND CONSTRUCTION INDUSTRY: A MULTILEVEL ANALYSIS OF THE CAUSAL RELATIONSHIPS

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Statement of Originality

I declare that this thesis is my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for degree or any other qualification.

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Lin Lin Zhao

Abstract of Research

Building development cost is influenced by a raft of complex factors which range from project characteristics to the operating environment and external dynamics. It is not yet clearly understood how these factors interact with each other and individually to influence building cost. This gap in knowledge has resulted in inaccuracies in estimates, improper cost management and control, and poor project cost performance.

This study aims to bridge the knowledge gap by developing and validating a multilevel model of the key drivers of building development cost (BDC) and their causal relationships. Based on literature insights and feedback from a survey of industry practitioners, some hypotheses were put forward in regards to the causal relationships between the BDC and the following key drivers as latent constructs: project component costs factor, project characteristics factor, project stakeholders' influences factor, property market and construction industry factor, statutory and regulatory factor, national and global dynamics, and socio-economic factor. Observed indicators of the model's latent constructs were identified and measured using a mixed methods research design.

Results showed that property market and construction industry factor was the most significant predictor of building development cost in New Zealand, while project component cost factor has the least impact. The model's fit to the empirical dataset, and its predictive reliability, was validated using structural equation modelling. Results of an additional model validation test by a panel of experts further confirmed its efficacy. Overall, the results suggest that sole reliance on the immediate project component costs without due consideration of the wider and more influencing effects of the external factors could result in inaccurate estimates of building development cost. Key recommendations included addressing the priority observed indicators of the most significant latent variables in cost studies and analysis.

Keywords: Building development cost, cost drivers, cost modelling, cost prediction

Ethical Approval

Massey University Human Ethics Committee (MUHEC) granted ‘Low Risk Notification’ to this research project. Such approval was granted on 20 October 2015 under Ethics Notification Number 4000015096 for the study titled “Building Development Cost Drivers in the New Zealand Construction Industry: A Multilevel Analysis of the Causal Relationships.

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Dedication

To my amazing Mother

Feng Yun Li

List of Abbreviations

ACENZ	Association of Consulting Engineers New Zealand
AMOS	Analysis of Moment Structures
ANOVA	Analysis of Variance
BDC	Building Development Cost
BRANZ	Building Research Association of New Zealand
DBH	Department of Building and Housing
IPENZ	Institution of Professional Engineers New Zealand
MANOVA	Multivariate Analysis of Variance
MUHEC	Massey University Human Ethics Committee
NGD	National and Global Dynamics Factor
NGD1	Global Political Dynamics
NGD2	Natural Forces
NGD3	Global Economic Trend
NGD4	Global Business Sentiments
NZIA	New Zealand Institute of Architects
NZIOB	New Zealand Institute of Building
NZIQS	New Zealand Institute of Quantity Surveyors
PCA	Principal Component Analysis
PCC	Project Component Costs Factor

PCC1	Design Cost
PCC2	Construction Cost
PCC3	Procurement Cost
PCF	Project Characteristics Factor
PCF1	Project Location
PCF2	Project Complexity
PCF3	Procedures Methods
PCF4	Contract Types
PCF5	Technology Innovation
PCNZ	Property Council New Zealand
PINZ	Property Institute of New Zealand
PMCI	Property Market and Construction Industry Factor
PMCI1	Material Market
PMCI2	Labour Market
PMCI3	Competition Level
PMCI4	Market Structure & Size
PMCI5	Boom and Bust Cycles
PMCI6	Relationship of Supply and Demand
PMCI7	Investment Tendency
PMCI8	House Sell/Rent Prices
PSI	Project Stakeholders' Influences Factor

PSI1	Clients
PSI2	Consultants
PSI3	Contractors
PSI4	Suppliers
PSI5	Building Officials
RMBF	Registered Master Builders Federation
SEF	Socio-Economic Factor
SEF1	Gross Domestic Production
SEF2	Capital Goods Prices
SEF3	Producers' Prices
SEF4	Consumer Price Index
SEF5	Productivity in Construction Industry
SEF6	Labour Cost
SEF7	Net Migration and Population Growth
SEF8	Employment Rate
SEF9	Housing Prices
SEF10	Building Consents
SEF11	Energy Prices
SEF12	Exchange Rate
SEF13	Monetary Policy
SEF14	Investors' Confidence

SEF15	Government Fiscal Policies
SEM	Structural Equation Modelling
SPSS	Statistical Package for the Social Sciences
SRF	Statutory and Regulatory Factor
SRF1	Building Code and Compliance
SRF2	Health and Safety Regulations
SRF3	Political Policies
SRF4	Financial Regulations
SRF5	Construction Contracts Act

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CHAPTER 1 INTRODUCTION

1.1 RESEARCH BACKGROUND

Building development cost has increased dramatically during the last decade (AISC, 2014). According to an American report (AISC, 2014), non-residential building development cost increased sharply in the past five years, surpassing the total consumer price index (CPI) based inflation rate by 19.4%. According to the UK's Nationwide Building Society (METRO, 2014), the average building cost increased by 8.4% during 2013 and might further increase by 8% in 2014. In the New Zealand context, building development cost increased more than the annual average earnings in Auckland for the period 2009 – 2014 (NBR, 2014). Building cost rose by 9.48% in the country's eight major cities in 2013, up from the minimal year on year increase of 2.61% in 2012 (GPG, 2014).

The construction industry is the foundation of New Zealand's economy. It contributes 5 percent of the GDP growth and employs 8 percent of the workforce in New Zealand; it also provides facilities that support the private and working lives of numerous New Zealanders (CIC, 2012). Moreover, it is by far the largest contributor to gross fixed capital formation (GFCF), which is the foundation of economic growth, contributing 45 percent of all investments in New Zealand (PWC, 2016). Also, the construction industry plays a more important role in New Zealand's economy than any other industry except the gas, electricity, waste, and water sectors, through its workers' income spending and the cascading effect on the supply chain. Unquestionably, the construction sector is one of the largest contributors to New Zealand's economy.

Clients that decide to invest in the construction sector consider building development cost as the most important factor (Grimsey & Lewis, 2005). A lack of extensive studies on the leading indicators that significantly influence building development cost is one issue that impacts clients' investments (Johnson et al., 2013). A study of the factors that significantly influence building development cost in New Zealand would not only contribute to narrowing the gap in existing knowledge but also provide empirical evidence to support clients’ investment decisions.

Many studies have examined the factors influencing building development cost (Hwang, 2009); however, the influence levels of the identified factors varied widely due to differences in the regulatory regimes of the respective construction industries. Furthermore, previous studies only focused on preliminary influential factors such as building cost components, project characteristics, stakeholders' influences, and new technology innovations (Johnson et al., 2013). They did not examine wider factors, which also have effects on building development cost. To mitigate the gap in the existing knowledge, this research aimed to examine the influences of a broad range of factors which have significant impacts on building development cost. For instance, although many studies have examined the relationships between building development cost and influencing factors, only a few considered the effects of the macro-economy and policies that have underpinning effects on the aggregate economy (AISC, 2014).

Exploring the relationships between building development cost and the significant influencing factors in the construction sector is vital to reliable cost estimation and cost management practices. Any fluctuation in building development cost could impact upon the decisions of investors, developers, clients, and financial institutions (Johnson et al., 2013). Reliable and validated relationships between building development cost and influencing factors can assist investors, developers, and contractors in making appropriate decisions thus ensuring well-planned cost management. Also, with a reliable relationship model of building development cost, construction managers can more effectively plan project schedules, estimate budgets, and manage projects more successfully.

1.2 PROBLEM STATEMENT

The dramatic increase in building development cost is usually explained by the increase in the prices of building materials and labour (MBIE, 2013a). However, the building material supply sector holds a different opinion. Although the costs of building materials have increased by 19 percent from 2002 to 2011, one-third of the increase is due to the changing specifications of the building materials in compliance with stricter codes and regulations (CCANZ, 2013). However, the main drivers behind the marked increase in building development cost remain unclear. Seventy-four percent of cost overruns are caused by underestimating the significant factors influencing building development cost (Elhag et al., 2005).

Building development cost relationship models have proved unreliable for many reasons, thus presenting a dilemma to the construction sector. Due to unreliable building cost estimates, investors and construction contractors could lose profits and other benefits, which could ultimately discourage them from investing in the construction industry altogether. This outcome could undermine actual construction sector growth. The relationship between building development cost and influencing factors may be determined using appropriate linear or non-linear statistical, mathematical, and simulation models. Modelling the relationship in some areas of application is capable of contributing to more accurate and effective planning and policy formulation.

The predicted relationship can be used to support many decisions on the management of construction activities. Owing to the uncertainty in the relationship between building development cost and influencing factors, practitioners and researchers have long recognized the importance of improving prediction performance in the construction sector (Love et al., 2005). Although many methods have been developed to predict the relationship between building development cost and influencing factors, the results are still unsatisfactory (Hegazy & Petzold, 2003; Isdore & Back, 2001).

From a different viewpoint, Baloi and Price (2003) argued that most cost relationship models base their calculations on preliminary influential factors, but they do not focus on other equally important factors. Chan, Scott, and Chan (2004) opined that it is unwise to ignore the cause-and-effect relationships between the construction sector and the international and national economic environments. All the sectors and industries conduct business in the macro environment and are influenced by it. Focusing the estimation of building development cost solely on factors within the immediate project system could exclude wider underpinning factors; for this reason, realistic results cannot be presented. Therefore, there is a need to examine the relationship between building development cost and a holistic range of influencing factors. This could provide a more stable base for policy making and investment decisions. Similarly, stakeholders require robust and reliable predictive models that address wider factors including socio-economic factors, the property market, and industry dynamics. The outcome of such systemic thinking could provide a more realistic view of the key influences of the observed movements in building development cost and thus help to effectively analyse and understand better the key drivers of building development cost fluctuations in the construction sector, which if taken on board at the estimation stage could result in more accurate and reliable estimation and contract planning.

1.3 RESEARCH AIM AND OBJECTIVES

1.3.1 Research aim

The primary aim of this study was to determine the factors affecting building development cost and the causal relationships between them. Previous studies have found that current building development cost relationship models are unreliable due to estimators not considering a wider range of significant influencing factors that contribute to building cost increases (Aibinu & Pasco, 2008).

1.3.2 Research questions

To address the research aim, the following research questions were put forward:

1. What key factors influence building development cost in the New Zealand construction industry?
2. What are the relative levels of influence of the identified factors on building development cost?
3. What causal relationships exist between the influencing factors and building development cost?
4. How do experts view the validity and practical relevance of the developed causal relationship model?

1.3.3 Research objectives

The key objectives of this research are to provide answers to the research questions. Specifically, the objectives are as follows:

1. To identify the key factors influencing building development cost in the New Zealand construction industry.
2. To examine the relative levels of impact of the identified factors on building development cost.
3. To develop and validate a model of the causal relationships between building development cost and the significant influencing factors.

1.4 RESEARCH SCOPE AND LIMITATIONS

The scope of information gathering for the study was limited to New Zealand. The focus was on the factors influencing building development cost from the perspectives of the survey participants who were experienced industry practitioners.

It is anticipated that the impact of the key cost drivers could vary depending on the building types and other potential influences such as locations, contract types, project types, client types and the experience and project management capabilities of the project team. However, the focus of the survey was on an average stock of buildings without exploring the intricate interplay of the complex influences.

Anticipated limitations of this study would primarily include the short window survey period within which the questionnaire data and the interview data were collected as planned in the doctoral study programme.

Some international factors could influence national building development cost, particularly for countries susceptible to global influences, like New Zealand. However, the analysis did not involve any international influences so as to minimise potential complications and achieve results that could provide starting points for more refined and focused studies in the future.

Therefore the research only provided a snapshot or window view of the building development cost in New Zealand within the data gathering period; it did not holistically address the changing and often complex array of factors that may be in operation as the construction industry transits from the boom to the bust cycles and back

Building development cost is also affected by various external events, such as political or economic policy initiatives, technological changes, and wider international influences. The study limitations require some caution regarding the extent to which the results can be generalised beyond the scope of the empirical data due to the complex nature of the macro-economic environment, and some gaps in the data.

1.5 CONTRIBUTIONS OF THE FINDINGS TO KNOWLEDGE

The study provides a framework for gaining a deeper understanding of a raft of factors that influence building development cost. It also identifies the key socio-economic factors that underpin and shape future trends of the immediate factors influencing building development cost. In addition, the study provides a causal relationship model between building development cost and the significantly influencing factors. This knowledge is expected to mitigate the current reliability issues, uncertainties and risks surrounding the trend and estimation of building development cost.

The research contributes to knowledge in several ways: first, it deepened understanding of the scope of influencing factors beyond those considered in existing literature (Aibinu & Pasco, 2008; Hwang, 2009a). The range of factors comprised project component cost, project character, project stakeholders' opinions, property market and industry dynamics, statutory and regulatory compliance, national and global dynamics, and socio-economic factors as identified from the empirical surveys. Secondly, the study examined causal relationships between the influencing factors and building development cost, with a view to establishing their relative levels of influence. The established causal relationship model was tested for internal reliability and validity via SPSS- and AMOS-based model validation tests. External reliability and validity tests were carried out through a third stage model validation survey conducted with experts who were experienced and high-ranking industry professionals. Finally, the study provided a pathway for ease of uptake and application of the findings by industry stakeholders. Overall, the findings could guide estimators of building development costs to understand and take into consideration trends in the key influencing factors in their estimation process in order to produce more accurate and reliable estimates; this is a clear departure from the current practice of loading contingency provisions to estimates merely on gut feelings without an empirically tested evidence base. The findings could also assist investor clients to make informed decisions about investments in the building construction industry.

1.6 STRUCTURE OF THE THESIS

The thesis comprises seven chapters as follows:

Chapter 1 is the introduction. It discusses the problem statement, objectives, limitations, and the contributions of the study to knowledge.

Chapter 2 focuses on literature review. It presents a review of related studies and research and the knowledge gaps that this research aims to fill. It also introduces the key concepts for the study, putting them in the context of the existing body of knowledge.

Chapter 3 presents the research model. It highlights the theoretical/conceptual framework that underpins the study. It also presents the key hypotheses to be tested based on the empirical data.

Chapter 4 presents the research methodology employed in the study. First, it explains why the study adopts mixed methods. Secondly, it introduces plans for qualitative and quantitative data collection and methods adopted, sources of empirical data, and representative sampling methods. Thirdly, the chapter presents methods adopted for analysing both the qualitative data and the quantitative data. Finally, the chapter ends with subsections on validity and reliability tests employed to validate the research model.

Chapter 5 illustrates the planning and implementation of the questionnaire survey, data presentation and analysis, and the structural equation model development based on the quantitative data.

Chapter 6 focuses on the tests and validation of the SEM model, including internal reliability and validity checks, and external reliability and validity tests carried out via analysed feedback from the industry experts' panel during the third stage empirical data gathering. Results are discussed in relation to the research objectives.

Chapter 7 is the conclusion. It presents a summary of the research findings, contributions to knowledge, a pathway for industry uptake of the research findings, recommendations to the industry and further research, and the limitations of the study.

The thesis comprises appendices that include samples of the questionnaire, ethical approval for the research, and other materials that add depth to the investigations and support the analyses.

CHAPTER 2 LITERATURE REVIEW

2.1 OVERVIEW

This chapter is dedicated to reviewing the literature on the key concepts embodied in the topic of research. It also explores the extent to which the key research questions and objectives have been addressed in previous studies. The chapter comprises discussions on the concept of building development cost and the key factors influencing the cost. The chapter ends with a subsection on the summary of the review of the literature, gaps in knowledge, and how the study aimed to contribute to filling the identified gaps.

2.2 BUILDING COST AND BUILDING DEVELOPMENT COST

According to International Construction Measurement Standard (ICMS, 2017), the building cost can be described as total project cost or total capital cost, including capital construction costs, associated capital costs, and site acquisition and client's other costs. This study only centres on the capital construction costs and associated capital costs, which collectively are described as the building development cost (Crompton & Howard, 2013). The Crompton and Howard (2013) approach to segregating the components of the total project cost lacks succinctness and could be confusing. ICMS (2017) provided a simpler and more succinct approach by breaking down the total project costs into three subcomponents: the land cost, land development cost, and building development cost. In the ICMS (2017) taxonomy, capital construction costs involve demolition, site preparation and formation, substructure, structure, architectural works/non-structural works, services and equipment, surface and underground drainage, external and ancillary works, preliminaries/contractor's site overheads/general requirements, risk allowances, and taxes and levies; while associated capital costs consist of work and utilities off-site, post-completion furniture, furnishing and equipment, construction-related consultants and supervision, and risk allowances.

The components of building development cost in this study are shown in Figure **2.1**.

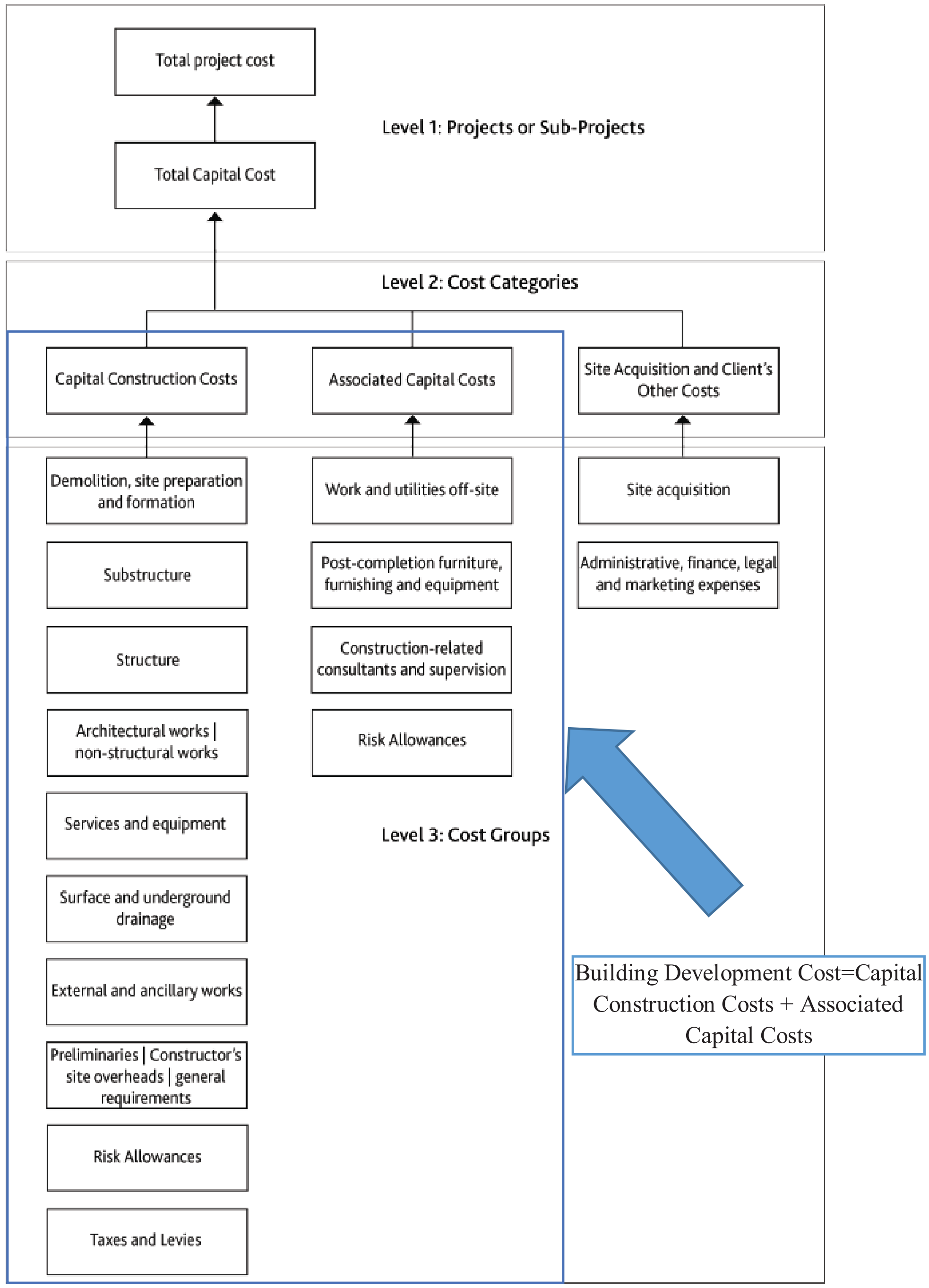


Figure 2.1 The components of building development cost [Source: (ICMS, 2017)]

Out of components of the overall building cost modelled in Figure **2.1**, the scope of the study focused on the building development cost. Focus on the building development cost was on the basis of these components being prone to the highest form of risks and uncertainties than the other cost components (Chan & Park, 2005). Furthermore, Harding et al (2000) argued that the industry practitioners are more concerned with the risks and uncertainties associated with estimation and understanding of the future directions of these cost components than other building cost components. This is also can be confirmed by the existing literature, which are displayed in Table **2.1**

Table 2.1 Literature summary of the component factor influencing BDC [Source: varied sources]

Underlying factors	Nature of effects	Literature source
Construction cost Fluctuation in material prices Shortage of suppliers Lack of standardisation Higher transport fees Shortage of skilled labour	The dramatic changes in materials from year to year means that with any preview of building cost it is difficult to capture current conditions, and thus calculate current increases in building development cost. There are just two major material suppliers in New Zealand; both are preferred by New Zealanders because custom-made products result in less efficiency in construction, and finally an increase in costs. The hilly terrain of New Zealand's geographic features and a relatively inefficient traffic system cause higher costs in materials transportation. Lack of skilled construction labour is a long-term problem in NZ's construction industry. This imposes pressure on labour costs.	(Rahman et al., 2013); (Page, 2008); (New Zealand Institute of Economic Research, 2013)
Design and consultant fees Proper scope definition Design errors	Proper scope definition right from the design stage is important for cost estimating - it has significant influences on decision making. Moreover, design errors can adversely affect the building cost budget through project failures.	(AbouRizk et al., 2002); (Lopez & Love, 2012)
Procurement costs Procurement process is difficult Efficiency of the competitive tender system	Managers usually consider a procurement process for construction projects to be a difficult and demanding task. Some professionals also complain that unnecessary costs are incurred in the contractor selection process.	(Jimoh et al, 2016); (Hardie & Saha, 2012)

The following section explains the various key factors influencing building development cost as reviewed in the literature.

2.3 KEY FACTORS INFLUENCING BUILDING DEVELOPMENT COST

Various factors significantly influence building development cost. Many studies have identified those factors which are significant in different countries. They all state that these factors are related to project characters, stakeholders' influences market and industry, statutory and regulatory regimes, socio-economic conditions, and the national and global environments within which they are operating. These, in turn, influence building development cost.

Bari et al. (2012) identified the factors, such as the statutory and regulation factors and socio-economic conditions which significantly influence the building development cost, by conducting a questionnaire survey. Bubshait and Al-Juwairah (2002) addressed the theory that component costs factors and stakeholders' influences are the key determinants for building development cost in Saudi Arabia by measuring 42 factors known to affect building development cost. Chan and Park (2005) conducted a random sample survey in Singapore to evaluate the factors that significantly influence building development cost, and then generated a result showing that project characters and stakeholders' influences are the major contributors to building development cost. Elhag et al. (2005) stated that market and industry factor impose a strong influence on building development cost in the UK after the analysis of their questionnaire results. Memon et al. (2010) conducted a questionnaire survey in Malaysia to identify the factors significantly affecting building development cost, and then said that stakeholders' influences are the key factors that impose significant effects on building development cost.

2.3.1 Project-related factor influencing building development cost

A review of the literature to date shows that the key factors influencing building development cost comprise project component costs, project characters, stakeholders' influences, market and industry factor, statutory and regulation regimes, national and global environments, and socio-economic factor. These are reviewed in the following subsections.

Although the component factors can significantly influence building development cost, it is reported that there are wider factors beyond the immediate component costs, including the project characteristics, the market conditions, industry completion levels, the socio-economic factor, and taxes (Turner Construction, 2014).

Factors influencing the cost base on the estimated result have been widely published. They primarily concern the project complexity, scope, and location (Love et al., 2005). Further, it is said that procurement procedures and contract types would affect building development cost (Harbuck, 2004).

It is obvious that large projects are invariably more expensive to be produced than relatively small projects (Chan & Park, 2005). When a large project is prepared for building, there might be a high demand for resources, such as material, labour, and equipment. For such requirements, local resource markets might not be sufficient, and resources from other regions must be called for. Moreover, if the project is complex, specialized resources might be required, thus incurring extra costs. In addition, both the project size and complexity are identified as the top factors to influence the building cost (Koleola & Henry, 2008).

It is said that projects in different locations would generate different construction costs (Martinez et al., 2009). The differences in land costs, labour productivity, equipment, materials, transportation, procurement methods, design and engineering, project management, building regulations, local market conditions and tax schemes are necessary to be well recognized.

Any procurement method is a combination of processes and procedures for acquiring construction products, including not only contractual arrangements for the construction project but also the sourcing of professional services, such as design, project management, and health and safety management (Brian, 2013). Currently, three main procurement methods are widely used, namely, traditional procurement, design and build procurement, and partnering procurement (Kirkham, 2015). The relationship between the client and the contractor by contract, compensation type, and cooperation forms can be settled in the procurement process.

The selection of proper procurement methods can underpin the relationship between involved parties so that the goals can be achieved, such as openness and trust cooperation, and the early involvement of key parties thus reducing the chance of risk (Alderman & Ivory, 2007; Dagenais, 2007; Wynstra, 2001). It was recently suggested that the chosen procurement methods might influence project performance, including the components of quality, time and cost (Ernzen & Schexnayder, 2000; Forgues & Koskela, 2008; Tang et al., 2006).

The existing literature investigated the effects of the project-related factors on the building development cost are summarized in Table **2.2**.

Table 2.2 Literature summary of the project-related factor influencing BDC [Source: varied sources]

Underlying factors	Nature of effects	Literature resources
Project size and scope	Increased costs are driven by high demand for resources.	(OBrien, 2009); (Chartered Institute of Building, 2014)
Project complexity Technical complexity Interdependence of workflow Task difficulty Lack of routine	Increased costs by conducting in detailed design and engineering. Project management becomes more difficult. Most likely to incur variation costs	(Christoph & Konrad, 2014); (Kerzner, 2017)
Project location	Price fluctuations in resources (labour, materials, and equipment).	(Stoy & Schalcher, 2007); (Dursun & Stoy, 2011); (Henderson & Stackman, 2010)
Procurement methods Contract type Form of payment Responsibilities for design, project management Number of subcontracting	The relationship between the client and contractor can be determined by contract types. Moreover, the contract can clearly state the responsibilities and liabilities of the parties involved. Procurement methods can influence all aspects of the project, from inception to completion, quality, time and cost.	(Lam & Gale, 2015); (Hardie & Saha, 2012); (Jimoh et al, 2016)

2.3.2 Stakeholders' influences on building development cost

The stakeholders, with a wide range of different areas of experience and expertise, can influence the construction sector through their connections including clients, contractors, and other suppliers (Fellows & Liu, 2012). Generally, the construction sector globally is subjected to any conflicts among the parties that are involved in the project (Rosenfield, 2014). Moreover, the knowledge and experience of the contractor in the project also influences the project cost (Zwikael, 2008). In addition, communication among the parties involved in the project also plays a vital role in project cost (Tabish & Jha, 2012). Normally, the client determines the scope and function of the project, and then consultants (architects and engineers) choose the structural types and materials. However, contractors are not considered as free agents in the construction process (Wang et al., 2013).

Clients as the initiators of the whole construction process can be broadly divided into two types: owners and developers (Hillebrandt, 2000). The owner builds the project for his own usage, while the developer desires to sell or let the finished project. Therefore, owners might place more emphasis on quality than on costs. It is reported that the clients' concern has shifted from capital or initial costs to whole-life costs (Sarker & Sahay, 2004). Moreover, clients' preferences for bespoke and tailor-made projects can complicate the project, thus increasing the building cost (Ondieki, 2011).

An experienced and expert contractor can better predict and control construction costs (Xiao & Proverbs, 2002). Moreover, some contractors are pleased to maintain a mutual trust and long-term relationship with their clients, which then assists them to sustain a continuous and stable workload in the future (Oakley, 2013). In addition, some contractors pursue the making of sufficient profits in order to satisfy their shareholders, while others emphasise producing projects within the time-schedule and under budget (Müller & Jugdev, 2012).

Also, the application of new technology and innovation in construction products and progress can improve effectiveness and efficiency, and thus decrease building development cost (Hampson & Brandon, 2004).

The findings from previous studies shown the significant effects of the stakeholders' influences on the building development cost are displayed in Table **2.3**.

Table 2.3 Literature summary of the project stakeholders' influences factor affecting BDC [Source: varied sources]

Underlying factors	Nature of effects	Literature resources
Clients Experience View on cost Preference on types of projects	One-off clients with less bargaining power must rely on professional advice to obtain appropriate contractors. Different clients might have different views regarding costs. Moreover, the clients might have different needs regarding projects.	(Cooke-Davies et al, 2011)
Consultants/Contractors Experience and expertise Vision on relationship Objectives of projects	Those contractors who build good long term relationships with clients can satisfy clients more effectively. Moreover, the experienced and expert contractors are less exposed to risks. In addition, instead of concentrating on making sufficient profits, some contractors place emphasis on producing quality projects within the time frame and under budget.	(Flyvbjerg, 2005; Ivory & Alderman, 2005; Remington et al, 2009)
Suppliers Level of services Value the relationships	The services provided by the suppliers also can affect building development cost. Further, a good relationship between the stakeholders and the suppliers also can encourage the suppliers to provide more valuable services.	(Chua, 1999)

2.3.3 Industry-related factor influencing building development cost

The structure of the construction sector affects the costs (Akintoye, 2000). For example, the more small firms exist in the sector, the fiercer the competition for small projects, as in New Zealand where nearly 90 percent of construction firms are small firms. These small firms compete for around 30 percent of the total construction work. Furthermore, a prosperous property market tends to increase the demand for construction products, thus increasing building development cost (Grimes & Hyland, 2013b).

2.3.3.1 Boom and bust cycles

Broadly speaking, the construction sector can be divided into private residential, private non-residential, and public construction, while residential construction has always been regarded as one of the most important groups in the construction sector (Stoy & Schalcher, 2007). The level of new construction is historically significantly affected by the housing market. However, the housing market is often regarded as unstable and speculative (Bageis & Fortune, 2009). An increased demand for housing can bring a construction boom, while a recession in the housing market results in a decline in housing sales, which in turn effectively reduces funding for the next round of construction. The volatility in construction outputs is caused partly by a fluctuation of the economy as a whole and partly by the character of construction products (Chan, 2005). Moreover, the boom and bust cycles in the construction sector have larger amplitude than the fluctuations in GDP (Ive & Gruneberg, 2000). The longevity of construction products and relative large stock of buildings also generates volatility in the need for construction, and external factors can determine to what extent the need can be transferred into economic demand (Aibinu & Pasco, 2008).

Cycles in the construction sector are assumed to be strongly related to economic growth, population, and the investment in building. Growth in the economy would lead to a natural increase in the population or in net migration. This, in turn, results in a population-led investment, in particular, the construction of dwellings and public infrastructure. It is manifested by the fact that a boom is always followed by a recession in the construction sector, reflected by volatility in the prices of land and property (Parke & Warren, 2014). The fluctuation in construction outputs is a global phenomenon. It gives rise to inefficiency in the productive functions, and generates decreased employment and investment in recession periods (Jiang et al., 2013; Ng et al., 2008). It is suggested that the prices of real estate deviate most remarkably from the fundamentals during these boom and bust periods (Ahiaga-Dagbui & Smith, 2013). If the developers' expectations are based on this myopic price, the response will be exaggerated, which results in an oversupply, followed by an asymmetrical slump in development—all of which increases the amplitude in the development cycle (Kim et al., 2004). Moreover, the prolonged and volatile cycles are generated by the unique nature of building investment (Barras, 2009).

Economic growth is triggered by an exogenous shock, such as the application of innovative technologies and government stimulus plans. Then the expansion of outputs and increased income lead to an increased demand for construction end-products such as dwellings and public facilities for the increased population, and industrial and commercial buildings for production expansion. The demand initially is met by the vacant building stock, and then either rent prices or housing prices increase. The increased profitability in development along with easily achieved credit due to the economic upturn drives the start of the first wave of development. Moreover, the increased building activities also stimulate the aggregate demand, but supply cannot increase in the short term due to construction lags, so prices will tend to increase quickly.

Economic prosperity continues to boost the demand for property, which maintains the increase in prices and intensifies the investor euphoria. The building boom - now in full swing - is accelerated by financial effects such as the expansion of credit to fund the second wave of more speculative building started by the steep increase in collateral values. At the same time, the first wave of building starts is completed and continues to reach the market, at last increasing the supply of buildings. The prices of buildings begin to turn down after they reach their peak, resulting in a decline in confidence on future returns. But construction costs are still increasing due to the construction industry nearing its operating capacity. Consequently, development profitability is decreasing, and then the rate of development starts its inevitable downturn.

This overheating of the economy also generates inflationary pressure, so that the interest rate is increasing and then the supply of credit is tightened, which further decreases development. Moreover, the multiplier effects of building activity lead to a slump in aggregated demand; a slowdown in the economy is underway. However, a high level of completed projects continues to reach the market, resulting in over-supply. The decline in prices accelerates. The shrinking value of collateral further restricts the supply of building loans. Eventually, the supply of newly-completed projects tails off, the rate of decrease in prices slows down. The value of property drops so far below the early expectations that building development is close to zero. Many developers will cease to exist, and many house-occupiers will be unable to cover their building loan with the increased interest rate. As a result, widespread loan defaults, bankruptcies and repossessions will occur. However, because of a decrease in building prices, construction costs also fall. All the necessary conditions are now in place waiting for the next building cycle. And each building cycle will increase the productive capacity of the economy up to a higher level by adding quantitative and qualitative fixed capital. How the building cycle works is displayed in Figure **2.2**.

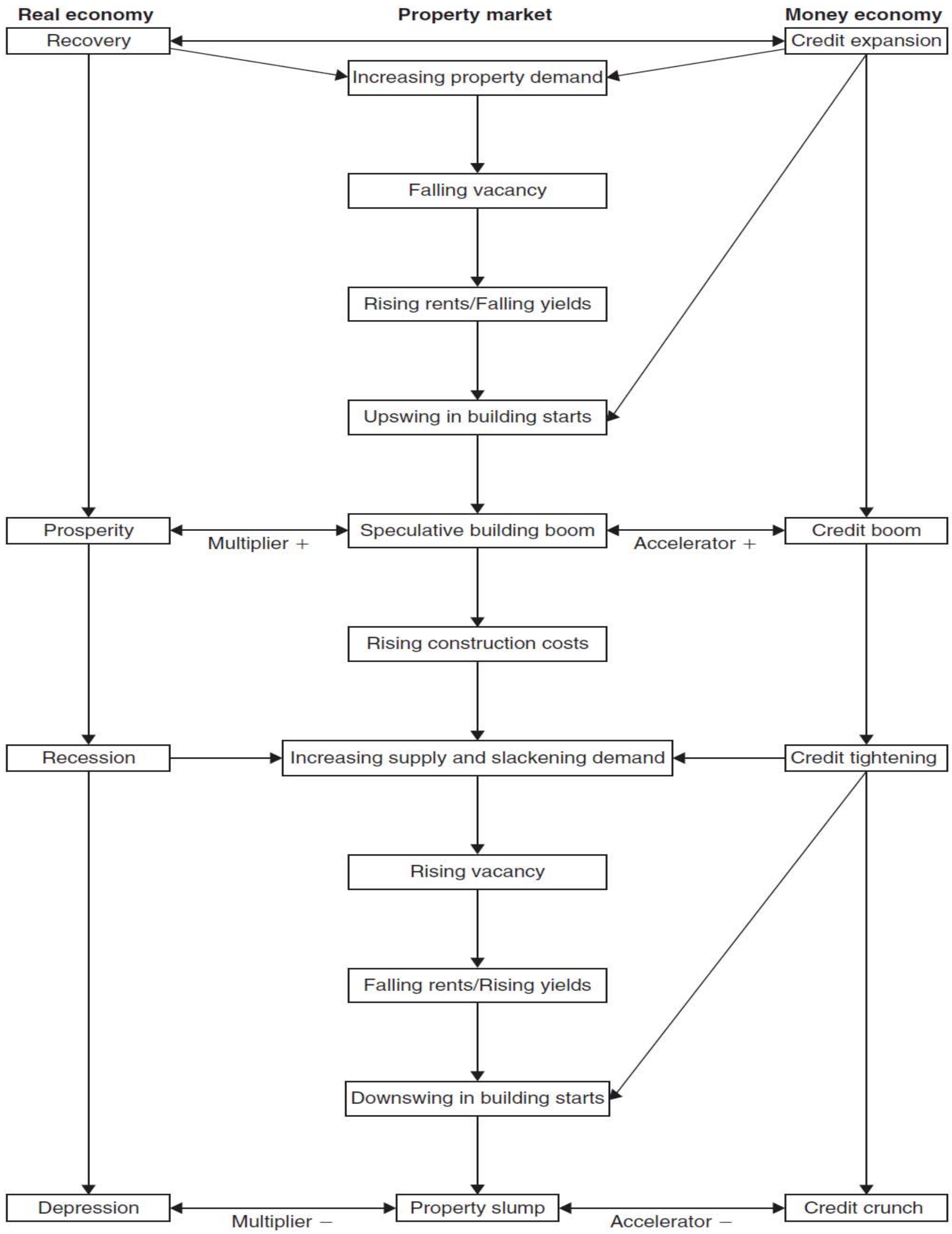


Figure 2.2 The mechanism of how building cycle works [Source: (Barras, 2009)]

2.3.3.2 Capacity

In the short run, the capacity is mainly determined by the fixed factors of production (Hillebrandt, 2000). The industry buildings with plant and machinery are the fixed assets in manufacturing firms, and their costs are often substantial. In the construction industry, where the fixed costs are relatively small, it is possible to hire plant and machinery to work on the site. The management of a construction firm, rather than fixed assets, can constrain its expansion. For example, the work quantity in a factory is mainly decided by the pace of the equipment, but on a construction site, a project is really a complex collaboration of a huge range of subcontracting inputs, so that project management is essential.

If the construction output is nearly at or above the maximum potential, the factor costs (material, labour, etc.) increase quickly. For example, firms tend to find themselves having a shortfall in labour, so they start to pay more and more in wages. Care is required to keep pay within the capacity of the construction industry, but it is difficult to measure.

Capacity provides a natural chock effect for the construction sector as increasing resource costs will depress the profitability of any construction development. But in some markets, this chock effect is mitigated by suppressed factor costs sourced from international migration. It is reported that migration inflows reduce construction costs (Barkham, 2012).

2.3.3.3 Productivity

In general terms, productivity can be defined as maximizing output while optimizing input (Constructing Excellence NZ, 2012). It is widely proven that the construction industry is far less productive in economic development across many countries (Department of Building and Housing, 2009). The low productivity of this industry can be summarised as being due to high prices of building materials, few of which are sourced from local materials (Abdel-Wahab et al, 2008), rising transport costs, delays caused by a less-advanced transport system, and a monopoly or oligopoly in the supply chain (Cheetham & Lewis, 2001). Also, a severe shortage of all types of skilled labour (Yi & Chan, 2014), such as manipulators, technicians and project managers, a less efficient local consent approval process (Lin & Huang, 2009), and the less development of local industry which is unable to undertake large and complex projects (Crawford & Vogl, 2006). All of these factors not only delay the projects and increase (and destabilise) prices but also are far from the objective whereby construction activity serves as the driving force of economic development.

In particular, the complete division of responsibilities of design and the obligations of construction along with the professional and institutional barriers would adversely impact the efficiency of the construction progress. Moreover, the competitive tendering stage after the design has been completed will exaggerate the separation. This inhibits the investments in this industry (Chartered Institute of Building, 2010); and hampers the stabilisation of skilled labour (Hanna et al., 2002); and prevents the investments of contractors in long-term benefits (Gao et al., 2014), such as training of labour, development of local materials, investment in new techniques and error correction for improving efficiency.

2.3.3.4 Conditions of construction industry

Owing to the complex nature of construction products, it is impossible to complete the work entirely alone, which normally involves managing and integrating a huge range of subcontracting activities and processes. Construction firms not only construct various products but they also diversify into other businesses to provide reliable services. For example, a large-sized construction firm might select to merge with a material supplier to complete the project on time. Considering changes in the conditions of the construction industry will assist to better understand the supply implications.

The previous studies examined the effects of the industry factors on the building development cost are summarised in Table **2.4**.

Table 2.4 Literature summary of industry factor influencing BDC [Source: varied sources]

Underlying factors	Nature of effects	Literature resources
Boom and bust cycle	The increased demand for housing can bring a construction boom, while a recession in the housing market will result in a decline in housing sales, which in turn effectively reduces funding for the next round of construction. The volatility in construction outputs is caused partly by fluctuations in the economy as a whole and partly by the characteristics of construction products.	(Ive & Gruneberg, 2000); (Kim et al., 2004); (Parke & Warren, 2014); (Stoy & Schalcher, 2007); (Hillebrandt, 2000)
Capacity and productivity	The capacity and productivity of the construction industry also represent the maximum limit of the industry.	(Crawford & Vogl, 2006)
Conditions of construction industry	The construction outputs usually can be seen as the products of the property market; the amount of construction products in the market has significant effects on the relationship between supply and demand.	(Kelly et al., 2015); (Smith, Merna, & Jobling, 2014); (Yusof et al., 2017)

2.3.4 Market mechanism influencing building development cost

It is reported that the factors that have impacts on the cost estimating practice include both market and financial conditions (Akintoye, 2000). Investigation of various theoretical types of market structure enables us to gain knowledge of the economic theories in the construction sector, and the formation of building costs relevant to outputs. Before introducing the market structure, it is necessary to illustrate the relationship between supply and demand which assists to better understand the effects of market structure on building costs.

2.3.4.1 Force of supply and demand

The interrelationship between supply and demand plays a vital role in the construction sector. A change in demand will drive supply to a new equilibrium state. For example, an increase in demand for building will increase housing prices. The price is not reduced until a new level of supply is achieved. In the construction sector, either the housing prices increase or the increased supply will increase the building cost (Clark & Coggin, 2009).

The market mechanism also can be called a price mechanism (Myers, 2013). The prices are determined by the interrelationship between supply and demand. If the demand for a product is increasing, this indicates that the consumers are pleased to expend more to acquire the product—the price goes up. In turn, the incomes of those firms which produce the product increase. Finally, with the increased profits, more resources are attracted into the sector —supply expands. On the other hand, if the demand for a particular product decreases, its price would fall, and the resources would leave the sector. This happened in the property market during the 2008 sub-prime crisis. The demand for housing declined, and prices fell by more than 30 percent during 2008-2010.

The concept of equilibrium is important for the relationship between supply and demand, defined as opposing forces being in balance. In any market, the point at which the given demand curve crosses the given supply curve is the equilibrium price. If the price drifts away for whatever reason, a new equilibrium price would be generated by the forces of supply and demand. A shock can cause a shift in the supply curve or a shift in the demand curve or a shift in both curves. This would cause a new set in the interrelationship between supply and demand and a new equilibrium price. Now consider a particular example in the property market.

In order to explain the dynamics of the property market, imagine a situation where mortgage interest rates decrease, while other factors remain constant. This would increase the demand for owner-owned property. Consequently, there will be a shortage of supply in the market, and prices are allowed to move up. As prices increase, consumers will become less interested in buying and demand will decline. As a result, a new equilibrium price will be generated. The relationship between supply and demand is shown in Figure **2.3**.

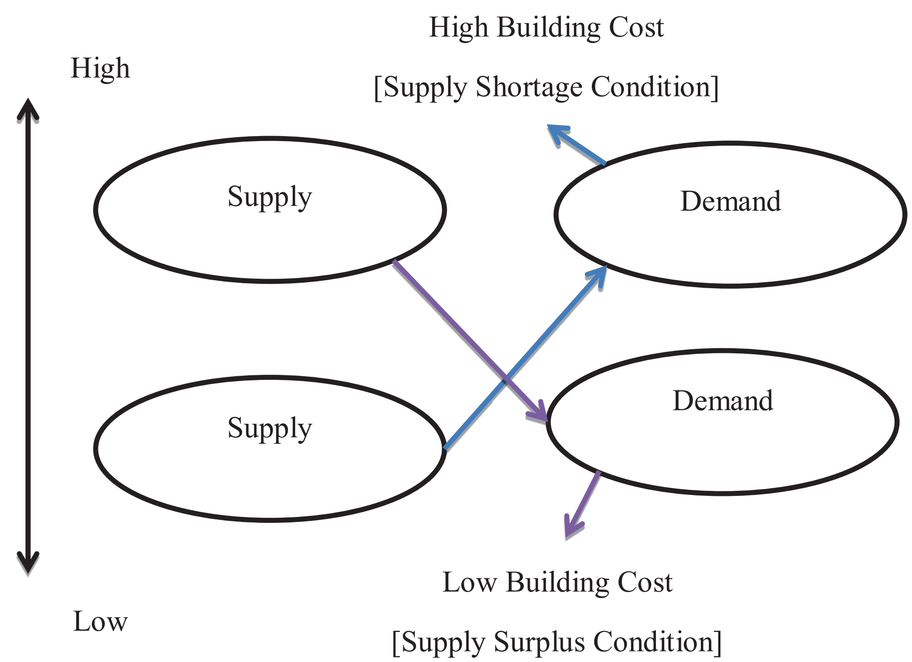


Figure 2.3 Price change related to supply and demand [Source: (Lai, 2003)]

2.3.4.2 Demands for construction products

It is a complicated exercise to attempt to determine the factors that significantly affect the demand for construction products. This is partly due to the nature of the construction products, such as scope, complexity, longevity, cost and investment incentives, and partly due to the wide range of subcontracts in any construction activity. Generally, the demand for construction products is determined by the price of the product being considered, the price of related products, the income level, and government policy and regulations. Moreover, there are some non-price facts that significantly affect the demand, namely, demography, interest rates, technology developments, fashion, etc.

2.3.4.3 Supply for construction products

The relationship between price and quantity of supply is direct and positive (Barker, 2003). When price rises, an increasing amount of products are supplied, and as price falls the number of supply products declines. It is impossible to estimate total construction supply due to a huge range of contractors. There are thousands of firms in the industry, from a small town builder undertaking repairing and maintenance to a large civil engineering firm. The industry clearly cannot be defined as one simple market. It is worthwhile to take notice of the factors which influence the supply of the construction industry.

The basic law of supply states that the larger the quantities of goods supplied, the higher the prices. The higher prices enable firms already in the market to consider expanding supply, and new firms to enter the market. Apart from the price factor, there are also other factors affecting the supply of construction goods, namely, the condition of the construction industry, expectations, and legislation (Cariaga & EI-Diraby, 2013).

2.3.4.4 Market expectations

A change in expectations of the prospects of the economy and future prices from a producer also influence the present level of supply. For example, if the producers anticipate a price increase in the future, they might withhold part of their newly-built stock from the market. In this case, a shortage of supply will increase the price.

2.3.4.5 Market structure

As stated above, the study has not assumed any market distortion, yet, in reality, the factors such as oligopolies, monopolies, trade unions, subsidies, high transaction costs, externalities and other market imperfections would distort the conditions. In order to understand the factors influencing building development cost, it is important to know the market structure into which the construction firms are selling their products. There are different market structures. Monopoly is one extreme where the market is dominated by one producer who can control the output and price, whereas perfect competition is the other extreme where both sellers and buyers cannot influence market price. Most construction firms are engaged in the market between these two extremes. In general terms, the market structure of construction is usually monopolistic competition or oligopoly in nature, both of which have an element of control over price making.

- Monopolistic competition

In reality, most markets are far from perfect competition. Monopolistic competition is where each firm can easily achieve a degree of monopoly advantages but is ultimately constrained by many competing firms. All the construction firms, including contractors, material suppliers and subcontractors, will try to distinguish their product from that of their rivals in order to obtain monopoly advantages. In this case, firms can obtain above normal profits only for a short time period because other firms will soon produce similar products. This means the market is really competitive and restricts long term profits.

- Oligopoly

An oligopoly can be defined as where a few sellers compete for the entire market (Ball et al., 2000). In this kind of market, each firm can avoid being a price-taker, but they still compete sufficiently because they cannot entirely control the market. In an oligopoly market, firms price their products or services depending on the response of their competitors. Moreover, if the firms make a coordination agreement in an oligopoly market, they will obtain more profits; however, if one firm breaches the agreement or become aggressively competitive, it can obtain more profits for itself (Chiang et al., 2001).

- Contestable market

A contestable market is used to describe how freely the firms enter or exit the market. The market is particularly contestable if the firms can enter and exit the market without incurring too much cost. A new entrant potentially increases the competition and constrains prices, so the making of high profits is unlikely to persist (Ball et al., 2000).

The firms will decide the price of the product depending on the market structure in which they are engaged. The price of building materials will directly influence building costs. Moreover, the market structure of the construction firms will decide the level of competition for the finite resource. For example, if firms can easily enter the construction market in a boom period, this will intensify the competition for the raw resource, and thus drive up the resource prices.

2.3.4.6 Business cycles-property market fluctuation-building investment

The impetus for economic development is not as smooth as is assumed in the idealized state of equilibrium growth (Kim & Shim, 2014). In reality, development progress is influenced by shocks which drive the economy away from its regular trajectory until some adjustment forces move the economy back to its new trajectory. This historic interplay of the shocks and adjustment forces generates the economic cycles in general and building cycles in particular (Freeman & Louca, 2001). The main cause of the business cycle is periodic investment (Shehu et al., 2014). The raising of product prices and declining production costs will lead to an increase in investment, but the expectation of future return is based on the present market conditions, without adequate consideration of the additional supply. This miscalculation will lead to over-investment, followed by an abrupt decrease in prices and a slump in production, and an economic downswing is underway. The banking factors like loan supply will exaggerate the fluctuations.

The trends of real house prices are closely related to the business cycles (International Monetary Fund, 2008). The link between the business cycle and property cycle is that property is often regarded as an asset on company balance sheets (Reed & Wu, 2010). The property assets account for a large part of the collateral for company borrowing so that the changes in their values can significantly influence economic activity. The changes in asset prices can directly influence the borrowing level of the corporates and further affect their investment expenditure, and the borrowing of the companies also affects the money supply. Moreover, the introduction of new financial instruments enables the linkage to become even closer. The fluctuations of the property market can influence the flow of investment in building activity, leading to volatility in property values that significantly affects the cyclical accumulation of building stock (Chan et al., 2001).

A lot of the existing literature has proved the close relationship between the business cycles and real estate cycles (Bracha & Jamison, 2012). A house is a luxury good; a certain number of people, whose income is insufficient, will be unable to own a house in the long term. In effect, their incomes are too low and volatile to cope with long-term loans. When interest rates are low, those people can possibly afford to buy their own houses, but when the interest rates increase, they are unable to afford the mortgage payments and thus default.

Every post-World War II economic recession was coupled with a precipitous decline in the housing market, which triggered a similar slump in demand for related goods and the reduction in employment in associated sectors (Yamarone, 2012). The business cycle is the main determinant for asset prices (Campbell & Diebold, 2009).

The findings from previous studies and research about the effects of the market factors on building development cost are displayed in Table **2.5**.

Table 2.5 Literature summary of market-related factor influencing BDC [Source: varied sources]

Underlying factors	Nature of effects	Literature resources
Force of supply and demand Equilibrium of supply and demand Demand for construction products Supply of construction products	An increased demand for housing will drive up house prices. This also increases the price of the raw resources (land, materials, labour, etc.) that are also a component of building costs. And, for rival firms in the construction sector, increased supply also intensifies their competition for resources.	(Clark & Coggin, 2009); (Cariaga & EI-Diraby, 2013)
Market structure Perfect competition Monopoly Monopolistic competition Oligopoly Contestable market	Firms' decisions on the price of their products will largely depend on the structure of the market in which they involved. Building costs are based on the price of raw resources (land, materials and labour). So the market structure of resource supplies will directly affect building costs. Furthermore, the market structure of the construction firms will determine the level of competition for finite raw resources.	(Ball et al., 2000); (Chiang et al., 2001)
Business cycle	This overheating of the economy also generates inflationary pressures, so that interest rates increase and then there is a tightening on credit supply; this further delays and reduces the start of new developments. Now, with the multiplier effects of a slump in building activity affecting aggregated demand, a slowdown in the economy is underway.	(Barras, 2009; Freeman & Louca, 2001; Jiang et al., 2013; Ng et al., 2008); (International Monetary Fund, 2008)

2.3.5 Statutory and regulatory factor influencing building development cost

Government policy and regulations can affect the demand for construction products in a variety of ways either direct or indirect (Schill, 2005). Generally, they can alter the incentives of participants from the construction sector. Unlike some short-lived factors, government regulations tend to permanently affect construction activities (Massimo et al., 2008). In their attempts to achieve their macro-economy objectives, all governments employ some policy instruments that, broadly speaking, fall into one of three groups: direct policy, fiscal policy, and monetary policy.

Direct policy places more emphasis on the specific objective and refers to direct control or intervention. Examples of direct policy are the building codes and regulations intended to improve the performance and quality of construction products. Changes in the building code will influence the design and application of standard materials and fittings used in buildings. The demand for code compliant products will increase, regardless of their price. Furthermore, the length of the building approval process will significantly influence building starts and hold fees for developers (Mayer & Somerville, 2000).

Fiscal policy comprises all forms of government spending and taxation (Myers, 2013). The government can control the overall economy by influencing supply and demand using public expenditure, taxation and financial powers (Glaeser & Gyourko, 2003). For example, if the economy is overheating, the government might decrease its spending or increase tax to constrain the demand. On the other hand, if the economy is in the downturn phase, the government might take reverse actions to stimulate the economy, and thus increase demand. Generally, the construction sector is one of the most favoured sectors by the government because it can absorb a large amount of labour and capital.

The government can act as client or contractors can directly invest in the required structure, namely, public schools and hospitals, roads and water supply, because the government is responsible for developing public facilities and infrastructure for enhancing the living standard of people. As well, some governments - like those in Hong Kong and Singapore - encourage the development of real estate because this development can create revenue for the government and generate economic prosperity. Moreover, the government can attract private or foreign investment in infrastructure development by introducing tax reductions or incentive schemes (Gundes, 2011). In either case, government expenditures act as investment accelerators for the private sector, which can affect the direction of economic activity.

The government can also affect the level of demand and supply by tax schemes, subsidy rules and environment considerations (Green & Malpezzi, 2003). Moreover, the general taxation affects the demand for construction products in a complex way because the demands are derived demands dependent on the requirements from other sectors.

Mostly, the central bank implements the monetary policy by setting interest rates each month to maintain the overall inflation target (Lanzafame, 2016). Owing to its important role in the economy, the government uses it to inflate or deflate the economy (Demopoulos & Yannacopoulos, 2015). For example, Australia's government used several intervention policies in order to stimulate the economy after the recession in the construction sector (Jiang et al., 2013). The building cycles are also influenced by the extent of capital market liberalization and the deregulation of financial and real estate markets (Goetzmann & Wachter, 2001). Inadequate regulation for financial services increases the risk of an excessive level of building supply. Moreover, the endogenous changes in credit market conditions can affect the demand and supply of buildings (Spencer, 2013).

The existing literature stated the importance effects of regulatory factors on the building development cost are summarized in Table **2.6**.

Table 2.6 Literature summary of the regulatory factor influencing BDC [Source: varied sources]

Underlying factors	Nature of effects	Literature source
Direct policy Building regulations and codes Trade policies Re-structure economy Structure reforms Foreign investment policies Labour union rules Environment issues	Direct policy places more emphasis on a specific objective and refers to direct control or intervention.	(Levin & Ward, 2011; Rolstadas et al., 2011)
Indirect policy Government spending Tax scheme Interest rate LVR Exchange rate	The government can control the overall economy by influencing supply and demand using public expenditure, taxation and financial powers. Mostly, the central bank implements the monetary policy by setting interest rates each month to maintain the overall inflation target.	(NZIER, 2014); (The Treasury, 2009)

2.3.6 National and international factor influencing building development cost

The demand for construction products is a derived demand, the level of which is materially decided by exogenous determinants (Ive & Gruneberg, 2000). The national and local government regulations can, directly and indirectly, influence the construction sector (New Zealand Productivity Commission, 2012). Other factors include unforeseen events such as Acts of God - including floods, hurricanes, tornados, or other weather-related factors - and also events controlled by third parties like terrorism, strikes, and changes in financial or commodity markets (Chang, 2002). In addition, New Zealand's economy is very dependent on global conditions; thereby the construction sector is vulnerable to the peaks and troughs of the worldwide economy (New Zealand Institute of Economic Research, 2013).

2.3.6.1 Global influence

- Globalization

Globalization has linked the world economy together, including the property market, and enables the movement of investment capital freely (Sassen, 2006). Because of the increasingly speculative nature of building investment, the building cycles seem to have become more convergent, widespread, and volatile, and appear to rapidly spread to many others (Hendershott et al., 2003). This effect can be illustrated by the 1997/8 Asian crisis. It appears that the integration of the market reinforces the contagion effect in the real estate market and encourages cycle coordination.

The increasing integration of financial markets and the liberation of capital flows have intensified the global investment in all kinds of assets (Trost & Oberlender, 2003b). The value of the global real estate market had an almost three-fold increase of $11.7 trillion from 1997 to 2007 (DTZ, 2008). It is apparent that the property cycle has become a worldwide phenomenon. The flow of investment in real estate propels the economy but also propagates market instability.

One implication of globalization is that investment is free and easily able to flow everywhere to achieve higher yields.

- Financial crisis

It has been indicated that the severity and duration of a recession could be determined by the macro-economy factors and the financial factors; in particular, the recession relevant to the housing price bust or credit crunch is deeper and longer than other recessions (Claessens et al., 2011).

A financial crisis can occur if three conditions are combined: speculatively inflated asset prices, high debt-income ratios, and a liquidity shortage (Kianir, 2017). The 2008 sub-prime mortgage crisis in the US housing market is a classic case of an excessive level of lending based on inadequate collateral in an over-heated property market, and it was spread through the worldwide financial market by complex securitized assets, such as mortgage-backed securities and credit default swaps (Syz, 2008). These credit derivatives previously had been used to trigger the economy, but they were now propagating instability (Augar, 2009). Then, two years of increasing interest rates had been sufficient to reduce US housing prices, leading to housing sales and development starting to slump (Berkowitz et al., 2003). This deteriorating market condition had been transmitted from the US to Europe by the new derivative instruments that magnified a national crisis into a worldwide financial disaster. Eventually, the global economy was in recession, as inter-banking ceased due to the universal uncertainty, and financial sectors were only able to continue functioning with support from central banks.

Inevitably, the 2008 financial crisis not only affected the financial systems but also induced the housing market collapse and the real economy downturn (Krugman, 2009). The transmission between financial market and real estate has been linked to credit financing (Allen & Gale, 2000). Moreover, the introduction of new financial instruments like mortgage-backed securities tends to magnify the transmission risks between financial markets and real estate (Hunter et al., 2003). The investment and output had been negatively influenced by the cutback in development starts; the over-burden of debt and shattered confidence further depressed household consumption, and the shortage of liquidity caused business failures across the economy. Therefore, the 2008 crisis generated worldwide bank failures, a large amount of unsold property, and a severe slump in construction activity.

The deregulation of banking and financial institutions has enabled loans and mortgages to be easily achieved; this is regarded as being responsible for the excessive level of construction (Dowd & Hutchinson, 2011).

- Sustainable development

The combined effects of global warming and diminishing fossil fuels are the catalyst for sustainable development that will significantly impact building features. Sustainable development has to become a priority objective in some construction projects (Grundy & Li, 2010). Sustainability itself consists of three parts: economy, environment, and social issues (Myers, 2013). Sustainable development will significantly influence the construction sector, as this sector consumes more resources than any other industry and generates a large proportion of waste and carbon dioxide. Moreover, construction products provide the physical facilities and infrastructure that can decide the extent of freedom and flexibility from which society can benefit.

2.3.6.2 Nature majeure

It has been stated that unforeseen events - called Acts of God and including floods, hurricanes, tornados, or other weather-related factors - and also events controlled by third parties, like terrorism, strikes, and changes in financial or commodity markets, are also cost-influential (Chang, 2002).

More than 220,000 people died in disasters, such as earthquakes, flooding and cyclones – in addition to a total loss of US$45 billion - in 2008 (Swiss Reinsurance Company, 2010). With the growth in population and facilities, the world's exposure to hazards—both natural and human-related—has been increasing. Disasters tend to cause loss of lives and damage to properties, both personal properties and common infrastructures. The construction industry plays an important role in response to disasters, such as providing temporary shelters and restoring public infrastructures and services. And, although disasters lead to loss of lives and wealth, they also provide a new opportunity for progress. A major disaster can often lead to a construction boom in the longer term (Benson et al., 2001).

Any unfortunate incident will inevitably require physical reconstruction. At the same time, it is important that any reconstruction should ensure these damaged areas are less vulnerable in the future. Moreover, the large scale of reconstruction will lead to a shortage of local resources in the construction industry. A sudden shortfall in human resources can produce immigrant employment niches (Sisk & Bankston-III, 2013). The immigrant factor plays a vital role in the restructure of the construction industry.

The construction industry is a strike-prone industry in the USA (Yu et al., 2008). Strikes cause construction stoppages and huge economic loss. Moreover, technical problems like equipment malfunction also can cause work stoppages and economic loss.

2.3.6.3 Socio-cultural factors

It is essential to understand that the process of the invention, innovation, and adoption of technical progress are subject to historic influences, social and cultural as well as economic and scientific (Akanni et al., 2014). The construction methods that are used to construct a house are affected at least as much by cultural and aesthetic considerations as by technical possibilities (Barras, 2009). Moreover, the building is sometimes considered as a cultural symbol (Navon, 2003). For example, the skyscraper is the most powerful representative of American life and civilization.

The existing literature suggested the influencing effects of the majeure forces and global influences on the building development cost are shown in Table **2.7**.

Table 2.7 Literature summary of the global factor influencing BDC [Source: varied sources]

Underlying factors	Nature of effects	Literature source
Fluctuation in material and energy prices Fluctuating energy prices Increasing commodity prices Increasing transportation fees Increasing prices of machinery and equipment	Price fluctuations are not only influenced by the domestic market but are also affected by global influences, especially in the natural energy sector.	(Olatunji et al., 2017; Yang et al., 2010)
Global influences Emerging Market Globalization Sustainable developments	Influences from emerging markets and new technology will spread faster around the world than ever due to globalisation.	(Grundy & Li, 2010); (Hendershott et al., 2003); (Trost & Oberlender, 2003)
Financial Crisis	As the fruit of globalisation, the world connects more deeply and broadly than ever, also in the financial sector. Financial distress occurring in one country, particularly one with a big economy, will have significant effects on the world economy.	(Allen & Gale, 2000); (Berkowitz et al., 2003); (Hunter et al., 2003); (Krugman, 2009)
Majeure Forces Flooding Earthquake Storm Bush fire	Such a sudden disaster can cause huge loss for human beings including a sudden shortage of shelter. The resulting increase in demand will push up the supply prices.	(Benson et al., 2001); (Sisk & Bankston-III, 2013)
Socio-cultural factors	Those construction products built centuries ago are considered as cultural symbols. Moreover, the buildings must also take into account the cultural and aesthetic aspects.	(Barras, 2009); (Navon, 2003)

2.3.7 Socio-economic factor influencing building development cost

A building project is complex and idiosyncratic, and building development cost is difficult to estimate beforehand. However, keeping a watch on the macro-economy to identify factors that influence building costs can reduce uncertainty (Barkham, 2012).

2.3.7.1 The direct impacts

The fluctuation in building costs shares a similar pattern to the macro-economy. However, this symmetry is complicated by the fact that economic growth is often associated with investment (Myers, 2013). Socio-economic indicators reflect the real social economic environment of the world, and they are the root factors; all social and economic activities including building activities would be influenced by them. Generally, the engineering and construction complexities of such projects are overshadowed by economic, social and political challenges which influence the project cost (Shane et al., 2009). A better understanding of the factors influencing the cost is achieved through exploring the forces driving each factor and the origins of the factors.

2.3.7.2 The impacts on housing market

OECD (2005) suggested that the fundamental factors within the economy would well explain the actual property prices. Gelain et al. (2015) revealed that the housing market booms and busts episodes often linked with the macro-economic fundamental changes. Single and cross-country studies generally concluded that the macro-economy has a strong interrelationship with the housing market. Snyder (2011) pointed out that the financial innovations changed the mortgage, interest rate and leverage and reduced constrain in borrowing sector, all these caused the housing prices overvalued beyond the housing supply and demand factors.

Case (2000) said the economic fundamentals have an impact on the US housing market and the influencing level depends on the openness of different states. Fraser et al. (2007) said that the high housing prices in New Zealand due to the house overvaluation. German real house prices have reached a modest peak in 1994, which coincided with a construction boom (Ahearne et al., 2005). Nguyen and Wang (2010) reported that the shocks of GDP, CPI and interest rate have significant effects on the housing prices.

Igan and Loungani (2012) addressed that housing prices are strongly influenced by the business cycles, thereby, driven by economic fundamentals, such as income growth industrial production and employment rate. McQuinn and O'Reilly (2008) said that the income level and the interest rate have an impact on the property prices. Reed (2016) stated that non-credit factors, such as immigration, income growth, and family structure changed played important role in the housing markets of UK, Ireland and Spain. Kishor and Marfatia (2016) provided evidence that the economic variables such as employment rate, industrial production, and money supply influence the housing prices.

Schneider (2013) revealed the relationship between the housing prices and the economic fundamentals like mortgage rate produce price and exchange rate. Stevenson (2008) used vector auto regression model to test the relationship between the economic fundamentals with the residential market of 17 developed economies between 1970 and 2003, they find that the factors, such as economic growth, inflation, interest rate, bank lending, and equity prices have more direct effect on the residential market.

Davis (2004) analysed the patterns of dynamic interaction between bank lending and property prices based on a sample of 20 developed countries using both time series and panel data techniques. The main finding of his study is that long-run causality appears to go from property prices to bank lending. Zhu (2006) examined the long-run relationship between macroeconomic variables and house price dynamics (including GDP, bank credit, equity prices, short-term rate, CPI and exchange rate) in six Asia-Pacific (China, Hong Kong, Indonesia, South Korea, Singapore and Thailand) economies by applying the two-step error correction method (ECM). The study suggested that the driving factors behind house prices tend to be country-specific. The interest rate that is manipulated by the central bank has holistic effects on the economy its influencing route is displayed in Figure **2.4**.

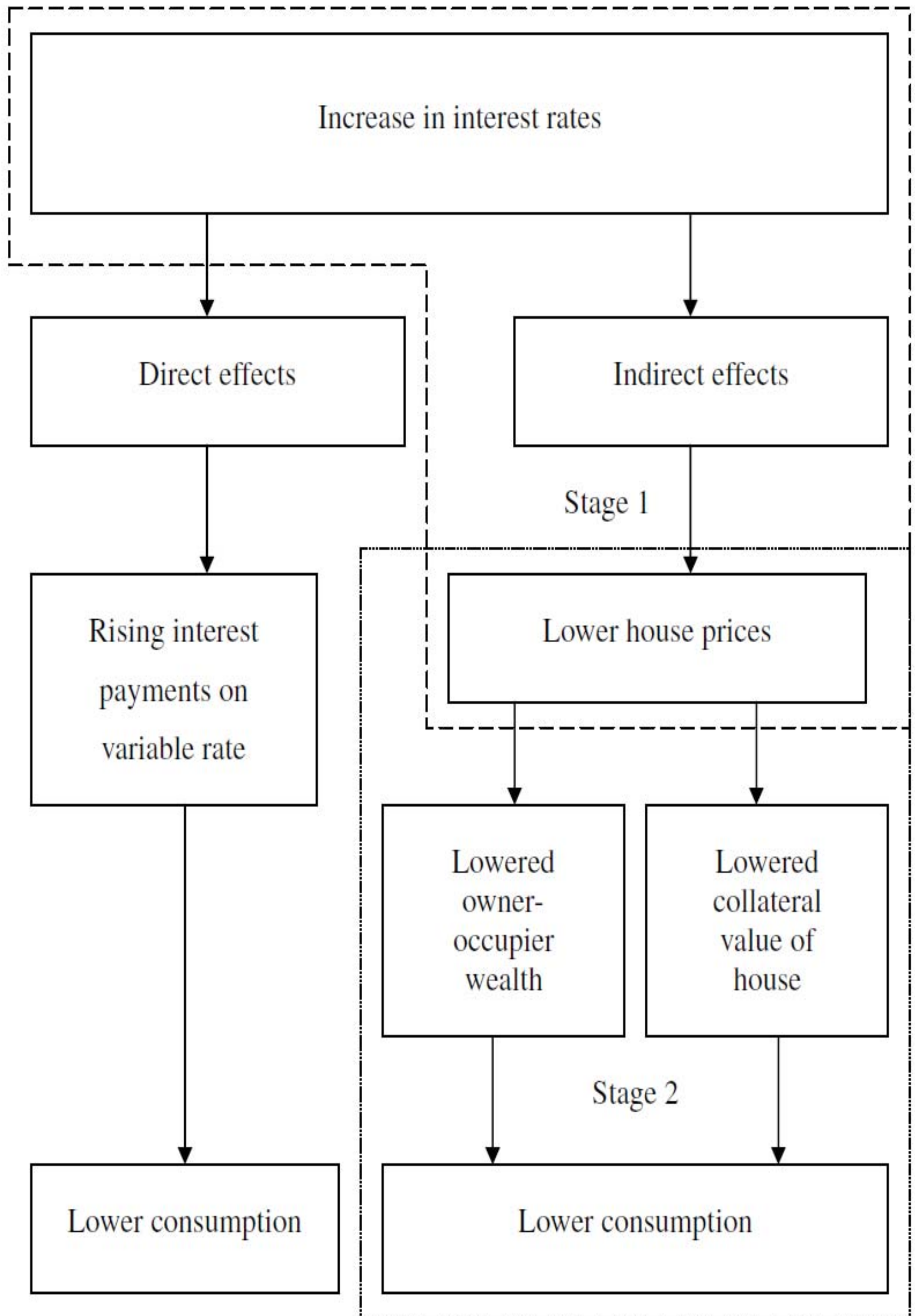


Figure 2.4 Simplified schematic of the interest rate mechanism [Source: (Schnell, 2003)]

2.3.7.3 The impacts on construction industry

As Roberti (2014) described that the inflation pressures would influence the building development cost via materials prices increase, the lending rate increase, and over-budget issues. The issue apparently not direct influence the building cost but actually the issue influence almost every part of the building cost. Construction inflation, based on several decades of trends, is approximately double consumer inflation. During that period, construction inflation/deflation was primarily influenced by depressed bid margins, which had been driven lower due to diminished work volume.

Work volume has increased, and short-term construction inflation has increased now to more than double consumer inflation. If consumer inflation reacts to money policies by accelerating and if it holds true that long-term trends eventually return to the norm, we may soon be experiencing rapid acceleration in construction inflation.

Levin and Pryce (2009) revealed that the real interest rate and expected inflation have significant impacts on the construction market. Some papers explored the importance of interest rates to building development cost fluctuation. More specially, the studies distinguish the impact of a short term from long term interest rates on building development cost dynamics. The works show that the short-term interest rate influence building development cost mainly through the effects on mortgage rates and the cost of financing for construction firms. NZIER (2014) said that mortgage rate and deposit regulations relevant to the construction cost.

Page (2008) said that the construction sector relay on the import products relatively low compared to other sectors, the residential construction only relies on 19% of imported products, but the exchange rate still has the influence on the building cost. The products prices fluctuations which reflect the inflation, the same for the housing market. However, the basic principle of inflation is that the amount of money increasing, as a result, the money has less value than before. So, it is easy to understand that the more amount of money in which sectors' market, the more serious inflation would occur in the sectors' market even if the whole inflation rate might not that high.

Construction Economics (2013) showed that several years of stimulus and easy money policies will eventually lead to strong inflation, and in the worst case scenario, a year from now we could potentially see inflation range between 4% and 5%. Choudhry (2010) distinguished the long term and short term interest rate impacts on the real estate markets and reported that short-term interest rate affects the mortgage rate and construction firms financing costs.

2.3.7.4 The impacts on New Zealand property market

According to RBNZ (2013), the net inflow migrations increase one percent to the population cause the housing prices increase eight percent over the following three years, and one additional house is built for around every six new migrants. One thousand persons increase arrivals in monthly in New Zealand raise the house prices four percent, whereas a 1000 person falls in departures monthly raise the house prices two percent. The population increase in arrivals has more effect on house prices than the decrease in departures. Moreover, RBNZ (2013) also said that the foreign migration influence more the house prices than the New Zealand citizens.

Fry (2014) stated that the origin of the migrants would also have an effect on the house prices. The inflow of the migration increase would also give the challenge to build the new houses. The migration inflow increase also includes the New Zealanders who desire to attain jobs in their home country other than in Australia because the employment rate decrease in Australia as the country passes the mining investment boom peak.

RBNZ (2013) reported that net migration changes are consistent with large housing effects, for example, an additional net inflow that adds one percent to the population causes an eight percent increase in house prices over the following three years and an additional house is built for around every six migrants. Stillman and Maré (2008) stated that real housing appreciation is strongly influenced by population growth. Table **2.8** exhibits the literature summary about the effects of the socio-economic factors on BDC.

Table 2.8 Literature summary of SEF influencing BDC [Source: varied sources]

Underlying factors	Nature of effects	Literature resources
Gross Domestic Production (GDP)	Economic growth shares the same pattern with building cycles, but building cycles have greater amplitude.	(Chiang et al., 2001); (Leung et al., 2005)
Labour cost (LCI)	Rising real wages can lead to an increase both in consumption and in population. These have positive effects on the demand for buildings.	(Barkham, 2012)
Employment/ Unemployment	Employment rate increase means more needs that can transfer to more demand. Then, the demand will drive up the supply, especially in the housing sector as the construction products can be seen not only as shelters for people but also as investments.	(Chakrabarti & Zhang, 2015; Visar & Alenka Temeljotov, 2014)
Population Growth	Population growth can increase the need for construction products and for shelters.	(Choi & Jung, 2017; Johnston et al., 2016)
Industry index (CGPI PPI PI)	The CGPI can be used to measure the average prices of capital goods. As the buildings can be seen as capital goods, the price index can also represent the average prices for buildings. The product prices can reflect the prices of raw resources that are used to construct the buildings. The productivity increase in the construction industry can mean more value added to construction products.	(Schneider, 2013)
Housing Price	The increasing housing prices also drive up the costs of building materials, and then the building development cost. Moreover, the increasing housing prices can create a wealth effect enabling people to expend more money, and thus stimulate the economy, and inflation is underway. In addition, the new building also can be seen as an asset - the increasing return will attract more investment into this industry. Thus, oversupply is underway.	(Tsai, 2012; Zainal et al., 2016)
Building Consents	The number of building consents approved by council can represent the conditions of the construction industry and the property market.	(Akbar et al., 2013)
Energy Prices	The construction industry will consume so much more energy. Therefore energy prices can influence building costs.	(Yusof et al., 2017)
Monetary policy (OCR Exchange rate)	The exchange rate is often regarded as a macro-economy tool - it directly impacts on the export and import sectors In addition, the exchange rate can also influence inflation.	(Cooper et al., 2016; Huang, 2014; Yang et al., 2016)
Inflation (CPI)	Rising inflation enables investors to prefer real estate to other asset groups. However, the increasing inflation, also coupled with an increasing interest rate, is bad for the real estate market as it slows the expansion rate and, ultimately, the requirements for new spaces.	(Barkham, 2012)
Credit supply	Credit costs and credit constraints are both important for borrowers. When credit is expensive and constrained, rental growth will drive up investment demand. When credit is cheap and plentiful, this will increase the demand of first-time house buyers.	(Favara & Imbs, 2015; Taltavull & Gabrielli, 2015; Wachter, 2016)

2.4 SUMMARY OF LITERATURE REVIEW AND GAPS IN KNOWLEDGE

This chapter has reviewed the factors influencing building development cost nationally and internationally as provided in existing literature. The reviews have provided insights on the extent to which the research questions have been addressed in the previous studies. They have also provided insights on gaps in existing knowledge which the current research aimed to help fill.

The components that comprise building development cost are illustrated in section 2.2. The factors influencing building development cost were explored in section 2.3, including project-related factors, stakeholders' influences, the construction industry, market forces, statutory and regulatory factors, national and international factors, and socio-economic factors.

In the project-related factors section, the factors, such as project location, size, complexity, procedures and methods, were identified as part of the key influences on building development cost. The project stakeholders were also identified as being key influencers; the stakeholders include clients, contractors and relevant key professionals. The stakeholders' demographic backgrounds, including education level, experience and practice, attitude and prejudice, and financial backgrounds, could greatly influence building development cost.

The nature of the construction industry was perceived as having significant effects on building development cost. This is because every construction activity conducted in the industry affects the capacity and productivity of the industry (Page & Norman, 2014). This can have a significant influence on the supply chain of the construction products and services, thereby imposing effects on the relationship between supply and demand. Moreover, the boom and bust cycles are also influenced by the supply and demand relationship. This, too, can also significantly influence building development cost.

Market forces usually act as an invisible force behind all economic activities. The foremost force is the supply and demand relationship that is a key determinant of every item's price in the market. The demand for, and the supply of, construction products definitely imposes pressure on building development cost. For example, the long-term shortage in the supply of housing and the growth in population and the economics that drive up the demand for housing combine to push up housing prices and, accordingly, increase building development cost in New Zealand. Furthermore, the long-term shortage of skilled labour, the isolated material market and relatively small economic scale also serve as factors that pose pressures on the increased building development cost in New Zealand. In addition, the cash flow or the financial availability to the players in the construction industry is also an issue. And the extended period required to obtain consents for building can also impact on, and increase, building development cost, as can the extended period required holding sites.

Likewise, the market structure and market expectations also serve as key factors to influence building development cost as the structure that can determine the competition style and the expectations can influence the investment tendency. In addition, the business cycle that affects almost all the economic activities can significantly influence the demands of the people.

The statutory and regulatory regimes are key players for building development cost, being separated into government policies, finance-related policies, construction industry regulations and other regulations. The government policies are the basics for all the statutory and regulatory requirements. For example, the free trade and customs policies can decide the prices of all the materials used in the construction industry. Finance-related policies can impose direct effects on credit availability and financing cost that can have significant effects on the cash flow of the key players in the construction industry. Moreover, the industry regulations directly influence the building development cost through the building code requirements and health and safety enforcement. In addition, other statutory rules and regulations also can add to building development cost, such as the environment regulations.

National and global factors cannot be ignored as energy costs, for example, are significantly influenced by global forces. Moreover, global financial situations also serve as one of the key players in the national economy. In addition, national disasters like earthquakes and fire hazards also impose urgent and sudden pressures on construction products.

Socio-economic factors are the root base for all activities as they are conducted in the socio-economic environment where both the construction industry and the property market also play. The socio-economic factors include some economic indicators and socio-benefit indicators and financial and banking indicators. They serve as the key indicators for the whole socio-economic environment. Simply, the increases in GDP, Productivity, Employment and Population and the relative increase in CPI indicate the positive things occurring in the economy while an increase in unemployment, a dramatic growth in interest rates, a relatively small increase or decrease in GDP and a sharp drop in the value of the home-country currency indicate an economic recession.

Socio-economic factors can influence building development cost directly and indirectly. For example, economic growth and an increase in population, employment and income can increase the demand for construction products. These factors have not been extensively discussed in the existing literature: but they are explored in detail in this chapter.

2.4.1 Model of the factors influencing building development cost

Based on the insights gained from the literature, a summary of the factors influencing building development cost could be modelled as shown in Figure **2.5**. The key factor categories provide potential constructs to be further explored during a pilot survey and a questionnaire survey.

It is proposed to summarise the existing literature for building construction projects, in order to identify the influencing factors and quantify their effects on project cost. Due to the complex and dynamic environment in which they operate, construction projects face a raft of challenges in terms of time, cost and quality (Rohaninejad & Bagherpour, 2013). The factors which influence building development cost can be multifaceted (Wang & Yuan, 2011). In construction projects, these influencing factors cannot be avoided and are present from inception to completion. Therefore, the project management team should properly monitor and control them.

2.4.2 Identified knowledge gaps

Identification and classification of the influencing factors and their impacts on building development cost are seen as one of the areas of greatest difficulty (Cheng, 2014). The factors influencing costs have been explored in the existing literature (Goh et al., 2013). However, a comprehensive and systematic list of the influencing factors in order of their relative influences is lacking, especially in the context of the New Zealand construction industry. The existing knowledge in the current form is too generic and could add to the information overload for the industry practitioners. What practitioners need is information that draws upon the 20-80 rule due to the limited resources at their disposal for tackling the myriads of the problems they face (Baloi & Price, 2003). In the context of this research, the information needed by industry practitioners - which is lacking in the current literature - is the 20 percent of the factors that provide 80 percent of the influences of building development costs. This study aimed to fill this knowledge gap.

Additionally, the information on building development cost influences presented in the literature lacks robust empirical tests of significance and reliability and validity verifications. This study also aimed to fill this gap by utilising structural equation modelling and external validation tests to ensure more reliable and valid results.

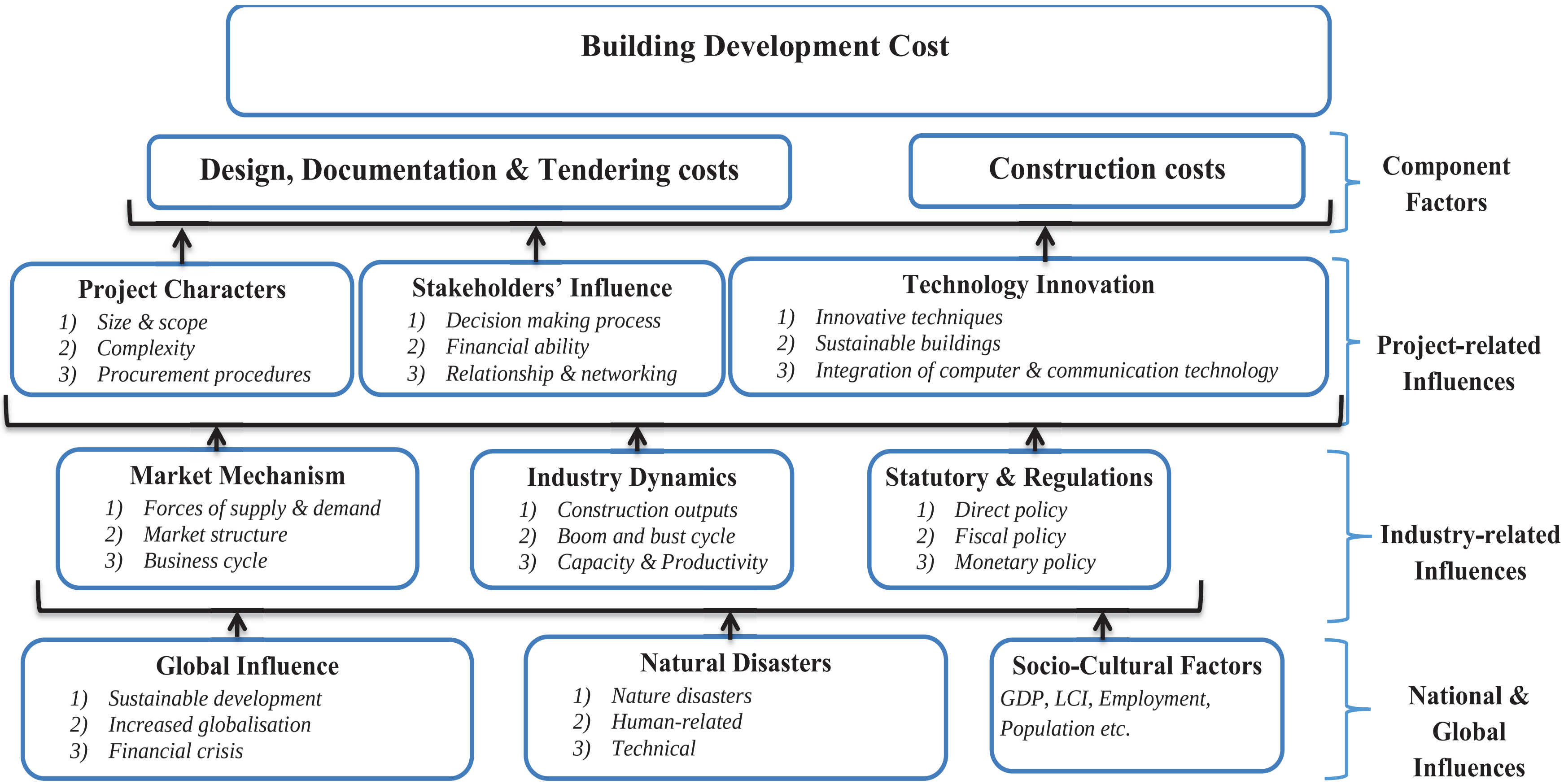


Figure 2.5 Multi-level influencing factors [Multiple sources:(Chan, 2005); (Baloi & Price, 2003); (Warsame, 2006)]

CHAPTER 3 RESEARCH MODEL

3.1 OVERVIEW

This chapter presents the theoretical basis for the conceptual framework formulated for the study. It details the key connections to the literature that inform the formulation of the research model and the basis for the hypotheses put forward for empirical tests. The chapter comprises discussions on the relationships between building cost and their key drivers.

3.2 MODEL COMPONENTS

External factors, such as local government requirements and concerns, market conditions, unforeseen events and conditions - acting separately or in combination with others - can and do exert significant influences on building development costs (Shane et al., 2009). The research model development has been drawn from the literature. It was found from a review of the literature – and verified during pilot interviews - that building development cost comprises seven major components: project component cost factor (PCC), project character related factor (PCR), project stakeholders' influences (PSI), property market and construction industry factor (PMCI), statutory and regulatory factor (SRF), national and global dynamics (NGD), and socio-economic factor (SEF). The empirical study measured the indicators for each set of factors. The measured indicators were the observed variables. The factor-sets are latent constructs. The seven latent constructs and their indicators numbering up to 45 comprise the research model. These are listed in Table **3.1**.

Table 3.1 Latent constructs and corresponding indicators [Source: varied sources]

Factors	**Indicators**	**Source Reference**
Project component cost factor (PCC)	Procurement cost (PCC1) Construction cost (PCC2) Design cost (PCC3)	(Crompton & Howard, 2013); (Griffis & Choi, 2013)
Project characteristics factor (PCF)	Project location (PCF1) Project complexity (PCF2) Procedures methods (PCF3) Contract types (PCF4) Technological innovations (PCF5)	(Love et al., 2005); (Harbuck, 2004); (Qureshi & Kang, 2015)
Project stakeholders' influences (PSI)	Clients (PSI1) Consultants (PSI2) Contractors (PSI3) Suppliers (PSI4) Building officials (PSI5)	(Iyer & Jha, 2004); (Wright, 1997); (Naoum, 2003); (Ng et al., 2008)
Property market and construction industry factor (PMCI)	Material market (PMCI1) Labour market (PMCI2) Level of competition (PMCI3) Market structure & size (PMCI4) Boom and bust cycle (PMCI5) Supply and demand (PMCI6) Investment tendencies (PMCI7) Housing prices (PMCI8)	(Akintoye, 2000); (Chang, 2002);(Grimes & Hyland, 2013b); (Shane et al., 2009)
Statutory and regulatory Factor (SRF)	Building code & compliance (SRF1) Health & Safety regulations (SRF2) Political policies (SRF3) Financial regulations (SRF4) Construction Contract Act (SRF5)	(Mayer & Somerville, 2000); (Myers, 2013); (Gundes, 2011);(Vincent & Monkkonen, 2010); (Lyons, 2014); (Mumford, 2011); (Stephan & Crawford, 2016); (Titaya, 2016)
National and Global Dynamics (NGD)	Global political dynamics (NGD1) National forces (NGD2) Global economic trends (NGD3) Global business sentiments (NGD4)	(Chang, 2002); (NZIER, 2014); (García, 2005); (Cesa-Bianchi, 2013); (Alagidede, 2016)
Socio-economic factor (SEF)	GDP(SEF1) CGPI (SEF2) CPI (SEF3) PPI (SEF4) PI (SEF5) LCI (SEF6) Net Migration (SEF7) Employment rate (SEF8) House prices (SEF9) Building consents (SEF10) Energy prices (SEF11) Exchange rate (SEF12) Monetary policies (SEF13) Investor confidence (SEF14) Fiscal policies (SEF15)	(Myers, 2013);(Xu et al., 2015); (Kosla, 2015); (Kaklauskas et al., 2011); (Balló, 2016); (Wier, 2000); (Akintoye et al., 1998)

3.2.1 Influences of project component costs factor on BDC

The project component cost includes design, document and tendering cost, construction cost and procurement cost (Crompton & Howard, 2013). While linking the project component cost to building development cost, many studies have identified high design cost at the pre-tender stage as one of the key indicators driving up the total project component cost (Turner&Townsend, 2016). Moreover, construction and procurement costs have been identified as key contributors to project component costs in New Zealand (MBIE, 2013b; Page, 2008).

The construction industry is a multi-disciplinary sector that comprises varied stakeholders, so project component cost can be influenced by a large number of stakeholder-related factors. The key factors might change with different types or locations of the projects. However, the project component costs as investigated in this study did not discriminate based on the underlying factors such as locations and types of projects.

Hypothesis 1

Based on the above insights gained from the literature, the study hypothesized as follows:

H1: Project component cost factor (PCC) significantly contributes to the building development cost in New Zealand.

3.2.2 Influences of project characteristics factor on BDC

Project characteristics involve project location and project complexity, procedures methods, contract types and technological innovations. These vary for different projects (Auer et al., 2006). Many types of research have been done to investigate the relationship between the project characteristics factor and the building development cost. A study conducted by Akintoye (2000), describing the factors influencing building development cost in the UK, surveyed 84 UK contractors. The result stated that the project characteristics factor is a main factor that has impacts on the building development cost. Moreover, other published research has also indicated that project characteristics factor play an important role in the construction projects (Love, 2002).

Hypothesis 2

Based on the above literature, this study hypothesized as follows:

> ***H2: Project characteristics factor (PCF) significantly influences the building development cost in New Zealand.***

3.2.3 The impacts of stakeholders' influences factor on BDC

Influence from clients, consultants, contractors, suppliers and building officials all contribute to the stakeholders' influence factor. As far as the stakeholders are concerned, their influences are the key factors affecting building development cost. Research has studied 69 cases generating the result that the stakeholders' influence factors can significantly affect the building development cost (Olander & Landin, 2005). All the project work conducted is ultimately for the benefit of the stakeholders, so their importance cannot be overemphasized (Cunningham, 2013). The stakeholders' influences contribute much to the building development cost as they are involved from the pre-design stage to the final usage of the building. Every decision they made during the building's progress might have significant effects on the building development cost. Moreover, a study conducted in Kenya that collected both qualitative and quantitative data, stated that stakeholders' influences are the paramount factors for a project's cost performance (Nyandika & Ngugi, 2014).

Hypothesis 3

Based on the information provided from the literature, the study hypothesized as follows:

> ***H3: Project stakeholders' influence factor (PSI) has a significant effect on the building development cost in New Zealand***

3.2.4 Influences of property market and construction industry factor on BDC

The indicators including material market, labour market, the level of competition, market structure and size, boom and bust cycle, supply and demand relationship, and investment tendency are all considered as the measured variables for the property market and construction industry factor (PMCI). Any one of these indicators can have a significant effect on the property market and the construction industry due to the fact that they are able to impose a strong influence on resource allocation in the property market and construction industry (Watson, 2013). The fragmented nature and the restricted access to material and labour both hamper the growth of the construction industry in New Zealand (Vaughan, 2016). A low level of technological demand in the private building sector has led to the easy entry which exists in the construction industry, and then the intense competition between contractors imposes risks on the construction industry (Ball, 2006). Moreover, construction is always considered as a cyclical industry which is highly influenced by the boom and bust cycle, the relationship between supply and demand, and investment tendencies (Parke & Warren, 2014). In addition, the relationship between supply and demand is also a key determinant of the property market (RBNZ, 2013).

An analysis of the questionnaire survey that has been conducted in the UK identified that the property market and the construction industry factor both significantly affect building development cost (Elhag et al., 2005). Moreover, other research also indicated that property market and construction industry factor can impose significant effects on building development cost - after analysis of a questionnaire conducted in Malaysia ranking 79 indicators (Toh et al., 2012).

Hypothesis 4

Therefore, based on the above existing literature the study hypothesized as follows:

> ***H4: Property market and construction industry factor (PMCI) has a significant effect on the building development cost in New Zealand***

3.2.5 Influences of statutory and regulatory factor on BDC

The indicators, which include building code and compliance, health and safety regulations, political policies, financial regulations and construction contract acts, are considered to be statutory and regulatory factor (SRF). The statutory and regulatory regime composed of these indicators imposes the restriction on the projects operated by them; these can significantly influence the building development cost of the project (Grimes & Mitchell, 2015). Existing research also explored the fact that the regulation regime, including a wide range of government, state and local regulations, building codes, land use laws, and regulations related to fees, places lots of pressure on the projects and generates substantial costs (Schill, 2005).

Hypothesis 5

Therefore, according to the above explanation, the study hypothesized as follows:

> ***H5: Statutory and regulation factor (SRF) has a significant effect on the building development cost in New Zealand***

3.2.6 Influences of national and global dynamics factor on BDC

National and global dynamic factor includes indicators such as global political dynamics, natural forces, global economic trends, and global business sentiments. The global influence sources that can affect New Zealand's building development cost are largely from overseas financial markets and global commodity prices (The Treasury, 2009). If the demand for New Zealand's commodities remains weak or there is a tightening of credit conditions in overseas financial markets, both businesses and households will be adversely affected. These factors will also have significant effects on the building development cost (Grimes & Hyland, 2013a).

A drought occurred in the summer of 2007/2008 causing a sharp decrease in dairy production in the first half of 2008 (DBH, 2009). Subsequent high prices for food and fuel along with high-interest rates and falling housing prices dampened domestic consumption. The situation deteriorated with the arrival of the GFC in September 2008; the local banking sector had limited access to overseas funding. This GFC lasted around 15 months and, until now, the economy in New Zealand has been in a slow recovery with a moderate increase in GDP (Richardson, 2015). Unexpected events occurring nationally and internationally will pose lots of risks to the construction industry, and these, in turn, yield substantial costs.

Hypothesis 6

According to the above existing research, the study hypothesized as follows:

> ***H6: National and global dynamic factor (NGD) has a significant effect on the building development cost in New Zealand***

3.2.7 Influence of socio-economic factor on BDC

The socio-economic factor includes GDP, CGPI, CPI, PPI, PI, LCI, net migration and population growth, employment rate, house prices, building consents, energy prices, exchange rate, monetary policies, investor confidence, and fiscal policies. All of these can have significant effects on the whole socio-economic situation. Construction projects conducted within socio-economic environments will be influenced on many levels, and these generate high costs. A study stated that the socio-economic factor has a significant effect on building development cost, as highlighted by questionnaire analysis (Iyer & Jha, 2004). Moreover, research also considers that socio-economic factor can significantly influence building development cost after correlation analysis (Akanni et al., 2014).

Hypothesis 7

According to the above existing literature, the study hypothesized as follows:

> ***H7: Socio-economic factor (SEF) has a significant effect on the building development cost in New Zealand***

3.3 THE PROPOSED MODEL

Based on the established connections between the key influencing factors and the building development cost as reviewed from literature in sections 3.2, the conceptual research model to be tested for causal relationships is shown in Figure **3.1**.

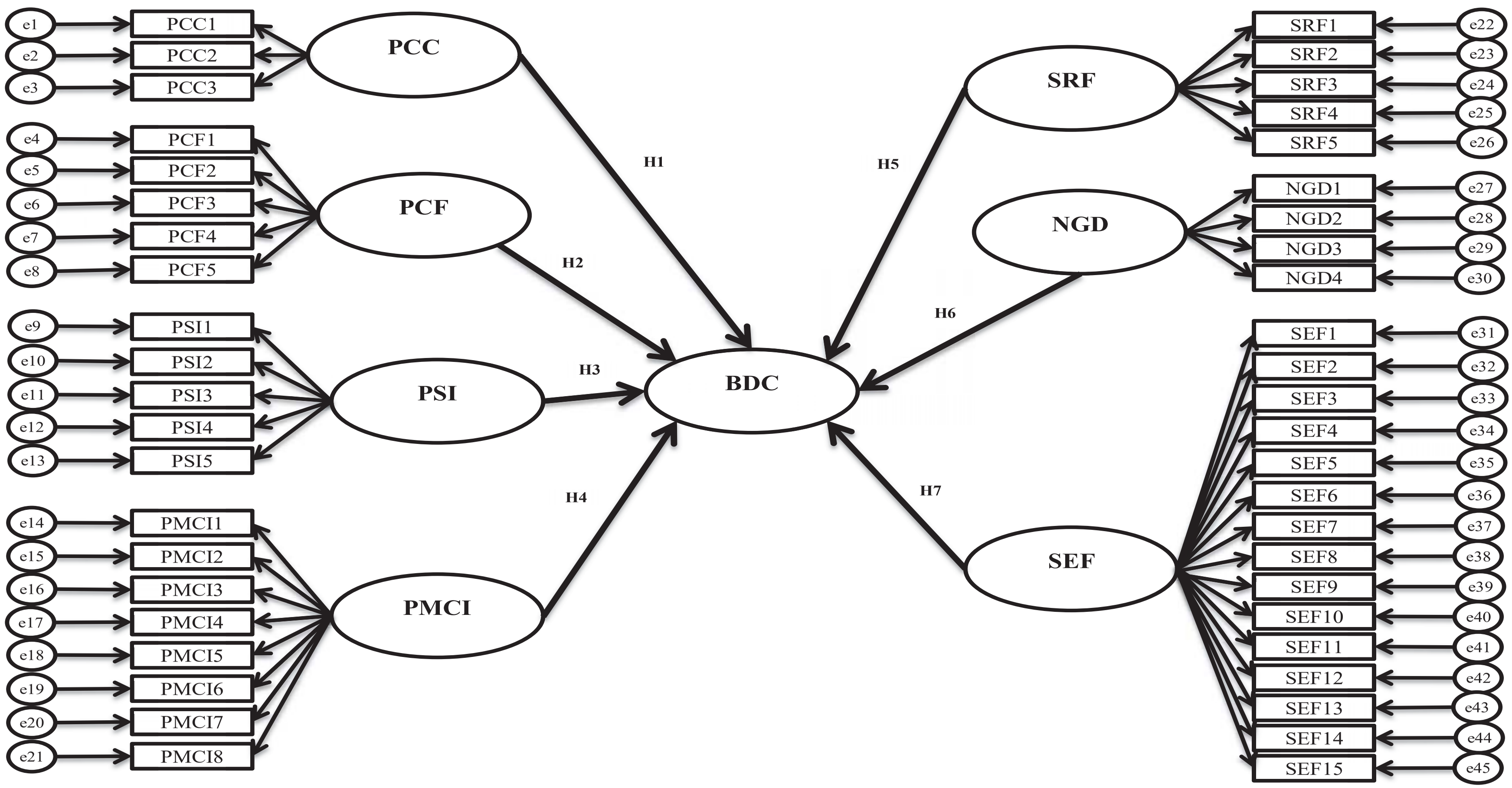


Figure 3.1 Hypothetical model of the factors influencing building development cost in New Zealand

CHAPTER 4 RESEARCH METHODOLOGY

4.1 OVERVIEW

This chapter describes the research method used for the research. To balance the disadvantages of qualitative and quantitative research methods, a mixed research method was adopted in this study. In the chapter, the overall research strategy is described and the corresponding flowchart of the process is displayed. The qualitative and quantitative data gathering process is also detailed in this chapter. The methods adopted for analysing the qualitative and quantitative data are illustrated and justified. In addition, the issues about the validity and reliability of the study and research ethics are also addressed.

4.2 RESEARCH METHODS ADOPTED

4.2.1 Research philosophical foundation

Ontology concerns the issues of the fundamental nature of reality (Easterby-Smith, 2012). The two basic categories within ontology are realism and nominalism; realism assumes that reality exists out there independently of people and their perceptions and interpretations of it, while nominalism assumes that people never directly experience the real world but through their own subjectivity and interpretations (Neuman, 2014). Moreover, internal realism assumes that the truth is out there but is difficult to observe directly, while relativism assumes that there is much truth out there, dependent on the viewpoints of the observers (Bryman, 2016).

Epistemology is concerned with issues of how we understand the truth of the world (Dudovskiy, 2016). There are two basic paradigm groups within epistemology: positivism and constructivism; positivism supports the view that truth or knowledge should be generated by way of a scientific approach, while constructivism argues that reality is composed of the viewpoints and opinions of people and therefore reality is highly subjective and can only be interpreted from the viewpoints or opinions of those who have experienced reality (Andrew et al., 2011).

Epistemology is rooted in the ontological position. For example, if a piece of research adopts assumptions of internal realism, the researcher can generate the research findings through making careful observations of the phenomenon and analysing the results. As the empirical evidence is gathered, the true findings can be tested and verified.

On the other hand, if the research employed nominalism assumptions, the research findings can be directly linked to the truth by observations due to the subjectivity and interpretations that significantly affect the observations and the observation process.

4.2.2 Research paradigm

Denzin and Lincoln (2016) argued that paradigms could be characterized by the underlying ontological and epistemological positions adopted in the research process. The paradigm in turn dictates the methodological approach to be adopted. It provides a holistic perception of how the researcher views knowledge, and formulates the methodological strategies to reveal it. Researchers generally develop the research methodologies based on different ontological and epistemological assumptions and the associated paradigms.

4.2.2.1 Ontological and epistemological positions and paradigm adopted in the study

The ontological and epistemological positions adopted in this study are not meant to explain the philosophy of science, but their link to the appropriate research methodology to be used in the data gathering and analysis and interpretation of the results in the context of the research questions/objectives. The link adopted in the research is modelled in Figure **4.1**.

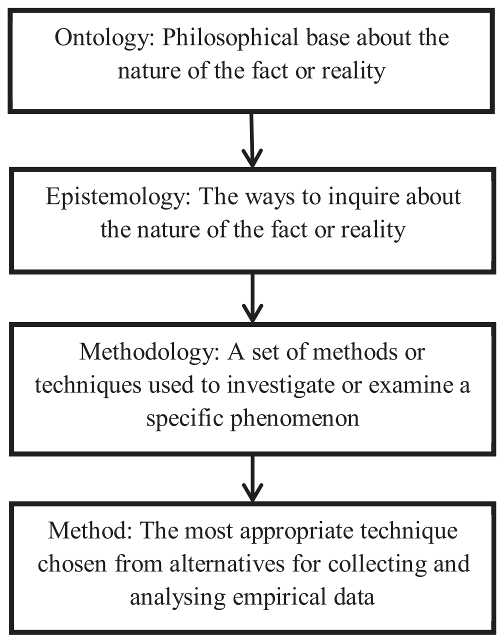


Figure 4.1 The relationship between ontology, epistemology, and methodology [Sources: (Nirod, 2005); (Marsh & Stoker, 2010); (Tuli, 2010)]

The basis of positivism is that the reality and facts are out there; it is appropriate to measure and investigate them by objective approaches rather than being inferred by subjective sensation, intuition or reflection (Blaikie, 2007). On the other hand, social constructionism addresses that the reality or facts are not objective and out there, but are given meaning and are socially constructed by people (Hallebone & Priest, 2009).

Moreover, positivism is usually related to quantitative methods, while constructionism is often associated with qualitative approaches (Creswell & Clark, 2011).

As to the debate between the positivism and constructionism, the pragmatism that emerged in philosophy emphasized that the criterion for valid knowledge should not only depend on theoretical or logical rigour but also on the perceptions, interpretations, and experience in the real world (Veal & Darcy, 2014). It has come to refer to a new research approach, to either positivism or constructionism but combine them in the same research at a different stage. For example, a study might consist of a questionnaire survey of the participants by collecting quantitative data, but also involve an in-depth interview with practitioners for gathering the qualitative data. A pragmatism approach may include the adoption of both qualitative and quantitative methods, resulting in a mix-methods research design. The research paradigm adopted in the study is modelled in Figure **4.2**.

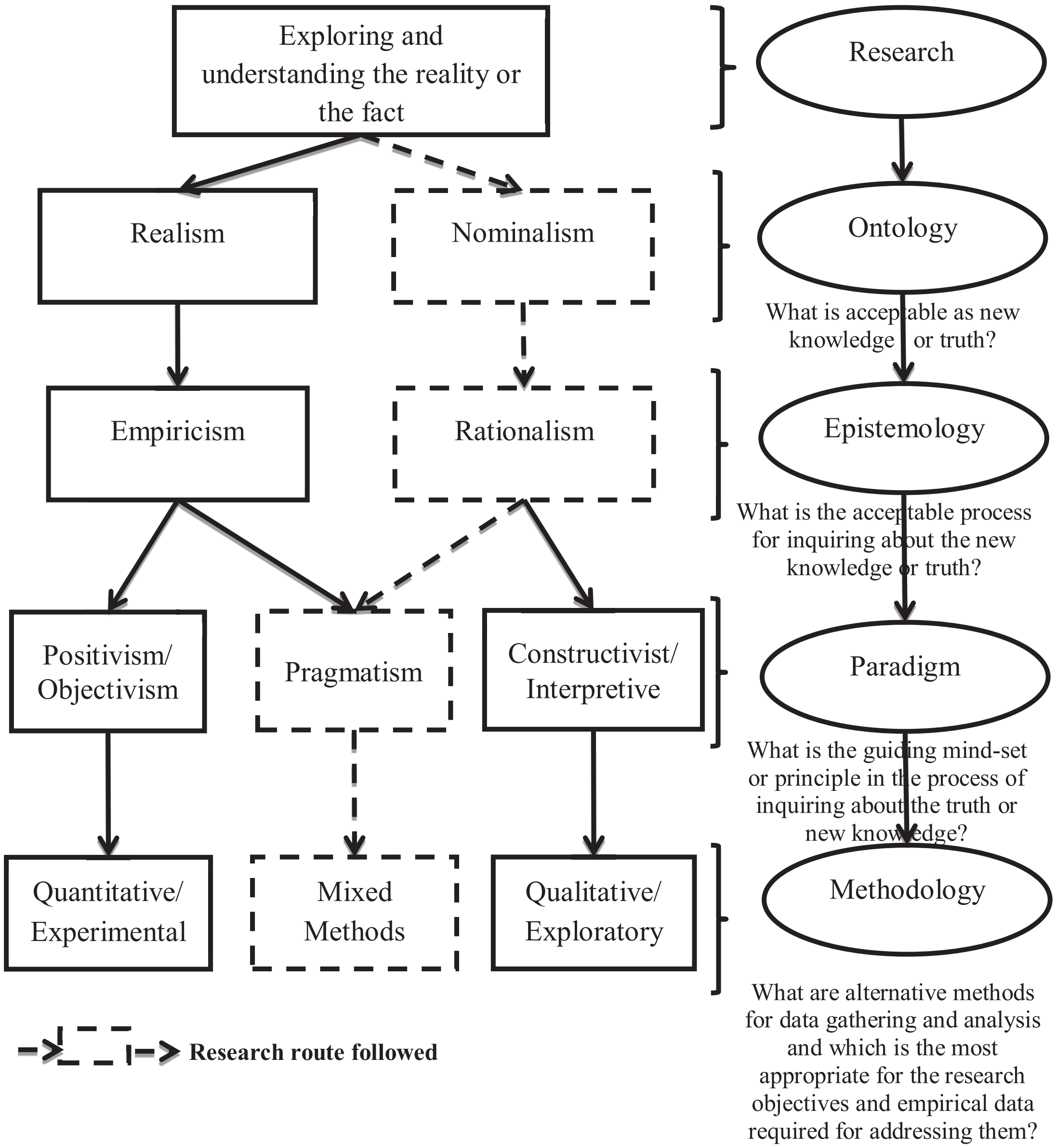


Figure 4.2 Research route followed in the study

4.2.3 Research methods in construction management

Owing to people playing an important role in construction, in order to fully interpret the human or social factors, proper social science research methods should be employed (Johnson & Onwuegbuzie, 2004). Qualitative and quantitative research methods are both employed in construction research. However, even today the debate continues as to which one is more suitable for construction research (Seymour et al., 1997). The current research trend in construction is a shift towards the application of multiple methods termed as multi-method (Dainty, 2008). Each method has advantages and disadvantages; the combination of qualitative and quantitative research methods can balance the strengths and weaknesses of each approach and thus enhance the reliability and validity of the research project (Fellows & Liu, 2015). It was for this reason that the mixed methods research approach was adopted in this study. The following subsections explore in detail the individual research approaches.

4.2.3.1 Qualitative research methods

A qualitative research method is an exploratory research method that tends to collect information and data and gain understanding; it is like a precursor of quantitative research (Busse et al., 2013). It works best on developing new theories and interpreting phenomena (Harrison et al., 2007).

Quantitative and qualitative methods are both used in the research for data collection. Each research method provides unique ways for data collection. Qualitative methods focus on the quality of description and then make efforts to collect extensive information from every case study; as a result, the methods generally include a limited number of samples rather than employing a large amount of data (Palinkas et al., 2015). Furthermore, qualitative methods can provide deep, broad sets of information about a particular phenomenon (Bettis et al., 2015). There is an upward trend in using qualitative methods, especially the qualitative interview (Bryman, 2016).

However, the qualitative research method without statistical analysis is more intellectually demanding than if quantitative methods had been adopted (Jones, 2015). Although the data from qualitative methods is often regarded as detailed and rich, they are also difficult to analyse and sort and the objectivity of the data can usually be questioned (Fletcher et al., 2016). In addition, the data collection and the conclusions drawn from qualitative methods are strongly influenced by external and environmental variables (Violante & Vezzetti, 2017).

4.2.3.2 Quantitative research methods

A quantitative research method is an explanatory method in which the propositions and hypotheses based on previous studies and literature are to be tested by scientific approaches (Ahmedshareef et al., 2014).

Quantitative methods usually include a large number of data and employ statistics for sampling that can represent a large population. As a result, the research findings and conclusions can be generalized to the population (Edmondson & Mcmanus, 2007). Moreover, the mathematical and statistical analysis adopted can generate a certain magnitude of statistical significance. The decision then is whether the previously set hypothesis should be rejected or accepted (Avagimov & Zeigarnik, 2016). In addition, clear documentation of the survey instruments can be provided, which allows other researchers to evaluate their reliability and validity (Hishinuma et al., 2016).

It is reported that 64% of studies used quantitative methods (questionnaire survey) to collect data (Bryman et al., 2000). The questionnaire survey only measures statistic situations and does not provide explanations of the process behind them. As a result, such measures cannot assist us to understand the multi-level dynamics of the phenomena (Fekete et al., 2010). Creswell (2003) also argued that quantitative methods only focus on single level analysis and are unable to explain the changeable situations and subjectivity in this process. The weakness of the quantitative method is the area of potential strength of qualitative methods (Johnson & Onwuegbuzie, 2004). Furthermore, the scope of the research area and the potential of investigation employed might be restricted as the priori theoretical commitments (Edmondson & Mcmanus, 2007).

4.2.3.3 Mix methods

The controversy about which is better for research--qualitative methods or quantitative methods-- is long-lasting (Fellows & Liu, 2015). However, until now there has been no agreement on which is best. But a preference for applying multi-methods in construction management studies is emerging (Dainty, 2008). In recent years, many researchers have advocated the employing of the mixed method in order to benefit from the advantages of both quantitative and qualitative methods (Mathieu & Chen, 2011). Mixed methods usually are composed of both qualitative and quantitative research methods in order to gain the advantages and eliminate the disadvantages of each.

4.2.4 Mixed method adopted in the study

The methods adopted in the study depend on the research question, what is measured, and constraints, validity and reliability (Weathington et al., 2012). Moreover, the research methods adopted also rely on the extent of the research development in the discipline (Edmondson & Mcmanus, 2007).

The research was designed so as to first explore the research concepts by qualitative research methods, such as in-depth interviews and pilot survey. The quantitative data collection and analysis is based on a quantitative research method involving questionnaire survey and statistical data analysis methods. Finally, the validation of the findings and associated conclusions rely on the results from both qualitative and quantitative research methods.

The mixed method was therefore considered the best option for this study as it helped to leverage the advantages of both qualitative and quantitative research methods in achieving the research objectives. This approach followed the recommendations by Niglas (2004) as the approach method where the research intention focuses on developing some constructs using interviews and testing those constructs using quantitative surveys. Moreover, triangulation—the application of both qualitative and quantitative research methods together in a study or research—is a powerful approach to gain deeper understanding of the issues, and to assist in making inferences and drawing conclusions from the findings (Fellows & Liu, 2015). In addition, triangulation enhances the internal and external validity of the research (Jick, 1979). The triangulation process was achieved through external validation in the form of analysed feedback from an expert panel of experienced industry professionals during the third stage of empirical data gathering.

4.3 RESEARCH PROCESS

The research design spells out the research framework used to address research problems and questions (Scandura & Williams, 2000). The research design is comprised of the appropriate strategy and approach used to access data and information, and the studied entity, and the way to access it (Mitchell & James, 2001). The following subsection discusses the flowchart of action plan adopted in the research process.

4.3.1 Flowchart of research process

Setting the research strategy is first addressed in the research design. The research strategy is a flowchart this research will follow including the generation of the research hypotheses, testing the research hypotheses, and validation of the hypotheses. One important decision is to select an appropriate research method with which to conduct the research taking into account the pros and cons of using quantitative and qualitative methods. As previously stated, mixed methods are adopted in this study due to the fact that they are in accordance with the research aims and objectives while simultaneously have originally contributed to the existing knowledge. The flowchart of the research strategy is shown in Figure **4.3**.

The study was divided into three stages as shown in Figure **4.3**. The exploratory stage began with identifying the research problem, proposing research questions, and establishing research objectives. Then the literature survey was conducted. After that, the research objectives and questions were refined due to incorporating the insights from the literature. In the second phase of the exploratory stage, a pilot survey was employed as a semi-structured interview to yield constructs for the draft questionnaire survey. The constructs include project component cost factor, project characteristics factor, project stakeholders' influences factor, property market and construction industry factor, statutory and regulatory factor, national and global dynamics, and socio-economic factor. The majority were from the existing literature; but they were also used in the semi-structured interview for checking their applicability in a New Zealand context.

At the descriptive stage, the questionnaire survey was conducted to collect the quantitative data for testing the research model generated from the previous literature and pilot survey. The research model was refined in accordance with the data analysis result. Then the validating stage was followed. A semi-structured interview was conducted to validate the refined research model and findings.

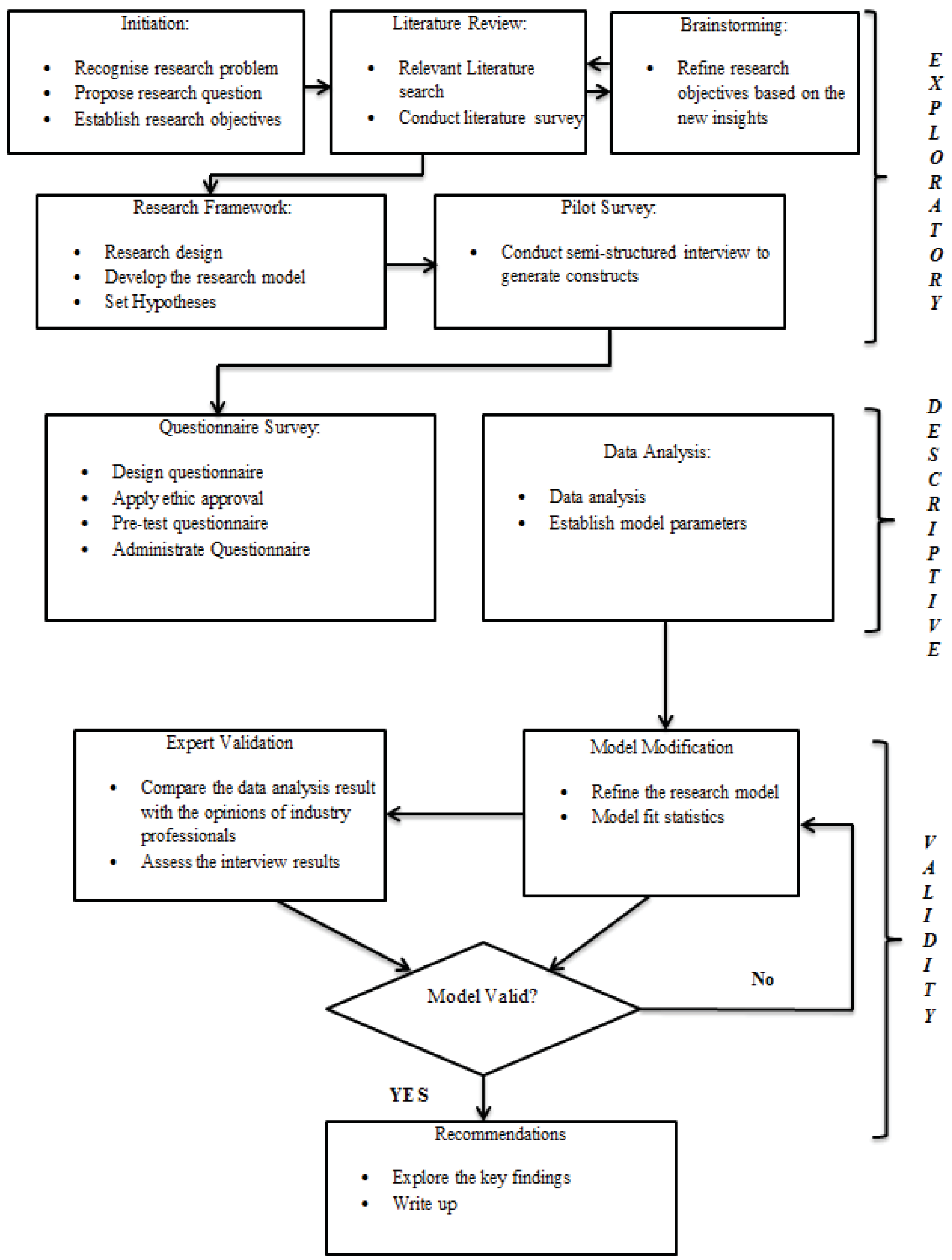


Figure 4.3 Flowchart for research practice [Source: varied sources]

4.3.2 Qualitative data gathering (pilot survey)

Interviews are usually an effective means of data collection for gathering deep insights of underlying motives, especially the studied phenomenon and its meaning to interviewees (Robson, 2002). The interview techniques consist of fully structured, semi-structured, and unstructured interviews (Patton, 2002). The main difference between these three techniques is the degree of freedom the interview participants have. Fully structured interviews are defined as the question and order are predetermined and never change in the interview (Denzin & Lincoln, 2005). Semi-structure interviews have predetermined questions but new questions can be added on, and non-related questions can be skipped (Schultze, 2000). Unstructured interviews allow the interviewees to talk freely about the specific topics (McCann & Clark, 2005). In this study, the semi-structured interview is adopted.

The methods employed in the planning and conducting of the semi-structured interview during the pilot survey phase with the professionals from their respective associations/institutions are illustrated in this section. The objective of the interviews is to capture the deep insights from the key professionals about their opinions on the factors influencing building development cost. The information then can be used to refine the research framework extracted from the literature and can be used to develop constructs which are then applied to the design questionnaire.

The pilot survey was conducted among registered members from the key professional associations/institutions in New Zealand. The sampling frames are the registered member lists positioned as managers from the following institutions:

New Zealand Institute of Architects (NZIA)

Association of Consulting Engineers of New Zealand (ACENZ)

New Zealand Institute of Quantity Surveyors (NZIQS)

New Zealand Institute of Building (NZIOB)

Property Institute New Zealand (PINZ)

Property Council New Zealand (PCNZ)

4.3.2.1 Interview scope and sampling frame

The scope of the research was constrained to the construction industry in New Zealand. The sampling frame for the interview was composed of construction industry professionals in the New Zealand region, including six institutions/associations in New Zealand. The pilot interviews were conducted with samples of the professionals who are registered members of the six institutions/associations. Stratified sampling strategy has been adopted to obtain samples for the interviews.

Furthermore, requests for participation were sent to all the target population. Only 12 registered members at manager level responded positively. The interviews proceeded with these 12 professionals.

4.3.2.2 Interview strategy

The semi-structured and scheduled interview was used to test and validate the constructs and measurement indicators that form the basis for the questionnaire. Given the need for control over the direction of the interview discussions, responses, and comments to the essential areas within the available time schedules, it was appropriate to select the semi-structured interview (Saunders, Lewis, & Thornhill, 2003). Moreover, the semi-structured interview is flexible in which the proposed questions are set in order and the interviewees are allowed to speak deeply and widely on the issues raised by the researchers (Denscombe, 2010).

It should be noted that responses on the significance of the identified measurement indicators were not sought at the pilot interview stage; they were rated at the questionnaire survey stage. According to Saunders, Lewis, and Thornhill (1997), motivational measurement methods involving projective techniques were used during the interviews in examining the perspectives of the interviewees. Moreover, Mbachu (2002) addressed that motivational research techniques may be helpful in exploring the real reasons for the observed phenomenon. In addition, Webb (1992) also suggested that projective techniques are useful at the exploratory stage of the research where hypotheses and ideas are formed, and the research is concerned with values, beliefs, motivation, personality, cognition, and behavior.

4.3.2.3 Sampling technique and size

Saunders et al. (2003) recommend non-probability sampling including self-selection and convenience sampling techniques as the most reasonable approach for the purpose of the pilot interview. Mbachu (2002) also confirmed that non-probability sampling permits the sample to be purposively selected. Therefore, convenience sampling was employed to identify the respondents who qualified to participate in the interview. Self-selection sampling was adopted to distribute the requests for the pilot interview via email to the entire registered members of the six institutions/associations. A list of self-selected professionals who were willing to participate in the interviews was developed.

Saunders et al. (2003) said that non-probability sampling provides a practical method to obtain samples at a rapid rate, as the sample size is only based on the resource availability and the understanding of the researchers. The sample size for the pilot interview in this research was limited to 12 registered members of the six institutions/associations. The suitable representative sample size was selected at the quantitative survey stage to validate and generalize the target population.

4.3.2.4 Interview planning and scheduling

At the inception of the interview, the registered members' contact details were obtained from the member directory list of the individuals' institutions or associations. Telephone contact followed by an email statement was adopted for the contacts. Most of the member directory lists provided complete details of their members. However, those that had no email address in the directory were contacted using their phone numbers to request their email address or fax number through which messages could be delivered to them.

Ninety messages were sent to the registered members in the sampling frame by email. The message included a covering letter indicating the aim and objectives of the research, the estimated time needed for the interview, and the options of the interview data and time.

After receiving the complete interview schedules indicating preferred date and time, the interviews were scheduled for interviewees based on their options. Given the time and traffic constraints, the interviewees accepted that the researcher go to their offices to proceed with interviews. As the time was constrained and some cases were tied in the schedules, further requests were sent to a few interviewees asking them to reschedule if possible. This made it possible to re-arrange all the interviews within one month. Reminder letters along with the interview questions were emailed to the interviewees one week in advance with a follow-up reminder email the day before.

4.3.2.5 Data gathering instrument

The pilot interview aimed to explore the cost-influencing factors from the perspectives of the industry professionals and examine the reliability and validity constructs that the cost-influencing factors fell into. The focus was on the perspectives or views from the industry professionals. Moreover, the key influencing factors of the building development costs from the perspectives or views of the industry professionals in the New Zealand region were revealed, along with how they affected the building development costs in New Zealand.

4.3.2.6 Conduct of the interviews

The sample size for the pilot interview was limited to 12. The interviews were conducted by face-to-face instead of by phone or skyping. All questions and main discussions were taken on the note. The transcribed feedback of the interviews was sent to the interviewees for confirmation or modification. Anonymity was maintained in the whole process.

4.3.3 Questionnaire survey

Some of the information is collected during the archival study, but not all the archival data will satisfy the research purpose, which means the study must undergo the time-consuming and tedious process of data collection. The study selects the quantitative method (questionnaire survey) to collect the data. Questionnaire surveys are simply divided into structured and unstructured questionnaire surveys (Bill, 2007). Structured questionnaire surveys only contain close-ended questions with some options from which the respondents can select in regard to each question; unstructured questionnaire surveys comprise open-ended questions that allow the respondents to write their answers (Cycytota & Harrison, 2006). This study employs the semi-structured questionnaire surveys to collect data; these include close-ended questions but also permit the respondents to write down their opinions with "other" as an open option to specify the detail.

Before designing the survey questions, some aspects and format of the survey should also be touched upon as the appearance of the questionnaire survey will affect the respondents' reaction to it (Dillman, 2007). A cover letter should be involved in the questionnaire survey. The cover letter is not only a greeting to potential respondents but also includes matters such as the self-introduction of the researcher, the statement of the research questions, the requirement for data, the certainty of confidentiality and anonymity of respondents, and contact details of the researcher. In addition, the estimated time to complete the questionnaire survey should be addressed.

4.3.3.1 Questionnaire design

The questionnaire survey employed in this study includes a cover letter, the main part of the questionnaire, appreciation, and disclaimer. The cover letter states the aims of the study, the requirement for data collection, the appropriate completion time, the introduction of the researcher. A questionnaire survey that includes 13 questions is designed. The questionnaire includes two main parts. The respondents are asked to rate the influencing factors which are categorized into seven major groups, and the rating consists of five-point Likert scales, namely, 1=very weak, 2=weak, 3=medium, 4=strong, 5=very strong in the first part of the questionnaire. The respondents are asked to state their professional backgrounds in the second demographic part. The appreciation part is for appreciating their assistance to complete the questionnaire survey and offering research feedback. The disclaimer part states that the conducted questionnaire survey is grouped into low risk as approved by the University's Human Ethics Committees.

The 45 factors involved in the questionnaire survey are either identified through literature review or pilot survey. They are categorized into seven groups and require the respondents to rank their influence level on building development cost. The followed demographic section is used to identify the eligibility and category of the respondents. Moreover, five-point Likert scales allow the respondents to provide more information that can be analysed by more powerful statistical methods (Norman, 2010). In addition, the options "not sure" and "other" provide freedom to the respondents to offer the answers that can truly reflect their opinions.

4.3.3.2 Target population and sampling frames

The target population is critically defined by research aims and objectives (Bonett & Wright, 2011). The target population is defined as the complete group of objects that possess information the research decides to collect (Bowling, 2005). Sampling frame is a working definition of the target population, which is a comprehensive list of objects that the sample is drawn from (Hu & Kaabouch, 2014).

The target populations in this study are clients, developers, and members of key professional groups (including architects, consultants, quantity surveyors, contractors, and project managers). The target population are registered members of the associations/institutions, based in New Zealand, as listed below:

New Zealand Institute of Architects (NZIA)

Association of Consulting Engineers of New Zealand (ACENZ)

New Zealand Institute of Quantity Surveyors (NZIQS)

New Zealand Institute of Building (NZIOB)

Property Institute New Zealand (PINZ)

Property Council New Zealand (PCNZ)

The sampling frame consists of a whole list of registered members of the various professional associations/institutions listed above. Moreover, the members' demographic backgrounds were checked to exclude those categorised as trainees, receptionists, or retired members. In addition, the professions which took part in the pilot survey were removed from the sampling frame. The sampling frame for the pilot survey and the questionnaire survey is the same due to the research objective being to explore the multi-level factors influencing building development cost in New Zealand. It is appropriate to collect the information from various professional institutions both in the pilot survey phase and the questionnaire survey part.

4.3.3.3 Sampling techniques adopted

The sampling methods used in the research are decided by several factors, such as the nature of the research, the objectives of the research and also the time and budget of the research (Hult et al., 2008). Probability methods are usually used in quantitative data collection, which assumes that each object in the target population has a known but not equal probability to be randomly selected into the sample (Weathington, 2012). Simple random sampling is one of the probability methods usually used in questionnaire sampling; it is based on a random procedure that gives equal opportunity for each object of the target population to be selected (Palta, 2003).

However, given the varying membership sizes of the six sampling frames delineated for the study, random stratified sampling was adopted in this study in order to randomly draw up representative samples from each sampling frame. The method used in establishing the representative sample size from each sampling frame is described in the next sub-section.

4.3.3.4 Sample size

It is wise to determine efficient sample size before the data collection as the studies usually estimate the characteristics of large populations (Arthur et al., 2014). Many determinations dictate the sample size including object variability, sample types, estimation precision, the degree of confidence and the availability of time and budget (Kuncel et al., 2005). The sample size can be calculated by statistical formula with three determinants, namely, the degree of confidence (historically 95 percent), the level of precision (acceptable error), and the variability of the object (standard deviation) (Edwards, 2001).

The questionnaire sample size of the study is calculated based on the numbers of members who belong to the above stated institutions in New Zealand. The number of members in each of these institutions is verified. The sample size for each of these institutions can be computed in Equation **4.1**:

$$n = \frac{\frac{z^2 \times \sigma(1-\sigma)}{e^2}}{1 + \frac{z^2 \times \sigma(1-\sigma)}{e^2 N}}$$

(4.1)

Where

z is Z-score which is equal to 1.96 associated with 95% confidence level

σ is population standard deviation which usually uses 0.5 for safe decision

e is margin of error with respect to a confidence level

N is the population.

4.3.3.5 Census survey

The initial plan was to access the membership directories of the six sampling frames and then draw up the representative sample sizes using Equation **4.1** above. However, it was discovered that access to the membership directories was denied by the secretariats of the organisations due to privacy issues. Therefore, census survey was adopted by extending invitation to participate in the survey to all members of each sampling group. This was done to eliminate bias and to give each member opportunity to participate. Since details of the memberships and their contacts were not accessible, invitations to the sampling frame members to respond to the survey hosted on Survey Monkey website were circulated through their secretariats on behalf of the researcher. Several reminders were requested when responses peaked.

4.3.3.6 Questionnaire administration

For the purposes of the study, the questionnaire survey included professional people from different academic institutes, namely, NZIA, NZIQS, NZIOB, ACENZ, PINZ, and PCNZ.

The questionnaire was distributed on the website Survey Monkey, which is considered as an economic and fast way of covering a wide geographical area. However, it usually has a low response rate and low in-depth information (Babbie, 2013).

The objective of the questionnaire is to determine the critical socio-economic indicators of building development cost. Survey data are randomly collected from people working in the construction sector in New Zealand, including clients, contractors, project managers and building quantity surveyors. Each respondent is asked to assign a one-to-five rating for the 45 indicators identified from the literature review. Past researches showed the factors that have impacts on building development cost from various perspectives. However, the factors might vary in different countries. Therefore, building development cost estimating requires an appreciation of a country's evaluation of the factors affecting the practice. A questionnaire survey was used to examine and rank the factors that can affect building development cost in New Zealand from the view of the professionals in New Zealand's construction sector. Questionnaires will be sent by on-line survey and hand delivery to industry professionals working for small, medium and large construction firms in New Zealand. Sample of the questionnaire is provided in Appendix **G**.

4.3.4 Research ethics

Research ethics are the moral principles used to guide research, from its beginning to its final stage, followed by publication and beyond (Devinney & Siegel, 2012). Researchers and the majority of the public have a right to investigate a phenomenon, while individuals and groups also have rights to protect their privacy (Aguinis & Henle, 2002). Generally, research organisations/institutions set up research ethics committees that produce an ethic code for research to guide their people when conducting their research (Pearce & Huang, 2012).

The code of ethical conduct for research that involves human participants has been produced by Massey University Human Ethics Committees (MUHEC). All research undertaken by staff and students of Massey University must comply with Section 161 of the Education Act 1989 (MUHEC, 2015). This article of law provides freedom to the researchers who can apply the measures that can generate the best results (MUHEC, 2015). However, it also states that the highest ethical standards should be maintained by the institutions and the maintenance of those standards should allow public scrutiny (MUHEC, 2015).

The code of ethical conduct should be consistent with the ethical principles that include respect for persons, privacy and confidentiality; minimisation of harm to participants, researchers, institutions and groups; informed and voluntary consent; avoidance of unnecessary deception and conflict of interest; social and cultural sensitivity to the demographic backgrounds of participants; and justice (MUHEC, 2015).

As a requirement of the study, interview and questionnaire survey instruments were employed to collect data. Prior to undertaking both of the methods, an ethic approval must be obtained from MUHEC. An on-line application and additional documents were provided to attain the approval certificate to conduct subsequent procedures. Low-risk declaration permission was issued by MUHEC that allowed the subsequent data collection. Then the disclaimer statement was added to the last section of the questionnaire to acknowledge the respondents about the ethical issue. The Low Risk Notification letter permitting the conduct of the research is provided in Appendix **A**.

4.4 SELECTION OF DATA ANALYSIS METHODS

4.4.1 Overview of appropriate data analysis methods

Mbachu (2002) identified two aims for adopting an appropriate approach to data analysis in the research: to provide answers to the research questions, and to evaluate the reliability and validity of the research findings. Figure **4.4** models the approach to follow in selecting the most appropriate data analysis technique among competing alternative techniques.

The choice of the most appropriate data analysis method to use depends on the nature of the research problems or objectives (Blaikie, 2011), the nature of the empirical data required to address the objectives (Mertens et al., 2016), the measurement scale of the empirical data (Johnson, 2016), the nature of data distribution (Griffith, 2015).

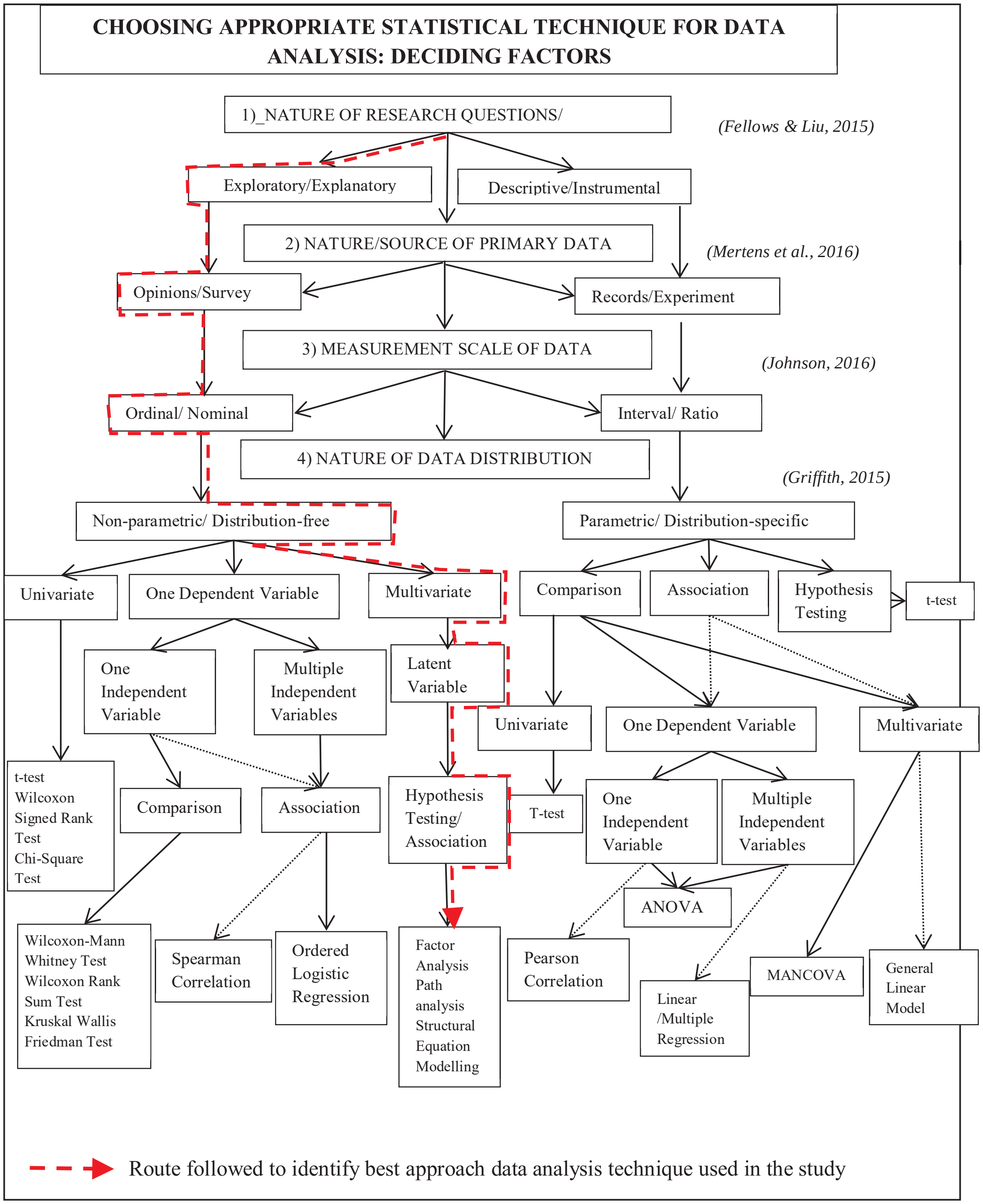


Figure4.4 Flowchart for selection of data analysis techniques [Source: varied sources]

4.4.2 Nature of research questions and objectives

According to (Blaikie, 2011), there is a need to select an appropriate data analysis techniques to answer the research question so that we advance the knowledge of phenomena. In this study, the aim of the research is to test the proposed hypotheses set in previous chapter 3. Generally, the hypothesis is derived from existing literature findings and theories; the use of hypothesis usually suggest the data analysis be performed (Fellows & Liu, 2015). The outcomes of the data analysis should link to the objective of the research addressed by Lancaster (2005).

The research objectives decide what should be tested, and what type of data is to be collected, and which data analysis techniques should be adopted (Hinton, 2014). In this study, the objectives are to explore the factors influencing the building development cost and test the relationship between them. Therefore, the study sets the hypotheses to be tested based on the research objectives.

A hypothesis is kind of supposition which should be tested rigorously to remove as much uncertainty as possible and replace it with certainty (Shi & Tao, 2008). One important step to test hypothesis is to draw a sample from the population for collecting data and conducting the analysis. Thus, statistical analysis techniques play a key role in testing hypothesis (Gül, 2017).

4.4.3 Nature of the primary/empirical data

At the early stage of the study, to give a preliminary consideration to the required data is a good discipline. An appropriate set of data allows rigorous hypothesis testing, and then to generate meaningful research findings, given the practical considerations (Wilcox, 2012). The selection of the effective data analysis techniques relates to two types of data--quantitative and qualitative data (Lancaster, 2005).

The study first collected the data and information from previous studies and findings, and then a questionnaire survey was adopted to collect the opinions from professionals. The data and information from literature review were used for hypothesis setting. The data collect from the questionnaire is ordinal data as the five-point Likert-Scale was adopted to rank the factors. Therefore, an appropriate statistical technique is necessary to analyse the ordinal data to test the hypothesis, and then to draw conclusion.

4.4.4 Scales of measurement

Generally, the data type is defined in terms of the scales of measurement employed; there are mainly four scales of measurement namely, nominal, ordinal, interval and ratio (Fellows & Liu, 2015). Nominal or categorical scales are used to group member of the sample (nationality, ethnicity and gender); ordinal scales are usually employed to rank the responses' opinions; interval scales are numeric scales which represents quantity and has equal units; ratio scales are similar to interval scales and they also have an absolute zero value (Cooper & Schindler, 2003).

Since the most common scale for collecting the respondents' opinion is the Likert scale (Harzing et al., 2009), this study requires the respondents to rank the influencing level of the costs drivers by five-point Likert scale. Therefore, the data collected from the questionnaire in this study is ordinal scale.

4.4.5 Nature of data distribution

The parametric analysis methods assume that the data generated by well-known distribution, but in some case, this stringent assumption often quite unrealistic, other methods are necessary; these methods are non-parametric analysis methods or distribution-free methods (Bonnini et al., 2014). Since the non-parametric analysis methods are an only valid solution when the assumption of the parametric analysis does not hold, in general, non-parametric analysis methods are more appropriate and flexible than parametric analysis methods. Before conducting data analysis there is a need to know the distribution of the data so as to select appropriate data analysis techniques.

In this study, the data collected from questionnaire survey is ordinal point data, it difficult to assume that the data is normally distributed or other well-known distribution. It is more appropriate to select a statistical technique that is not stringent on the data distribution.

4.5 DATA ANALYSIS METHODS ADOPTED

4.5.1Qualitative data analysis (Content analysis)

The objectives of the qualitative data analysis are to identify, examine and interpret the themes and patterns of the qualitative data and how they serve to answer the research questions (Jonsen & Jehn, 2009). As in the previous setting up of research questions, and to facilitate the following questionnaire survey, the content analysis method was adopted in this study. The content analysis method is used to code the responders' answers into a series of meaningful categories that are prepared to further quantitative statistical analysis (Franzosi, 2003). By content analysis, the study can refine and create new constructs in the questionnaire survey.

The demographic profiles of the responders were established and tabulated for locating their qualitative data. The content analysis is described in detail in the following chapter.

4.5.2 Quantitative data analysis process

4.5.2.1 Data screening

Generally, a thorough data description is critical to a comprehensive understanding of the data and appropriate adoption of statistical techniques (Downing & Haladyna, 2006). Moreover, a thorough data description can explore whether the data satisfy the assumption of the subsequent statistical analysis (Grissom & Kim, 2001).

The quantitative data collection in this study aims to test the research model; in this way the questionnaire allows the respondents to rank the influence level of the factors on building development cost from very weak to very strong. First, the data description uses Histograms to graphically display the frequency of the five-point Likert-level for respective constructs in the questionnaire. Following that, Box-Plots are employed to detect the outliers for facilitating subsequent statistical analysis. Finally, the Normality of the data is determined by the shape of distribution and adoption of the Q-Q plot as normal distribution is an assumption for most of the statistical analysis methods.

4.5.2.2 Cronbach's alpha test

The Cronbach's Alpha test is usually employed to measure the reliability or the internal consistency of the data collection instruments (Tavakol et al., 2008). The two fundamental elements to evaluate the instrument are the validity and reliability (Schoonheim-Klein et al., 2008). An instrument measurement cannot be validated without reliability (Auewarakul et al., 2005). Cronbach's Alpha test is the most widely used measurement to test the reliability or internal consistency, while internal consistency usually tells how well the items in the test measure the same construct (Streiner, 2003).

As the research used the questionnaire survey to collect the data, the reliability of the questionnaire should be tested in order to generate validated and reliable results.

Therefore, the Cronbach's Alpha test should be employed in the data analysis to measure the internal consistency of the items in the questionnaires.

The value of Cronbach's alpha ranges from 0 to 1 as the value closer to 1 the higher reliability of the items. The formula to calculate Cronbach's alpha is shown in Equation **4.2**.

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N - 1) \cdot \bar{c}}$$

(4.2)

Where

N is the number of items

$\bar{v}$ is the average variance

$\bar{c}$ is the average covariance between items

4.5.2.3 Regression analysis

A regression analysis is usually centred on describing and evaluating the relationship between a given variable Y (dependent variable) and one or more other variables $X_1, X_2, \cdots, X_n$ (predictors or independent variables) (Marsh & Cormier, 2001). Regression models include more than one predictors, or independent variables, called multiple regression models (Larose, 2015). One of the essential assumptions for regression analysis is that there is a linear relationship between the dependent variable and independent variables (Morrison, 2004). The regression model is shown in Equation **4.3**.

$$Y_i = a + b_1X_{1i} + b_2X_{2i} + \cdots + b_3X_{3i}$$

(4.3)

Where

a is the consent of the regression model

b_i are the coefficients of the regression model

The study aims to develop the relationships between the building development cost with the seven constructs. Moreover, the relationships between the constructs and indicators are also necessary to identify and evaluate. The regression analysis can provide a basic understanding of the relationships.

Algorithms for exploratory factor analysis involve principal component analysis, and an algorithm for structural equation modelling using the analysis of a moment structures (AMOS) maximum likelihood.

4.5.2.4 Principal component analysis

The principal component regression methods combine linear regression with principal component analysis (Zhang et al., 2013). The principal component analysis transfers a set of highly correlated independent variables into a set of uncorrelated independent principal components. The principal component analysis not only mitigates the multicollinearity problem but also reveals which independent variables should be predictors. The spatial patterns' new variables remove the properties caused by multicollinearity after principal component analysis, as the ideal predictors to use in a regression analysis. Essentially, the new variables are mutually orthogonal and uncorrelated which are linear combinations of the original variables.

Given a set of independent variables $X_1, X_2, \ldots, X_p$, the covariance matrix for the set of the independent variables is shown in Equation **4.4-4.5**.

$$V = \frac{1}{p}\sum_{t=1}^{p} X_t X_t^T$$

(4.4)

and

$$\lambda_i a_i = V a_i$$

(4.5)

Where

λ_i is the eigenvalue of V

a_i is the corresponding eigenvector

The principal components can be computed in Equation **4.6**

$$PC_t(i) = a_i^t X_t, \qquad i = 1, 2, \dots, p$$

(4.6)

The number of principal components is often reduced due to only several eigenvectors being used where their corresponding eigenvalues are greater or equal to 1. This is why the principal component analysis can reduce the number of independent variables. Principal components are linear combinations of the original variables, but they are orthogonal. The percentage of total variance in the original data represented by each principal component is calculated in Equation **4.7**.

$$L_i = \frac{\lambda_i}{\sum_{i=1}^{p} \lambda_i} \times 100\%$$

(4.7)

Where

λ_i represents the ratio of the component i to the total components

p is the total number of components

L_i represents the variance of component i

Therefore, the cumulative variance is shown in Equation **4.8.**

$$L(m) = \sum_{i=1}^{m} L_i$$

(4.8)

The reasonable number of principal components that are selected depends on the cumulative variance being over 85-90%.

4.5.2.5 Structural equation modelling

Structural equation modelling combines multiple regression analysis and factor analysis together to analyse the relationship between measured variables and latent constructs or factors (Raykov, 2006). Basically it provides a quantitative method to test a hypothesised model (Byrne, 2016).

Structural equation modelling can be employed to capture complex relationships between one or more dependent and independent variables that can be sourced from qualitative or quantitative data (Hox & Kleiboer, 2007). Unlike the correlation analysis from which the causality can't be inferred, structural equation modelling provides the option to test the hypothesized causal relationship. The correlation matrixes from the specified hypothesised model and the data collection are mathematically compared (Little et al., 2007). The fit of the correlation matrix of the hypothesised model to that from data collection is examined and evaluated by SEM analysis, and then generates a set goodness of fit index that indicates how well the hypothesised model fits the data (Raykov, 2006).

The other advantage is that the error variance of the measured variables can be estimated by structural equation modelling but they are assumed to be zero in exploratory data analysis. Moreover, the structural equation modelling usually employed to test the theory exists in the literature but is not well developed. As stated above, the structural equation modelling is fit for the research objectives and is suitable to analyse the data.

The structural equation modelling usually involves the latent variables, the measured variable and regression paths. The latent variable can be identified as an eclipse or circle, while the measured or observed variable is displayed as a rectangular shape while the regression path is expressed by an arrow. This is shown below in Figure **4.5**.

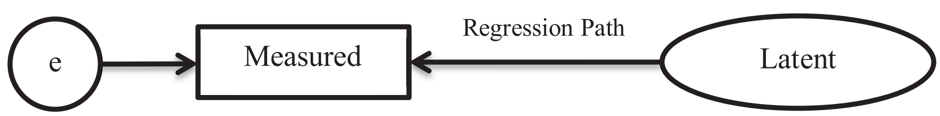


Figure 4.5 The diagram sample in AMOS [Source: (Byrne, 2010)]

The linear equation can be expressed in Equation **4.9**.

$$Measured\ variable = \alpha Latent\ variable + error$$

(4.9)

Where

α is estimated by structural equation modelling

e is the error variance generated from modelling

4.6 RESEARCH MODEL TEST PLANNING AND IMPLEMENTATION

Descriptive survey method was adopted since the empirical data for research were obtained from interview and questionnaire survey (Kahneman et al., 2004). At the design stage of the questionnaire, the data and information were collected from the pilot interview for key professionals in the construction industry of New Zealand. Then a questionnaire survey was distributed to the six associations/institutions in New Zealand, except for those professionals who have provided their opinions during the pilot-interview phase. After that, the interviews with the manager-level professionals from construction industry were held to collect their feedback on the research finding.

The random sampling method was used to define the sample size in order to ensure that the sample is good enough to represent the target population. The statistical methods involving principal component analysis (PCA), reliability test, and structure equation modelling are used to analyse the quantitative data for testing the research model.

4.6.1 Instrument for collection of empirical data

Structured questionnaires were employed to collect the responses from the registered members from the six associations/institutions in New Zealand about their perspectives on the factors influencing building development cost in New Zealand. The design of the structured questionnaire is comprehensive and concise in order to collect more information and more respondents. The semi-structured questionnaire is attached in the Appendix G.

4.6.2 Questionnaire distribution planning

The questionnaire was distributed through email, web-link and institutions' forums. The study put the questionnaire on Survey-Monkey to generate a web-link for this questionnaire and then sent the web-link to the registered members by email. The researcher also contacted the manager who operates the website of the institution to put the questionnaire on the forum in order to improve the response rate.

4.6.3 Instrument for research model development and verification

The data collected from questionnaire then were used to test the research model based on the theory framework in Chapter three. The structure equation modelling in AMOS software was used to develop and verify the research model. The structural equation model was adopted to test the feasibility of the concept model, and then the GOF measure was used to judge the qualification of the model. If the measure of the research model is satisfactory, the hypotheses will be tested by the research model. After that, the reliability test was adopted to prove the reliability and validity of the research model.

4.6.4 Research model validation

The professionals from the construction industry were invited to interview to provide their opinions on the research findings. The data and information collected from interviews were used to judge whether the research findings reflect the real situations in the construction industry of New Zealand and how the findings can apply to the practice.

4.7 RELIABILITY AND VALIDITY

Research focused on evaluating and examining the hypothesised relationships between dependent variables and independent variables, but such research always involves a set of validities (the possible truth of a hypothesis) (Creswell, 2014). The validities usually contain external validity, internal validity and construct validity.

Irrespective of the approach adopted, the research must endeavour to achieve reliability and validity for its results and conclusions (Lucko & Rojas, 2010). It is important to note that validity and reliability are as important as the actual results and conclusions; the former help to put the latter in proper context (Fellows & Liu, 2015).

4.7.1 External validity

External validity mainly concerns the question on how applicable are the research results drawn from the test sample to the population (Marcellesi, 2015). External validity is enhanced by a selection of the sampling frame, nationally and internationally, the adoption of the sampling techniques which assign equal opportunity to the objects, and the proper sampling size that is statistically qualified to represent the target population.

Triangulated studies are defined as studies which use two or more research approaches or techniques, so combining the advantages while eliminating the disadvantages of each approach (Yeasmin & Rahman, 2012). Moreover, triangulation between methods can enhance the external validity; triangulation in a method can improve the internal validity (Zohrabi, 2013).

The study adopted both qualitative and quantitative research methods in order to combine the advantages of the two methods, thus enhancing the external validity of the study. During the data collection stage, both a qualitative method (pilot-survey) and a qualitative method (questionnaire survey) were employed to collect comprehensive data. Moreover, the respondents are from varied key associations/institutions in New Zealand. In addition, the qualitative data analysis method (content analysis) and several quantitative analysis methods were used for data analysis.

4.7.2 Internal validity

Internal validity is concerned with how much the change in the dependent variables is caused by independent variables (Grajo et al., 2016). To achieve high internal validity, consideration should centre on no significant related data being ignored and appropriate methods should be selected (Schick & Vaughn, 2002). The research has done an in-depth study on the research questions and endeavoured to include almost all influencing factors in the research by a time-consuming literature review. Moreover, the pilot survey interviews were also involved to explore more potential constructs that might be specific to New Zealand or omitted by the previous study.

4.7.3 Construct validity

Construct validity is concerned with the question on how much the construct measured by the research reflects the hypothesised construct (Mona & Martin, 2016). To avoid poor construct validity, the following process was adopted: First, the constructs are generated from the extensive literature survey, and then refined by the subsequent pilot survey interview. Finally, the data analysis methods are adopted to provide statistical evidence that the constructs are adequate.

4.7.4 Reliability

Reliability is concerned with the question on what degree the applied measures are free from error, and the extent to which the results and associated conclusions can be generalised to wider settings beyond the immediate scope of the study (Ang, 2014). Reliability is a prerequisite for validity while validity guarantees reliability (Mitchell, 2013). The higher the reliability, the more results and conclusions can be generalised (Ramada et al., 2014).

The internal consistency form of reliability is concerned about the findings' consistency generated by the test method; it seeks to ensure that the various items measuring different constructs yield consistent scores (Lund et al., 2014). In brief, the internal consistency measure of reliability decides how well a measurement is measuring what you want it to measure (De Leng et al., 2017).

A test for internal consistency measure of reliability could involve comparing the results from survey respondents to see whether they have the same opinion (Chahoud et al., 2017). The Cronbach's alpha reliability test was employed in this study for this purpose. Moreover, to improve reliability, the external sources of variations are minimized by the adoption of standardized measurement approaches and by ensuring the anonymity of responses to minimize subject bias.

CHAPTER 5 DATA PRESENTATION AND ANALYSIS

5.1 OVERVIEW

The data collected from the pilot survey and questionnaire survey of key construction professionals are presented and analysed in this chapter. The chapter contains five main sections; in the first section, the pilot survey results are presented. In the second section, the demographic characters of the 283 useable questionnaire responses that were gathered from the key professionals in the construction industry are summarized and reported. In the third section, the preliminary tests about the data acceptance (mean ratings of the indicators), commonality (principal component analysis) and reliability (Cronbach's alpha test) are described. In the fourth section, the model development process using SEM is illustrated, including the process for confirmatory factor analysis (CFA) and model refinement and modification. In the last section, the assessment of the model using goodness-of-fit (GOF) measure is presented. Results of the comparison of the GOF indices for the first SEM and final SEM are also presented.

5.2 QUALITATIVE PILOT SURVEY RESULTS

The pilot survey method was adopted in this study to collect feedback from experienced and high-ranking industry practitioners on the factors influencing building development costs. The pilot survey also helped to refine and validate the factors sourced from a review of previous literature. The pilot survey also assisted in categorizing the factors into seven groups, which formed the basis for the design of the questionnaire.

At the beginning, professionals were sought to participate in the interview. The target professionals were selected from manager-level registered members of the six trade and professional construction associations in New Zealand, which were delineated as sampling frames for the study. Their contact details were identified through website searches and industry networks. Invitation letters were sent to them directly or through the secretaries of their various associations. A total of 84 invitations were sent out; only 12 people (17.9%) accepted. The 69 (82.1%) negative responses included 20 (29%) who failed to respond and 49 (71%) who said they were unable to participate in the interview because they were either too busy, on a business trip, or had no interest. The professional roles of the respondents are presented in Table **5.1**.

Table 5.1 Interviewees' roles in the industry

Property Developer		**Banker & Financier**		**Client**		**Contractor**		**Project Manager**		**Material Supplier**		**Other**		**Total**	
No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
4	33	1	8	1	8	2	17	3	25	1	8	0	0	12	100

5.2.1 Factors influencing building development costs

Feedback from interviewees in the pilot interviews showed seven groups, which formed the basis for the design of the questionnaire. The groups and their sub-factors are as follows. The below constructs were used to design the questionnaire so as to obtain ratings of their relative levels of influence by respondents.

1. Project component costs

- Design cost
- Procurement cost
- Construction cost

2. Project characteristics factor

- Project location
- Project complexity
- Procedures methods
- Contract types
- Technology innovation

3. Project stakeholders influences

- Clients
- Consultants
- Contractors
- Suppliers
- Building officials

4. Property market and construction industry factor

- Material market
- Labour market

- Competition level
- Market structure and size
- Boom and bust cycles
- Relationship of supply and demand
- Investment tendency
- House sell/rent prices

5. Statutory and regulatory factor

- Building code and compliance
- Health and safety regulations
- Political policies
- Financial regulations
- Construction contract Act

6. National and global dynamics

- Global political dynamics
- Natural forces
- Global economic trend
- Global business sentiments

7. Socio-economic factor

- Gross domestic production

- Capital goods prices
- Producers' prices
- Consumer price index
- Productivity in construction industry
- Labour cost
- Net migration and population growth
- Employment rate
- Housing prices
- Building consents
- Energy prices
- Exchange rate
- Monetary policy
- Investors' confidence
- Government fiscal policies

5.3 QUESTIONNAIRE SURVEY RESPONSES

A total of 2898 questionnaires were distributed by email as well as by invitation through their associations' secretariats, requesting the professionals to respond to the questionnaire hosted online on the Survey Monkey portal. By the cut-off date set to receive feedback, 289 respondents participated in the survey, out of which 283 were found to be usable. The response rate was 10 percent. Eighteen percent of the respondents indicated interest in receiving a summary of the key research findings by supplying forwarding email addresses. The survey responses are analysed in Table **5.2**.

Table 5.2 Questionnaire response analysis

Association	Sampling Frame	Min Sample	Adj Min Sample	Req Sample	Questionnaire Sent	Rece ived	Useful	% Res
NZIA	300	22	73	169	300	34	33	11
NZIQS	900	23	87	269	900	92	91	10
NZIOB	449	23	79	207	449	36	35	8
ACENZ	99	19	49	79	99	28	27	28
PINZ	800	23	86	260	800	52	51	6.5
PCNZ	350	23	76	183	350	47	46	13.5
	2898	133	450	1167	2898	289	283	10

5.4 DEMOGRAPHIC INFORMATION OF RESPONDENTS

The questionnaire includes a demography section that requests the demographic background of the key professionals. The demography section comprises five questions including the professional's role in the construction industry, their occupation role in the organization, the city they are working in, working experience, and professional qualifications. The demography backgrounds of the respondents are described below in detail.

5.4.1 Professional role in industry

The professional roles of the respondents are explored in Figure **5.1** as a percentage of the total number. The 283 respondents include owners/developers (11%), architects (11%), engineers (9%), project managers (14%), main contractors (10%), specialist tradespersons (4%), quantity surveyors (30%), building officials (4%), inspectors (2%), and others (5%).

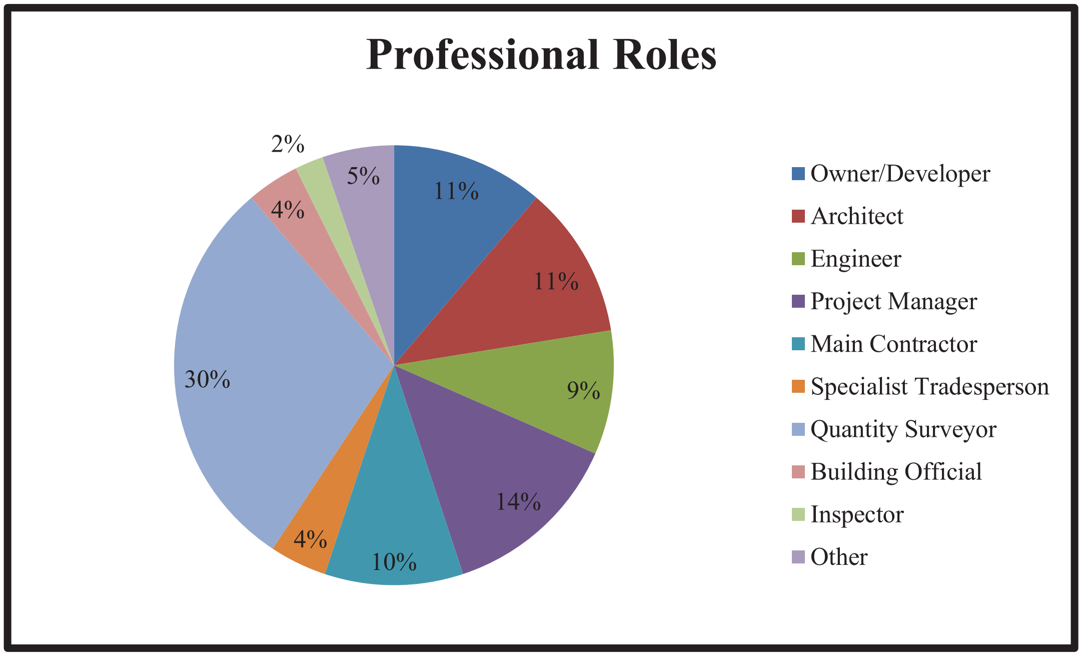


Figure 5.1 Professional roles of the respondents

5.4.2 Occupation in organisation

There are 87 professionals (31%) from the owners or chief executives, 148 professionals (52%) from senior management, 43 professionals (15%) from middle management and 7 (2%) from others who did not provide details of their position. During the questionnaire survey stage, the study aims to collect the opinions from key professionals in the industry and endeavour to send an email invitation to the professionals at the manager level. Therefore, the respondent rate from the lower level position is low. This is described in Figure **5.2**.

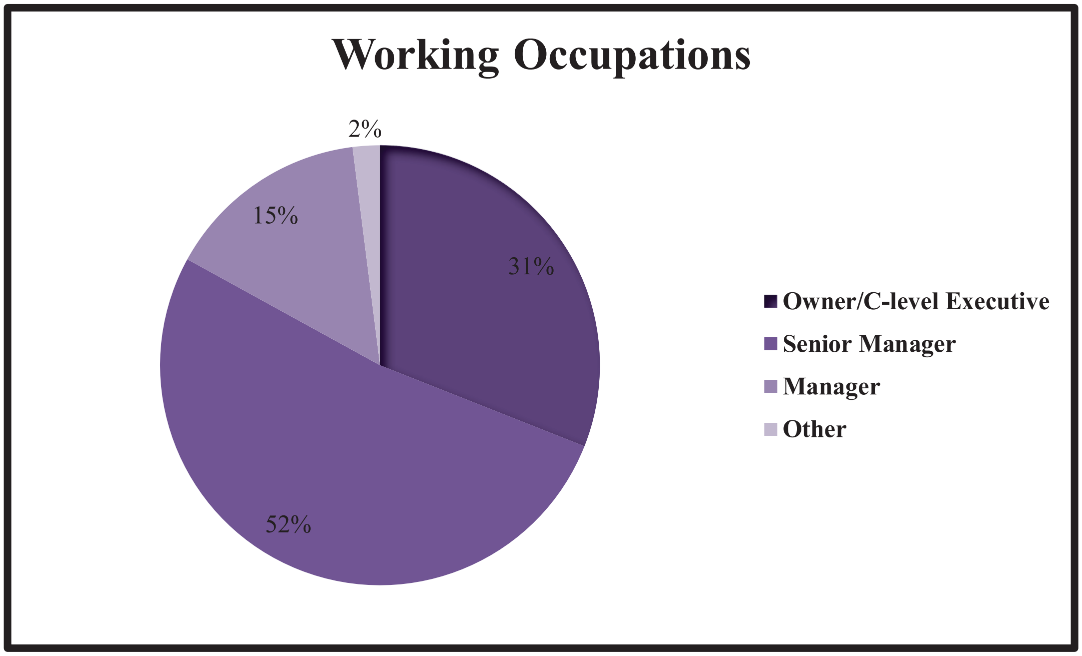


Figure 5.2 Working occupations of the respondents

5.4.3 Professional experience of the respondents

As previously described, the majority of the respondents are from manager level or above, most have been in the construction industry for more than 20 years, some of them have been working in this industry over 30 years. Therefore, the response rate from the group 21-30 years' experience is high (58%). Moreover, the percentages of respondents from the group above 30 years' experience, 11-20 years' experience and 6-10 years' experience are 12%, 29%, and 1% respectively. This is shown in Figure **5.3**.

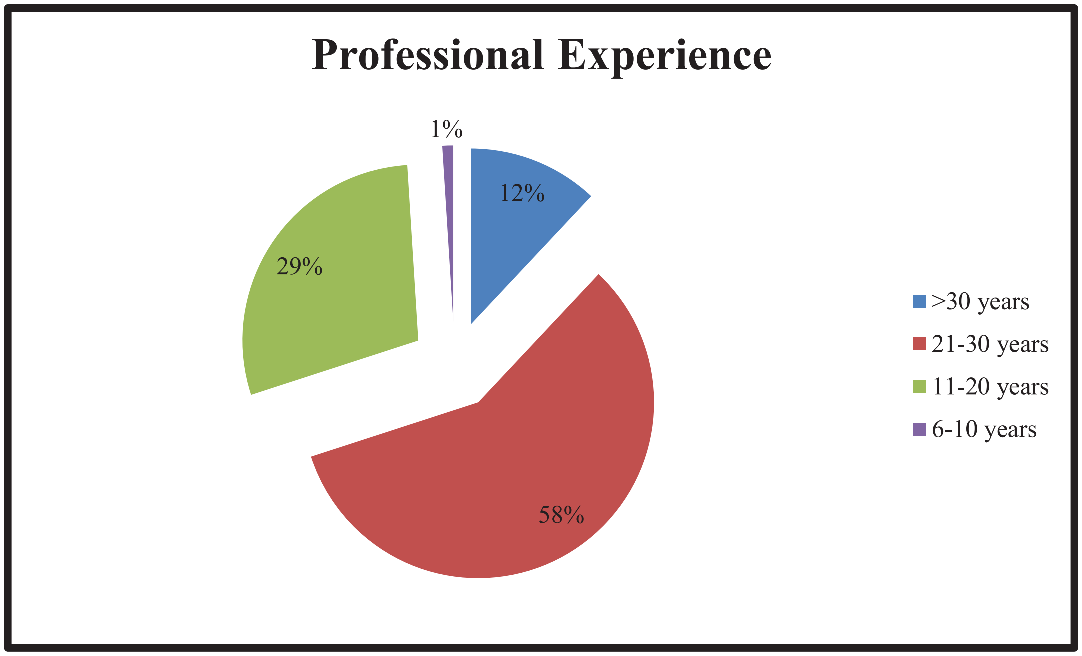


Figure 5.3 Professional experience of the respondents

5.4.4 The city currently working in

The questionnaires were mainly distributed in three main cities in New Zealand, namely Auckland, Wellington, and Christchurch. The majority of the respondents should come from the three cities; 37% of the respondents are currently working in Auckland, 30% are in Wellington, 25% are in Christchurch, 8% are in other regions of New Zealand and other countries. This is explored in Figure **5.4**.

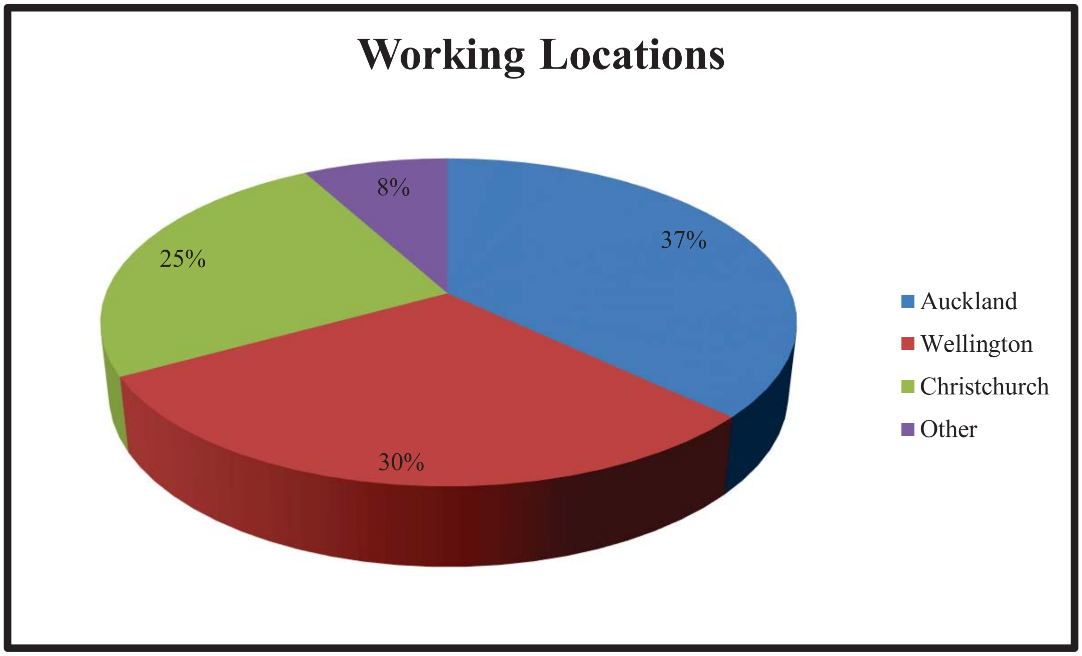


Figure 5.4 Working locations of the respondents

5.4.5 Professional associations

The sample frames of the questionnaires are the registered members from six associations/institutions in New Zealand, namely NZIA, NZIQS, NZIOB, ACENZ, PINZ and PCNZ. The percentage of the respondents from the six associations/institutions are 12%, 32%, 12%, 10%, 18% and 16%, respectively. This is indicated in Figure **5.5**.

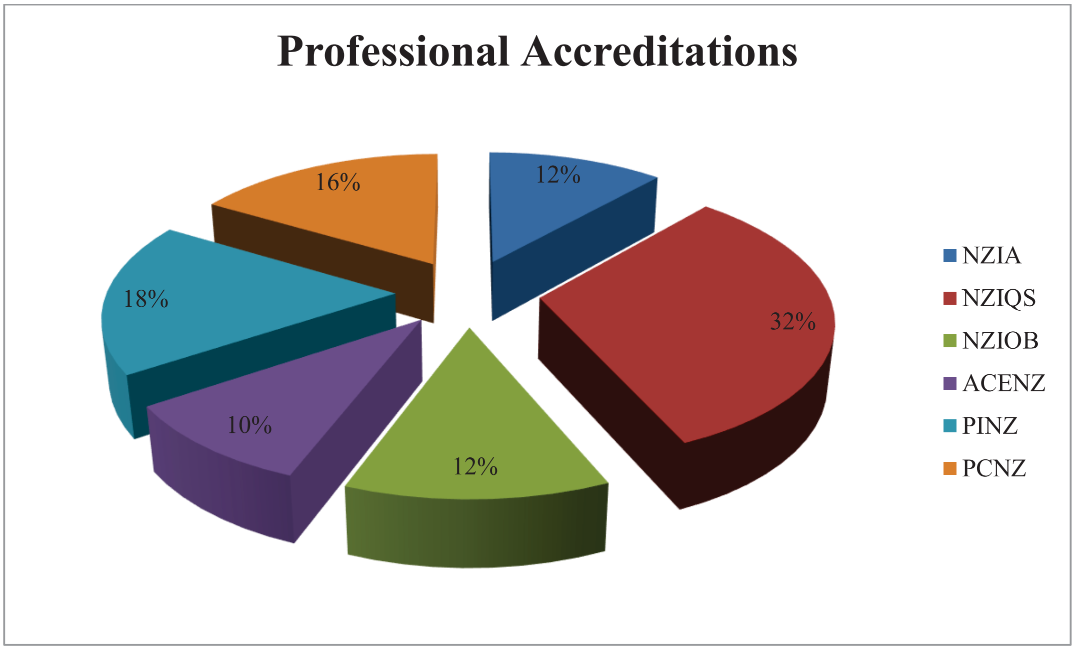


Figure 5.5 Professional accreditations of the respondents

5.5 QUANTITATIVE DATA ANALYSIS PROGRESS

5.5.1 The advantage of SEM

Structural equation modelling SEM can be seen as a unification of several multivariate analysis techniques, such as regression analysis and path analysis (Fan, 1997). It can be employed to develop the relationship between measurement variables and latent variables, and test the hypothesized relationship between observed variables and latent constructs by using the collected data. The involvement of latent variables in the model eliminates the measurement error from measurements and thus improves generalizability and the validity of the research design (Little et al., 1999). Traditionally, structural equation modelling is regarded as a confirmatory tool of data analysis.

5.5.2 SEM application in the construction domain

Although there is wide application of structural equation modelling in the research field, applications in construction engineering and the management domain are rare. The application of SEM for statistical analysis investigating the role of relational bonding in inter-organisational collaboration has been conducted by Sarkar et al. (1998). Molenaar et al. (2000) used SEM to examine the fundamental factors affecting contract disputes between clients and contractors in the construction sector. In this case, Molenaar et al. (2000) addressed the model advantage of SEM compared with regression analysis, and SEM is more suitable for complicated data analysis. Mohamed (2002) revealed the relationship between safe work behaviour and the safety climate on construction sites by using SEM. Moreover, Mohamed (2003) used SEM to test the hypothesized relationship model that attempts to explain the sequential effect from partner selection to venture formation and operation performance. Islam and Faniran (2005) adopted SEM to quantify the influence of the situational factors on project environment and the organisational characteristics of effective and reasonable project planning and concluded that the SEM approach enables the modelling of latent variables and quantifies the influence level for individual indicators or attributes. The study conducted by Leung et al. (2005) has identified the critical stressors affecting estimators in Hong Kong using SEM. The adoption of SEM-examined partner trust levels in their relational bonding, permeability and their performance has been carried out by Wong and Cheung (2005).

5.5.3 Data analysis process

To select an appropriate analysis approach for the current study several statistics analysis tools have been considered. To examine the grouping of the influencing factors of building development cost in New Zealand, confirmatory factor analysis, CFA, can be adopted, while to test the relationship between the building development cost and influencing factors, regression analysis can be used in a step-by-step fashion. However, the hypothesised relationships need to be checked simultaneously in a holistic manner in order to adequately take into account measurement error. To achieve this aim, SEM is the best option. SEM has been chosen over other multivariate analysis tools due to its ability to consider the measurement errors inherent in subjective operational measurement and to develop and explore the entire set of hypothesised relationships in the model (Molwus et al., 2017).

The development of a SEM research model includes some basic steps:

- Define and identify the model components which include the latent constructs and measurement indicators sourced from literature theory and empirical studies;
- Set up the hypothetical relationship depending on the aim and objectives of the study;
- Develop the initial model by using the data collected from the questionnaire survey;
- Verification of the model by evaluating the model estimates and goodness-of fit GOF measures;
- Validation of the model based on theoretical and empirical justification

The first two steps were achieved by using a literature review to define and identify the latent constructs and corresponding measurement indicators and set up the hypothesised relationship; the following two steps were achieved in this chapter, while the last stage will be performed in the next chapter.

There is no agreement on the acceptable sample size among researchers using SEM. Some researchers recommended a large sample size; whereas others used a smaller sample size in construction management provided different reasons (Doloi et al., 2012; Eriksson & Pesamaa, 2007; Islam & Faniran, 2005; Mohamed, 2002; Ozorhon et al., 2007)

5.6 MODEL DEVELOPMENT USING SEM

5.6.1 Structural equation modelling

The study reviewed the factors influencing building development cost from the literature and then grouped the indicators into seven categories based on theories and the pilot survey. Accordingly, the questionnaire survey was designed and distributed to industry professionals to gather the data, and then test the data to fit the hypothesis set previously.

The theory framework is the basis of the structural equation modelling as the analysis progress is to develop a good model. The conceptual research model is comprised of constructs and a causal relationship between these constructs. When succeeding from theory to measurement, constructs are transformed to variables. In SEM, a variable can be an independent variable or exogenous variable and a result variable called a dependent variable or endogenous variable in a chain of causal hypotheses (Groanland & Stalpers, 2012). The model is composed of seven influencing factors and building development cost. In the model, the study set out seven hypotheses and measurement components.

The adoption of the structural equation modelling for research and studies in the construction management-related field is increasing in recent years (Shanmugapriya & Subramanian, 2016). In structural equation modelling, the explained variance of the endogenous latent variables is estimated by assessing model relationships in an iterative sequence of maximum likelihood regression (Hair et al., 2010). Structural equation modelling consists of a measurement model that identifies the relationship between a latent variable and measurement attributes and indicators, and a structural model that identifies the relationship between latent variables (Molenaar & Washington, 2000). AMOS 23 software was used to analyse the research model and test the reliability and validity of the research model. The necessary data were fed into SPSS 23 software that links with AMOS 23 software

5.6.2 Choosing appropriate type of SEM analysis approach

There are two approaches to SEM modelling. The first is the covariance-based SEM (CB-SEM) method; the other is the partial least squares SEM (PLS-SEM) (Hair et al., 2011). CB-SEM aims to reproduce the theoretical covariance matrix that matches the sample covariance matrix; the objective of the PLS-SEM approach is to maximise the explained variance of dependent latent constructs. Both are suitable to test the hypothetical causal relationships between latent constructs. However, this study adopts the CB-SEM approach based on the reasons discussed below.

Although a growing number of studies use PLS-SEM, this approach is not as rigorous as the CB-SEM approach (Hair, 2017). Therefore, it is less reliable when examining the relationships between latent constructs. Few researchers view the PLS-SEM approach as a robust analytical approach for dealing with SEM challenges for reasons such as adequacy of sample size, normality and homoscedasticity (Wong, 2016). According to Boomsma (1985), where the minimum number of samples is between 100 and 200, then CB-SEM could be used, otherwise the PLS-SEM is more appropriate due to its tolerance of the violation of the normality assumption.

However, (Hair, 2017) confirmed (Boomsma, 1985) postulation by arguing that PLS-SEM use in such a situation is not model-specific and might result in an unreliable estimate of the sample size requirement. Westland (2010) advised that the ratio of measurement indicators to the latent constructs is a more reliable approach to calculating the minimum sample size required for CB-SEM application. This is in contrast to (Boomsma, 1985) use of a number of samples as against the minimum sample size as a decider for the use of CB-SEM.

Westland (2010) provided the expression for calculating the minimum number of samples required for the use of CB-SEM (see Equation **5.1**).

$$n \geq 50r^2 - 450r + 1100$$

(5.1)

Where:

n is the number of samples

r is the ratio of indicators to latent constructs

Using Equation **5.1**, the minimum number of samples for the study was calculated as 274 with 45 being the number of indicators and seven latent constructs as shown in Table 5.6. The value of r in Equation **5.1** is 45/7 = 6.4; then Equation **5.1** evaluates n = [(50×6.4^2)-(450×6.4) +110] =274; this is less than the 283 samples used in the study (i.e. 283>274). Therefore, justifying the use of CB-SEM in place of PLS-SEM (Westland, 2010).

Furthermore, PLS-SEM does not provide the calculation for goodness-of-fit (GOF) measures which provide a reliable tool for examining the goodness-of-fit of the proposed model to the empirical dataset (Rigdon, 2016). It is essential to assess how well the model fits the data as a key decider on the appropriateness of the research SEM model developed from the dataset (Barrett, 2007). Without this GOF assessment for the model, there will be no basis for concluding that the model is valid (Barrett, 2007).

Additionally, superiority of the CB-SEM approach draws from its strict requirements in meeting the assumption about the measurement variables to be multivariate and normally distributed. Byrne (2010) argued that this is fundamental to SEM estimation, particularly for the Generalized Least Squares (GLS) and Maximum Likelihood (ML) estimating subroutines of the CB-SEM analysis. Violation of this assumption might lead to inaccurate calculations for the chi-square and t-test.

Also, Hoyle (1995a) points to further reliability and validity test capability of the CB-SEM approach, which is on the univariate normality test conducted via the Kurtosis test. The data in this study satisfy the univariate normal test conducted by the SPSS Kurtosis test and the multivariate normal test performed in AMOS. The results are shown in Appendices **I2** and **J2**.

According to the suggestion by Hair et al. (2011), if the assumptions of the CB-SEM are satisfied with respect to the minimum sample size and data distribution, the CB-SEM is a better option; otherwise, PLS-SEM is a good approximation of CB-SEM.

Satisfaction of the above strict requirements of the CB-SEM by the empirical data attributes justified the use of CB-SEM in the study in place of a PLS-SEM approach.

5.6.3 Primary analysis for consistency checks

Primary consistency analyses include mean ratings of measurement indicators, principal component factor analysis and Cronbach's Alpha test. The mean ratings of the measurement indicators were obtained to check the acceptance of them by the respondents; principal component factor analysis was carried out to check the commonality within the data set; and Cronbach's Alpha test was performed to test the reliability of the data set. Finally, SEM with AMOS 23 software was employed to test the hypothesised relationship between the influencing factors and building development cost in New Zealand.

The reliability and validity of the data are important for a research study. The Cronbach's Alpha is a high-quality test widely used for reliability testing and an essential test for evaluating a questionnaire instrument. The appropriateness of the categories was first verified by a reliability test. The quality of the measurement attributes and the indicator for corresponding constructs in the model should be examined and evaluated. The first criterion is the internal consistency reliability. Cronbach's Alpha test is a widely-used method to test the internal consistency of measurement indicators, based on the correlations between indicators.

5.6.4 Primary consistency test results

The consistency tests are imperative to the study as they ensure the reliability and validity of the data set. The mean ratings of all the measurement indicators by the respondents are used to ascertain the acceptance of them by the respondents. The results of mean rating shown in Table **5.3** explored the high-level influences of the indicators on building development cost in New Zealand. The indicator with the highest rating by all the survey respondents is "Project Complexity" PCF2 with the mean rating of 4.57 and the indicator with lowest rating is " Energy Prices" SEF11 with the mean rating of 2.57.

The result of principal component analysis indicated the existence of more than one factor (up to 11 possible factors) as shown in Table **5.4**, and explored that there is no commonality issue within the data set. If the data all fall into one factor, it suggests that there is a commonality issue, indicating that the indicators might represent one group (Schriesheim, 1979).

As the questionnaire is designed to measure the factors from different concepts, it is unwise to measure the alpha value as a whole as the different direction of the questions will inflate the alpha value. Therefore, in principle, the alpha value is better to be reported separately for each construct rather than as an entire test. The reliability test results for individual latent constructs are presented in Table **5.5**.

Having confirmed the acceptance, commonality, and reliability of all the measurement indicators, the confirmatory factor analysis would be conducted to test the measurement model.

Table 5.3 Mean rating and ranking of influencing indicators for BDC

Code	Influencing indicators for BDC	Mean	Rank
PCF2	Project Complexity	4.57	1
PCC2	Construction Cost	4.43	2
SEF7	Net Migration and Population Growth	4.33	3
PCF1	Project Location	4.24	4
PMCI3	Competition Level	4.19	5
PSI1	Clients	4.10	6
PSI2	Consultants	4.10	6
PMCI2	Labour Market	4.10	6
PMCI1	Material Market	4.10	9
SEF14	Investors' Confidence	4.05	10
PSI3	Contractors	4.00	11
SEF6	Labour Cost	3.95	12
PMCI5	Boom and Bust Cycles	3.90	13
PMCI4	Market Structure and Size	3.90	14
PMCI6	Relationship of Supply and Demand	3.90	15
SRF1	Building Code and Compliance	3.86	16
SRF2	Health and Safety Regulations	3.86	16
SEF9	Housing Prices	3.81	18
PCF3	Procedures Methods	3.81	19
PCF5	Technology Innovation	3.81	19
SEF15	Government Fiscal Policies	3.76	21
SEF13	Monetary Policy	3.67	22
PCC1	Design Cost	3.67	23
SEF10	Building Consents	3.67	23
SEF8	Employment Rate	3.57	25
PCF4	Contract Types	3.57	26
SRF4	Financial Regulations	3.52	27
SEF5	Productivity in Construction Industry	3.52	27
SEF3	Producers' Prices	3.52	29
NGD2	Natural Forces	3.48	30
SEF2	Capital Goods Prices	3.48	30
PMCI8	House Sell/Rent Prices	3.43	32
SRF3	Political Policies	3.43	33
PSI5	Building Officials	3.38	34
PCC3	Procurement Cost	3.33	35
PMCI7	Investment Tendency	3.29	36
PSI4	Suppliers	3.29	37
SEF12	Exchange Rate	3.29	37
SRF5	Construction Contract Act	3.14	39
NGD3	Global Economic Trend	3.10	40
SEF4	Consumer Price Index	3.05	41
SEF1	Gross Domestic Production	3.05	42
NGD4	Global Business Sentiments	3.00	43
NGD1	Global Political Dynamics	2.90	44
SEF11	Energy Prices	2.57	45

Table 5.4 Total variance explained

Factors	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.398	29.774	29.774	13.398	29.774	29.774	11.555	25.678	25.678
2	3.152	7.005	36.780	3.152	7.005	36.780	3.904	8.675	34.353
3	2.182	4.849	41.628	2.182	4.849	41.628	2.256	5.013	39.366
4	1.467	3.261	44.889	1.467	3.261	44.889	2.120	4.710	44.077
5	1.404	3.120	48.009	1.404	3.120	48.009	1.353	3.007	47.083
6	1.334	2.964	50.973	1.334	2.964	50.973	1.332	2.959	50.043
7	1.244	2.765	53.738	1.244	2.765	53.738	1.308	2.908	52.950
8	1.199	2.663	56.402	1.199	2.663	56.402	1.276	2.835	55.785
9	1.167	2.594	58.996	1.167	2.594	58.996	1.263	2.808	58.593
10	1.132	2.516	61.513	1.132	2.516	61.513	1.214	2.697	61.290
11	1.078	2.396	63.908	1.078	2.396	63.908	1.178	2.618	63.908
12	.980	2.178	66.087						
13	.974	2.163	68.250						
14	.880	1.956	70.206						
15	.807	1.794	72.000						
16	.796	1.768	73.768						
17	.758	1.684	75.452						
18	.721	1.603	77.056						
19	.710	1.577	78.633						
20	.676	1.502	80.135						
21	.657	1.460	81.595						
22	.633	1.406	83.001						
23	.591	1.313	84.313						
24	.533	1.184	85.497						
25	.528	1.174	86.671						
26	.506	1.123	87.794						
27	.494	1.098	88.892						
28	.462	1.026	89.918						
29	.453	1.007	90.925						
30	.404	.897	91.822						
31	.395	.878	92.700						
32	.349	.775	93.475						
33	.326	.723	94.199						
34	.310	.690	94.888						
35	.295	.656	95.545						
36	.287	.637	96.182						
37	.267	.594	96.776						
38	.247	.549	97.326						
39	.230	.512	97.838						
40	.205	.456	98.294						
41	.187	.416	98.711						
42	.169	.376	99.087						
43	.155	.344	99.430						
44	.135	.299	99.729						
45	.122	.271	100.000						

Table 5.5 Reliability analysis for individual constructs

Latent Constructs	No. of items	Cronbach's Alpha
Project Component Costs (PCC)	3	0.756
Project Characteristics Factor (PCF)	5	0.781
Project Stakeholders' Influences (PSI)	5	0.801
Property Market and Construction Industry (PMCI)	8	0.739
Statutory and Regulatory Factor (SRF)	5	0.913
National and Global Dynamics (NGD)	4	0.818
Socio-Economic Factor (SEF)	15	0.704

5.6.5 Initial structural equation modelling specification

A SEM specification should first be developed based on the theoretical framework (Gainey & Klaas, 2003; Molenaar et al., 2000). Therefore the initial SEM specification followed the research model, as shown in Figure **5.6**, the main structural research model for key influencing factors of building development cost in New Zealand. The model denotes a theoretical framework where the seven categories of influencing factors have significant effects on building development cost in New Zealand.

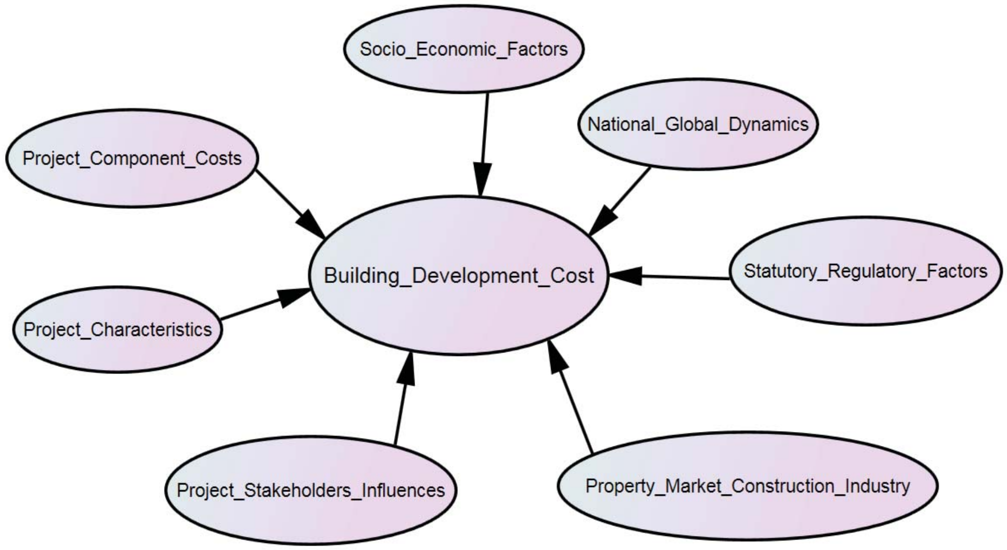


Figure 5.6 Main structural research model

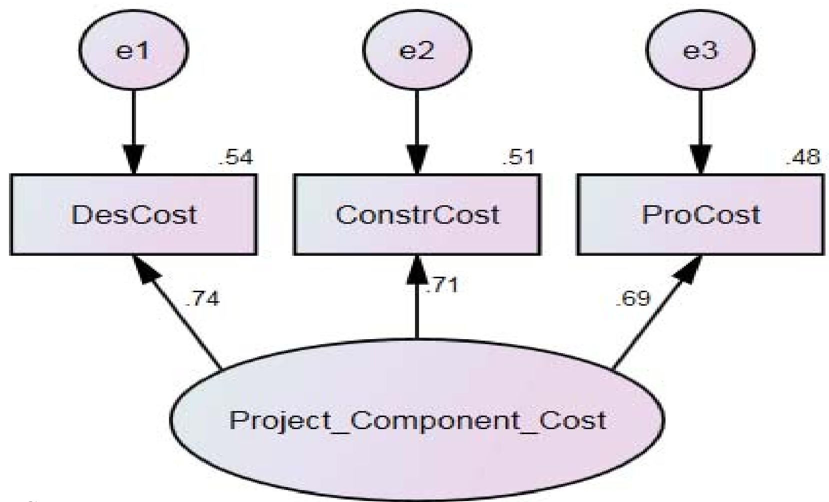
5.6.6 Confirmatory factor analysis

Confirmatory factor analysis was adopted to test the strength and appropriateness of the relationship between latent constructs and corresponding measurement indicators. CFA is also known as a measurement model as it can be used to assess the fit between the collected data and the conceptual relationship between measurement and latent variables.

In the project component costs group, design cost is the most significant influencing indicator (coefficient=0.74) followed by construction cost (coefficient=0.71) and procurement cost (coefficient=0.69). In the project characteristics class, the most significant influencing indicator is project complexity (coefficient=0.85) followed by procurement methods (coefficient=0.82) and project location (coefficient=0.79), whereas the indicators of contract type and technology innovations should be deleted as they have little effect (coefficient=-0.02 and -0.04) on the project characteristics factors. In the project stakeholders' influences group, the most significant influencing indicator is clients' influences (coefficient=0.87) followed by consultants' influences (coefficient=0.85 and contractors' influences (coefficient=0.8), while the indicators suppliers (coefficient=-0.04) and building officials (coefficient=-0.25) could be eliminated as they have minimal effects on the project stakeholders' influences factor.

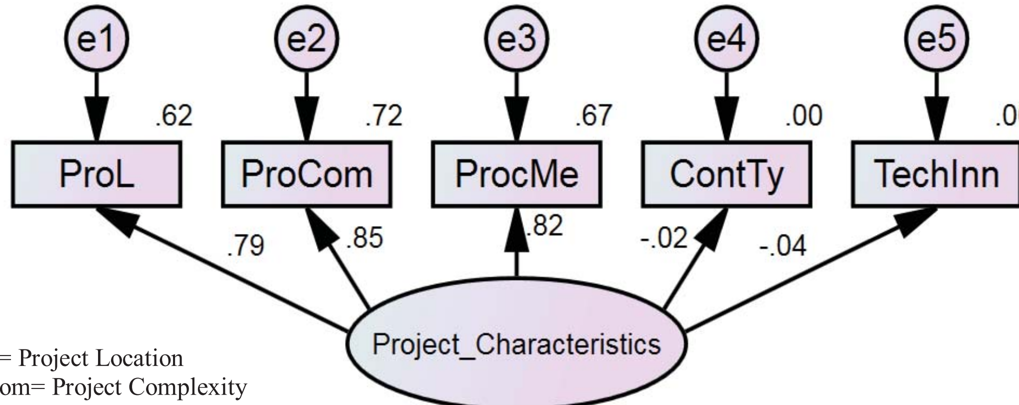
In the property market and construction industry category, all the indicators have significant effects on the factor with a coefficient greater than 0.8 except the indicators investment tendency and housing sell and rental prices. Thus, they were eliminated from the group. All the measurement indicators in the statutory and regulatory class are significant with coefficients greater than 0.8. Moreover, all the indicators are critical to explain the national and global dynamics factors. In the socio-economic factors category, some indicators are perceived as qualified to be measurement indicators with coefficients greater than 0.5, such as CGPI, PPI, PI, LCI, Population, Employment, Housing Prices, Building Consents, Investment Confidence; while the indicators namely GDP, CPI, Energy Prices, Exchange Rate, Monetary Policies and Government fiscal policies are deleted from the group as their loading coefficients are far smaller than the cut-off value of 0.5.

The quantified information provides comparative results for examining the influencing level of different indicators in each group, as shown in Figures **5.7-5.13**.



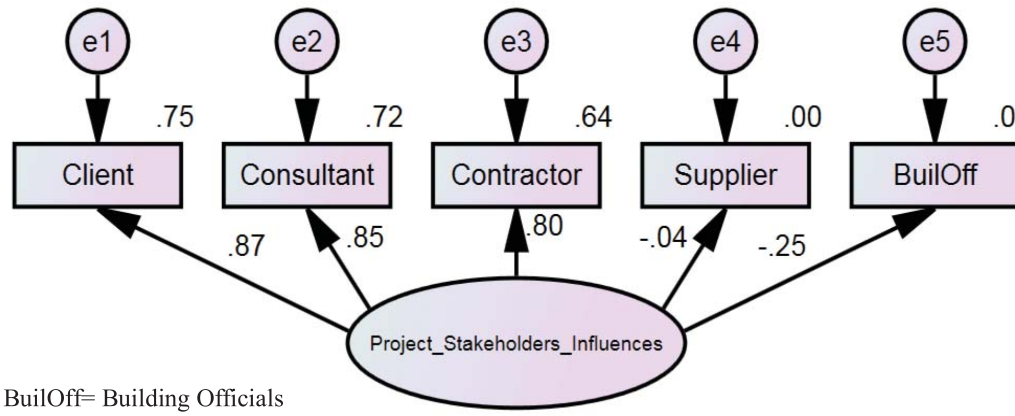
DesCost= Design Cost
ConstrCost= Construction Cost
ProCost= Procurement Cost

Figure 5.7 Project component costs factor



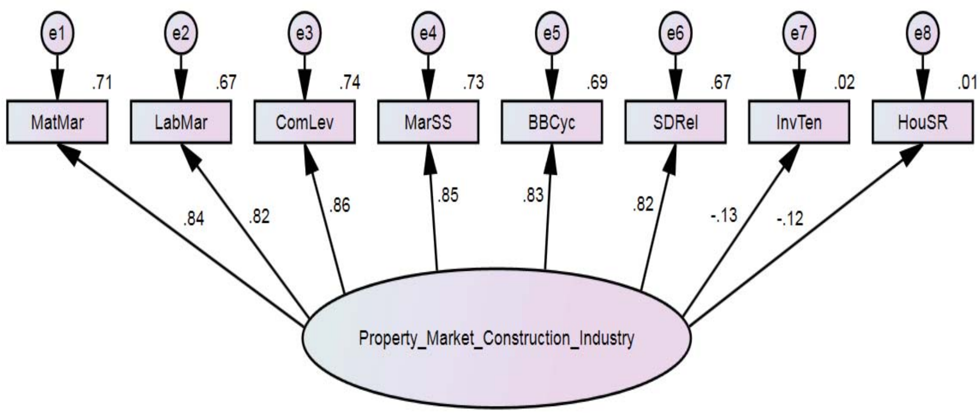
ProL= Project Location
ProCom= Project Complexity
ProcMe= Procedures Methods
ConTy= Contract Type
TechInn= Technology Innovation

Figure 5.8 Project characteristics factor



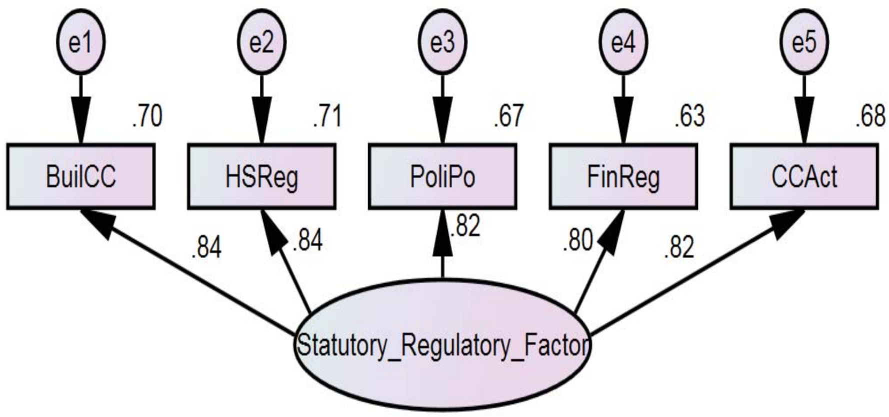
BuilOff= Building Officials

Figure 5.9 Project stakeholders' influences factor



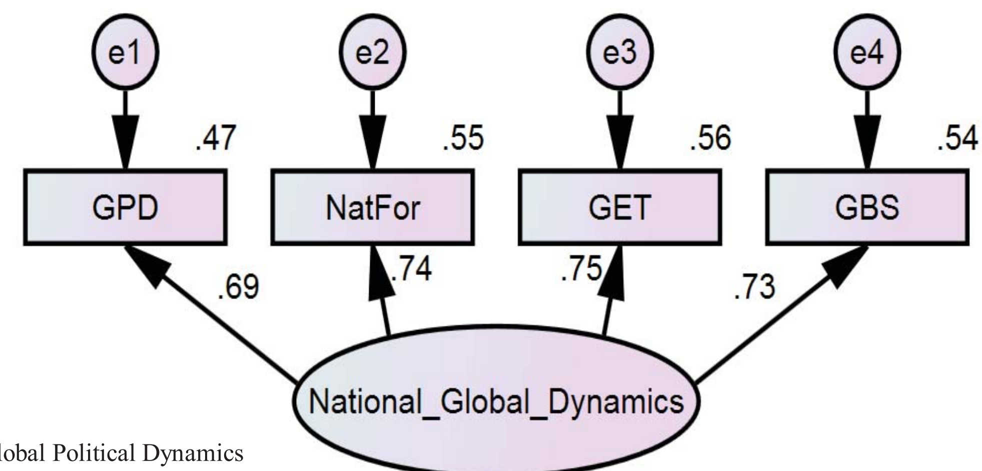
MatMar= Material Market
LabMar= Labour Market
ComLev= Competition Level
MarSS= Market Structure & Size
BBCyc= Boom & Bust Cycle
SDRel= Relationship of Supply& Demand
InvTen= Investment Tendency
HouSR= House Sell/Rent Prices

Figure 5.10 Property market and construction industry factor



BuilCC= Building Code & Compliance
HSReg= Health & Safety Regulation
PoliPo= Political Policy
FinReg= Financial Regulations
CCAct= Construction Contract Act

Figure 5.11 Statutory and regulatory factor



GPD= Global Political Dynamics
NatFor= Natural Forces
GET= Global Economic Trend
GBS= Global Business Sentiments

Figure 5.12 National and global dynamics factor

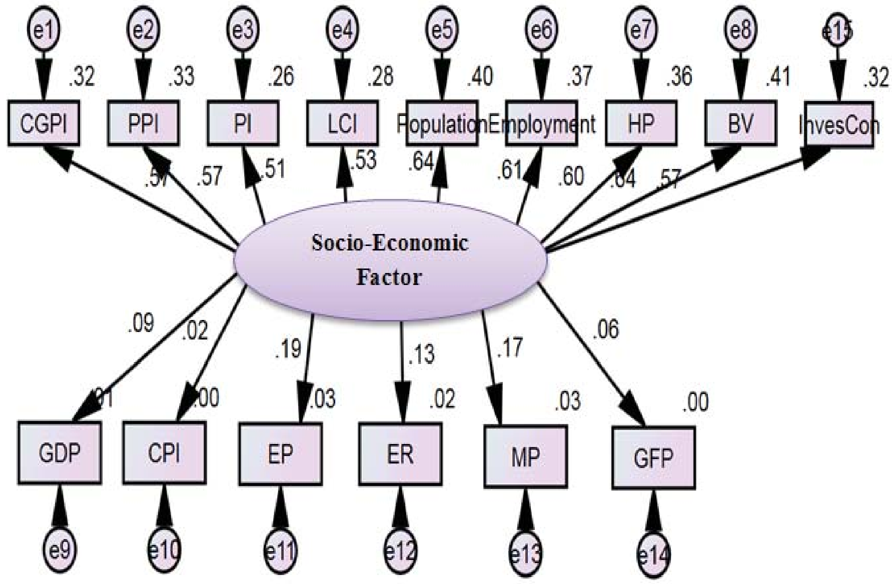


Figure 5.13 Socio-economic factor

CGPI= Capital Good Price
PPI= Producer's Prices
PI= Productivity in Construction Industry
LCI= Labour Cost
Population= Population Growth
Employment= Employment Rate
HP=_Housing Prices
BV= Building Consents
InvesCon= Investors' Confidence
GDP= Gross Domestic Production
CPI= Consumer Price Index
EP= Energy Prices
ER= Exchange Rate
MP= Monetary Policy
GFP= Government Fiscal Policies

Table 5.6 Standardised regression weights of indicators on latent constructs

Item	Standardised regression coefficients						
	PCC	**PCF**	**PSI**	**PMCI**	**SRF**	**NGD**	**SEF**
PCC1	0.74						
PCC2	0.71						
PCC3	0.69						
PCF1		0.79					
PCF2		0.85					
PCF3		0.82					
PCF4		0.02					
PCF5		0.04					
PSI1			0.87				
PSI2			0.85				
PSI3			0.80				
PSI4			0.04				
PSI5			0.25				
PMCI1				0.84			
PMCI2				0.82			
PMCI3				0.86			
PMCI4				0.85			
PMCI5				0.83			
PMCI6				0.82			
PMCI7				0.13			
PMCI8				0.12			
SRF1					0.84		
SRF2					0.84		
SRF3					0.82		
SRF4					0.80		
SRF5					0.82		
NGD1						0.69	
NGD2						0.74	
NGD3						0.75	
NGD4						0.73	
SEF1							0.09
SEF2							0.57
SEF3							0.57
SEF4							0.02
SEF5							0.51
SEF6							0.53
SEF7							0.64
SEF8							0.61
SEF9							0.60
SEF10							0.64
SEF11							0.19
SEF12							0.13
SEF13							0.17
SEF14							0.57
SEF15							0.06

5.6.7 Model refinement and modification

Confirmatory factor analysis is carried out to test whether the measure of a latent construct corresponds with the study of the nature of the individual factor. At this stage, the indicator elimination and model re-specification are performed for each latent construct. The reliability and validity of the constructs must be examined and evaluated before using them in the following structural model (Shanmugapriya & Subramanian, 2016). The measurement model includes all latent constructs and specifies the measurement indicators and attributes for corresponding constructs. The measurement indicators or variables have different correlations or loading values as the indicators measure the latent construct in different degrees. Measurement indicators having low loadings should be eliminated since they offer small explanatory power to the model (Aibinu & Al-Lawati, 2010). A common acceptable threshold value for a good indicator is having a loading higher than 0.5 (Rahman et al., 2013).

Convergent validity ensures that a set of indicators measure one and the same latent construct and not another construct. Squared multiple correlations (SMC) is used as a criterion of convergent validity and the cut-off value of 0.5 is considered as an acceptable indicator (Azen & Sass, 2008). The results of the reliability and validity test for the indicators are shown in Table **5.6**. As seen in Table **5.6**, the loading ranges from 0.02 to 0.87, the indicators PCF3 and PCF4 form the project characteristics factor (PCF), PSI5 of project stakeholders influences, PMCI6, PMCI7 and PMCI8 form the property market and construction industry factor (PMCI), SRF3 form the statutory and regulatory factors (SRF); SEI1, SEI4, SEI5, SEI6, SEI11 and SEI12 having loadings less than 0.5 and an SMC value less than 0.4. Therefore, these indicators were eliminated to improve the reliability and validity of the constructs. After the deleting of these indicators the values of Cronbach's alpha, regression loadings and SME are improved.

5.7 FINAL MODEL SPECIFICATION

The strength of how well the indicator measures the corresponding latent construct is indicated by the path coefficient (also known as factor loading). The path coefficients of the effects of the influencing indicators on the corresponding latent constructs are shown in Table **5.6**. Since the standardised path coefficients range from 0.51 to 0.87, it suggested that the retained measuring indicators significantly measure the latent constructs. Moreover, all the coefficients are positive and statistically significant at level $p<0.05$ as the value of path coefficient is equal or greater than 0.4 at level $p<0.05$ indicating strong measurement (Akson & Hadikusumo, 2008; Li et al., 2005). Therefore, the latent factors are the valid categories of the indicators in the New Zealand construction industry.

According to SEM analysis results, the property market and construction industry category (coefficient=0.771) is the most significant influencing factor for building development cost in New Zealand. However, other factors also play important roles in the structural research model as their p-value is smaller than the cut-off value 0.05. An implication of the results is that all the influencing factors' categories (project component costs factor, project characteristics factor, project stakeholders' influences factor, property market and construction industry factor, statutory and regulatory factor, national and global dynamics and socio-economic factor) have significant effects on building development cost in New Zealand. The findings support the hypotheses set in Chapter 3. Therefore, the structural research model provides a meaningful map with path coefficients for describing and quantifying the effects of different groups of influencing factors on the cost.

The structural research model was developed using the AMOS 23 computer program. A base model incorporates the latent constructs and their corresponding measurement indicators. Similarly, the strengths of the relationships among the latent variables indicate that the influencing factors strongly affect building development cost in New Zealand with the smallest value of the path coefficient being 0.26 (between project component costs factor and building development cost) that is still statistically significant at $p<0.05$. Moreover, all the path coefficients are statistically significant at level $p<0.05$, and critical ratios and standard errors do not show with any outliers (i.e. any extremely small or large values). Therefore, all the hypothesised relationships among the latent variables can be examined in the following analysis.

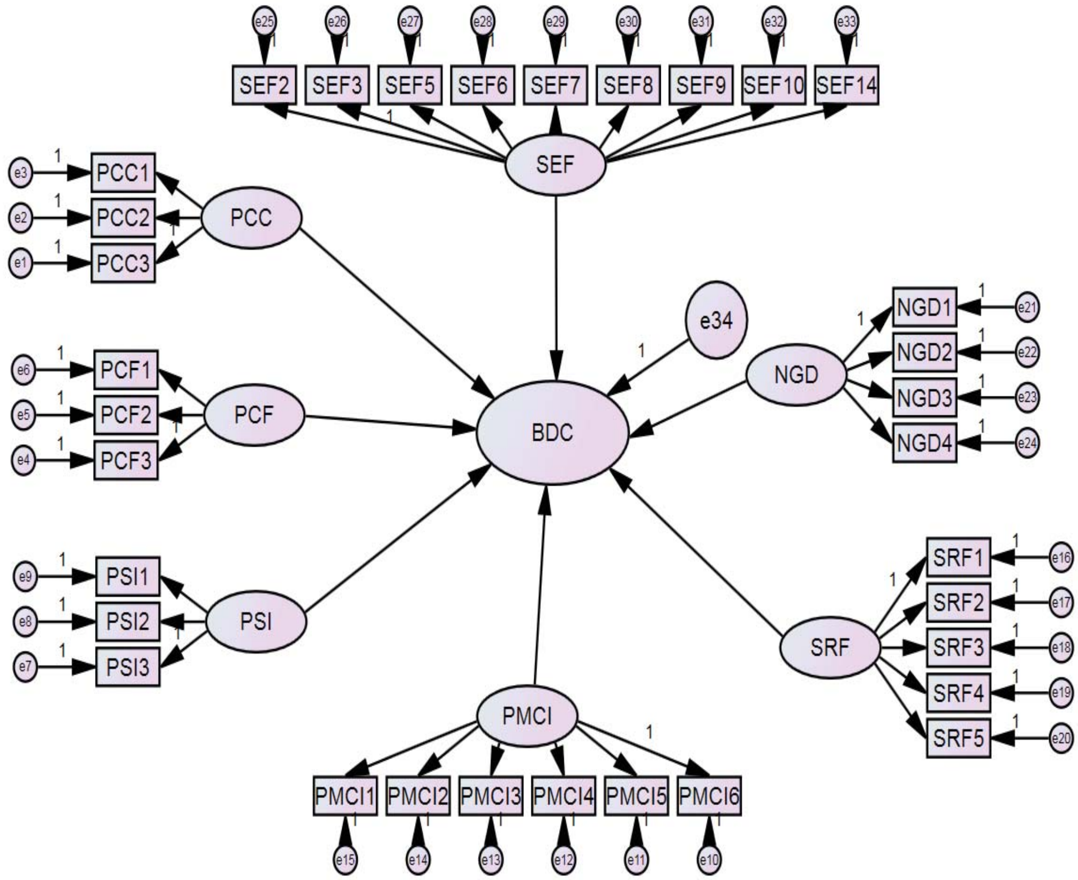


Figure 5.14 Final structural research model

5.8 ASSESSMENT OF STRUCTURAL MODELS

As seen in Chapter 4, structural equation modelling can be employed to test the postulate relationship between the measured variables and latent variables. The goodness-of-fit index can then be generated to provide the statistical evidence on how consistent the quantitative data is with the structural model. If the goodness fits are adequate, the hypothesised structural relationships between the latent and measured variables are plausible. If the fits are inadequate, the hypothesised relationships should be rejected (Byrne, 2016). The GOF measures are efficient tools for assessing the fitness of the SEM.

In this study, the dependent variable is the building development cost in New Zealand, the independent variables are influencing factors namely project component costs factor (PCC), project characteristics factor (PCF), project stakeholders' influences factor (PSI), property market and construction industry factor (PMCI), statutory and regulatory factor (SRF), national and global dynamics factor (NGD), and socio-economic factor (SEF).

The overall fitness of the initial research model can be assessed by using goodness-of-fit (GOF) indices. In fact, GOF measures are available to check the fitness of the SEM. If the GOF indices of the initial SEM could not reach the recommended levels, model refinements are necessary to enhance the overall fitness. The recommended levels of the GOF indices are shown in Table **5.7**. In this study, model refinements were conducted by a systematic approach to eliminate low correlation paths and associated variables (Churchill, 1979; Sarkar et al., 1998). After the model refinements, the model performed well with regard to both the theoretical expectations and GOF measures, and was selected as the final SEM model (Molenaar et al., 2000).

According to GOF indices of the initial SEM model, model refinement is necessary until the indices reach the recommended levels, as shown in Table **5.7**. After four refinements by deleting 12 measurement indicators, the GOF indices of the final SEM model achieve the recommended levels. The final research model is shown in Figure **5.14**.

As displayed, the final model for building development cost and influencing factors based on the necessary goodness-of-fit (GOF) measures is appropriately supported. The chi-square/degree of freedom ratio, giving a value of 1.774, indicates acceptable fit for the research model. The root mean square error of approximation (RMSEA) value is 0.051 at $p<0.05$, which indicates that the final model cannot be rejected at the 95% confidence level. The two incremental fit measures such as comparative fit index (CFI) and Tucker-Lewis index give values of 0.938 and 0.933 respectively which also indicate an obvious and satisfied model fit. Normal fit index and parsimonious goodness of fit index (PGFI), giving values above 0.5; sufficiently prove the acceptable fit between the research model and the collected data. In addition, the normal fit index NFI value of 0.869 suggests an acceptable fit between the model and data (Gainey & Klaas, 2003; Molenaar et al., 2000; Sarkar et al., 1998).

The RMSEA is used to measure the square root of the residual that is the difference between the collected data and model prediction (Anderson & Gerbing, 1984). It ranges between 0 and 1 with the value smaller than the cut-off value of 0.08 perceived as an acceptable fit (Kline, 2005). The CFI compares the fit of the hypothesised model to the collected data with the fit of a baseline model to the data (Iacobucci, 2010b). The IFI is the ratio of the difference of Chi-square between the hypothesised model and the baseline model and the difference of the degree of the freedom of the two models (Bentler, 1990). The TLI compares the discrepancy and degrees of freedom of the baseline model with that of the hypothesised model (Bentler & Bonett, 1980). The GFI is used to assess the fit between the hypothesised model and the data set (Bollen & Long, 1993a). They all range from 0 to 1 with a larger value indicating better fit (Bentler, 1990).

Compared with the initial SEM model, 12 measuring indicators were eliminated according to their low correlations with the corresponding latent constructs. Therefore, 12 measurement indicators were excluded in the research model. The standardized coefficients of the final model are summarized in Table **5.6**. All path coefficients are significant at $p<0.05$, and thus the significance of the final model is augmented. The comparisons of the GOF measures for the initial and final research models are shown in Table **5.7**.

Table 5.7 Indices of GOF measures of first and final SEM models [Source: varied sources]

Goodness-of-fit Measures	**Recommended level of GOF measures**	**First SEM**	**Acceptability**	**Final SEM**	**Acceptability**
CMIN/df	1(very good)-2(threshold)	2.963	No	1.774	Accepted
RMSEA	0.05(very good)-0.1(threshold)	0.081	Marginal	0.051	Accepted
GFI	0(no fit)-1(perfect fit)	0.741	Marginal	0.860	Accepted
CFI	0(no fit)-1(perfect fit)	0.703	Marginal	0.938	Accepted
NFI	0(no fit)-1(perfect fit)	0.613	Marginal	0.869	Accepted
IFI	0(no fit)-1(perfect fit)	0.705	Marginal	0.938	Accepted
TLI	0(no fit)-1(perfect fit)	0.688	Marginal	0.933	Accepted
PGFI	>0.5	0.674	Marginal	0.749	Accepted
PNFI	>0.5	0.584	Marginal	0.803	Accepted

5.9 RESPONDENTS' FEEDBACK IN THE OPEN-ENDED SECTIONS OF THE QUESTIONNAIRE

Respondents at the questionnaire survey were asked to provide further inputs within the textboxes provided in the questionnaire. Their responses were aggregated in Table **5.8**.

Content analysis of their feedback showed that the building development cost influencing factors could be grouped into the seven broad categories already established in the study. Some cost influencing factors were found to be reworded versions of those established in the main stream survey.

Table 5.8 Response analysis for open-end questions in the questionnaire

Latent construct	**Measurement indicator**	**Response frequency**
Project component costs factor	Procurement cost	1
	Construction cost	4
	Design cost	1
Project characteristics factor	Project location	3
	Procedures methods	1
Project stakeholders' influences factor	Clients	2
	Suppliers	2
	Building officials	1
Property market and construction industry	Material market	2
	Labor market	1
	Level of competition	1
	Market structure & size	1
	Supply and demand	1
Statutory and regulatory factor	Building code & compliance	2
	Health & safety regulations	2
	Financial regulations	1
	Construction Contract Act	1
National and global dynamics factor	Global economic trends	1
Socio-economic factor	CPI	2
	LCI	1
	Net migration	1
	Building consents	1

CHAPTER 6 MODEL VALIDATION

6.1 OVERVIEW

In this chapter, the final research model was evaluated further and validated in two ways: First, internal reliability and validity tests were carried out through model fitness tests and hypotheses testing involving a statistical test of significance. Secondly, the internal reliability and validity test results were triangulated by the feedback of a panel of industry experts on the model's robustness and practical usefulness to industry practitioners. The chapter comprises three sections. In the first section, the normal distribution and multicollinearity of the data were checked, and the validity of the model was assessed via tests of the research hypotheses. The second section presents discussions on the design and implementation of a semi-structured interview of industry experts and analysis of the collected data. The third section presents discussions of the results of the internal and external model validations.

6.2 MODEL FITNESS TO EMPIRICAL DATASET

As discussed in the Methodology section 5.6.2, structural equation modelling was chosen for the model development and internal model validation because the technique offers the most robust reliability and validity checks on the developed model (Hair et al., 2010). The model fitness test subroutine of the analysis of moment of structures (AMOS) provides an advanced test process for this purpose (Hafeez et al., 2006). The model fitness test examined the degrees of fit between the final model and the empirical dataset. The following subsections discuss the AMOS-based battery of model fitness tests; these include goodness of fit (GOF), normality, multi-collinearity, model adequacy, and reliability and validity tests.

6.2.1 GOF measure

A range of established fit indices should be introduced to decide upon the goodness of fit (GOF) between the research model and empirical data. Broadly, fit indices can be classified into three categories: overall model fit, goodness-of-fit, and badness-of-fit (Green, 2016). The overall model fit is measured by a chi-square statistic that is used to examine whether the statistical significance exists between the observed and estimated variance-covariance matrix (Bagozzi & Yi, 2012). However, chi-square statistics are sensitive and artificially inflated by sample size (Iacobucci, 2010). As such, chi-square statistics are insufficient to determine the merit of a model which is where goodness- and badness-of-fit indices should be introduced. Goodness-of-fit indices include comparative and absolute fit indices (Green, 2016). Comparative indices comprise Comparative Fit Index (CFI) whilst absolute fit indices consist of Tucker-Lewis Index (TLI), Adjusted Goodness of Fit Index (AGFI), Incremental Fit Index (IFI) and Normed Fit Index NFI (Bagozzi, 2010; Iacobucci, 2010). Badness-of-fit indices are indicated by the root-mean-square error of approximation (RMSEA) with a 90% confidence interval (90% CI) and the standardised root-mean-square residual (SRMR) (Hu & Bentler, 1999).

6.2.2 Assessment of normality

One critically important assumption in an SEM approach, especially in AMOS, is that the data are of multivariate normality (Arbuckle, 2015). As skewness severely affects the means and kurtosis tends to impact variances and covariance, it is necessary to appraise this criterion for the final model (DeCarlo, 1997). Moreover, SEM is a method that is based on the analysis of covariance structures; hence, the multivariate kurtosis is exceptionally important in SEM analysis. Prerequisite to the test of multivariate normality is the need for assessment of univariate normality (DeCarlo, 1997).

The kurtosis values and corresponding critical values of the measurement indicators in the model can be computed by AMOS 23 in the section of assessment of normality. The results are shown in Table **6.1**. As shown, positive values range from 0.005 to 1.341 and negative values from -0.024 to -1.014, generating an overall mean of univariate kurtosis value of 0.027. According to Hoyle (1995), a kurtosis value greater than seven or equal to seven is an indication of a violation of normality. Using this rule of thumb as a guide, a review of the generating kurtosis values in Table **6.1** revealed no items to be non-normal.

Table 6.1 Assessment of normality

Variable	Skew	CR	Kurtosis	CR
PCC1	-0.356	-2.520	-1.014	-3.584
PCC2	-0.420	-2.973	-0.868	-3.07
PCC3	-0.410	-2.899	-0.719	-2.541
PCF1	-1.066	-7.541	1.262	4.461
PCF2	-1.012	-7.158	0.807	2.854
PCF3	-1.128	-7.978	1.341	4.743
PSI1	-0.853	-6.032	0.775	2.739
PSI2	-0.778	-5.500	0.366	1.295
PSI3	-0.809	-5.717	0.543	1.920
PMCI1	-0.915	-6.470	0.548	1.936
PMCI2	-0.884	-6.251	0.634	2.243
PMCI3	-0.839	-5.932	0.421	1.489
PMCI4	-0.809	-5.718	0.304	1.075
PMCI5	-0.904	-6.393	0.609	2.153
PMCI6	-0.897	-6.341	0.595	2.102
SRF1	-0.184	-1.301	-0.763	-2.699
SRF2	-0.171	-1.212	-0.759	-2.682
SRF3	-0.158	-1.118	-0.692	-2.448
SRF4	-0.194	-1.374	-0.714	-2.523
SRF5	-0.189	-1.336	-0.772	-2.729
NGD1	-0.149	-1.051	-0.445	-1.573
NGD2	-0.084	-0.593	-0.502	-1.775
NGD3	-0.203	-1.437	-0.525	-1.855
NGD4	-0.185	-1.309	-0.343	-1.214
SEF2	-0.612	-4.329	0.310	1.097
SEF3	-0.564	-3.990	0.013	0.048
SEF5	-0.585	-4.140	0.005	0.017
SEF6	-0.493	-3.486	-0.027	-0.096
SEF7	-0.387	-2.738	-0.089	-0.315
SEF8	-0.472	-3.338	-0.024	-0.087
SEF9	-0.648	-4.583	0.326	1.154
SEF10	-0.469	-3.318	0.051	0.181
SEF14	-0.629	-4.450	0.245	0.866
Multivariate			713.471	128.558

However, the presence of normal measurement variables is not sufficient to support the existence of the multivariate normality (Hoyle, 1995). The multivariate kurtosis value and related critical value are also shown at the bottom of Table **6.1**. Based on the recommendation by Bentler (2005), the critical value of multivariate kurtosis greater or equal to five suggests a departure from multivariate normality. In this application, the critical value of 128.558 is far greater than the criterion value; thus, multivariate non-normality exists in the sample.

Then the Bollen-Stine bootstrapping procedure in AMOS 23 was introduced by (Bollen & Long, 1993b; Bollen & Stine, 1992) to test the appropriateness of the model without assuming multivariate normality. As the Bollen-Stine suggested, the model is correct. The results of the bootstrapping are displayed in Figure **6.1**.

Bollen-Stine Bootstrap (Default model)

The model fit better in 467 bootstrap samples.
It fit about equally well in 0 bootstrap samples.
It fit worse or failed to fit in 533 bootstrap samples.
Testing the null hypothesis that the model is correct, Bollen-Stine bootstrap p = .533

Figure 6.1 Output of Bollen-Stine test

The information indicated that the model better fits 467 bootstrap samples than the original samples. If the procedure ranks 468 datasets, the added on is the worst of the 467 datasets. Regarding probability, it indicates the probability that the research model holds in the real population. Therefore, the study accepts the hypothesis that the research model is correct with probability = 0.533.

6.2.3 Multicollinearity

Multicollinearity is defined as two or more predicators being highly correlated with each other (Lauridsen & Mur, 2006). Multicollinearity arises from two different sources – one is the high correlation among underlying constructs (Grapentine, 2000; Grewal et al., 2004) and the other case is where two or more measurement variables are highly correlated as they both essentially represent the same latent construct (Temme et al., 2006). Multicollinearity influences the parameter estimates and standard errors so that they are far from the real estimates and large standard errors (Hwang, 2009b). Moreover, it also affects significant values of hypotheses testing and then it is likely to poses difficulties for theory testing (Jagpal, 1982).

The multicollinearity problem is well understood in traditional analysis approaches for non-latent variables. However, the detection and consequence of the multicollinearity in SEM are not adequately addressed. This problem cannot disappear by using more advanced analysis techniques like SEM. Moreover, it can render the outcome uninterpretable and generate erroneous conclusions. Specifically, this problem imposes aggregate influences on non-linear latent variables rather than manifest variables (Kelava et al., 2008). In defending the final research model, the study should provide sufficient checking on the multicollinearity in order to avoid inappropriate understanding and spurious conclusions.

A critical evaluation of the output of the AMOS analysis explores that no extremely large correlations (r>1) exist between the variables, with both latent constructs and measurement indicators. Moreover, the signs of the standard errors also signal no multicollinearity problem in the variables as they are extremely small. The results of the correlations of the variables are displayed in Table **6.2**. From the results, the final research model is free from multicollinearity problem.

Table 6.2 The correlation matrix of the latent variables

	BDC	**PCC**	**PCF**	**PSI**	**PMCI**	**SRF**	**NGD**	**SEF**
BDC	1							
PCC	0.336	1						
PCF	0.935	0.315	1					
PSI	0.956	0.322	0.894	1				
PMCI	0.983	0.331	0.919	0.94	1			
SRF	0.855	0.288	0.799	0.817	0.84	1		
NGD	0.774	0.261	0.724	0.741	0.761	0.662	1	
SEF	0.466	0.157	0.436	0.446	0.458	0.398	0.361	1

6.2.4 Model adequacy

Some indices computed in AMOS were used to validate the research model. The model evaluation should mainly centre on the adequacy of the parameter estimates and the whole research model (Byrne, 2010). Looking at the adequacy of the parameters estimated by the model, the feasibility of the parameters and the appropriateness of standard errors were checked. To test the feasibility of the parameters, the parameters should have correct sign and size to represent the underlying theory (Motawa & Oladokun, 2015). Any deviations from these suggest that the model is unable to adequately explain and capture the subject under examination. An example of these is the negative variances. Critically reviewing all the variances estimated by the model, as shown in Table **6.3**, suggests that the model is acceptable in this respect. Moreover, to ensure the adequacy of the final research model the appropriateness of the standard error should be assessed due to the fact that it supports the accuracy of the parameter estimates. Joreskög and Sörbom (1993) argued that an extremely large value of standard error indicates a poor model fit. In addition, the statistical significance of the parameter estimates should be checked as all the estimates should be significant in the model. They are all exhibited in Table **6.4**.

Table 6.3 Variances estimated by the model

Error	Estimate	Stand Errors	Critical Ratio	p-value
e1	0.594	0.068	8.733	***
e2	0.497	0.064	7.741	***
e3	0.499	0.069	7.251	***
e4	0.272	0.027	10.076	***
e5	0.183	0.020	8.976	***
e6	0.255	0.025	10.054	***
e7	0.276	0.027	10.369	***
e8	0.215	0.022	9.565	***
e9	0.214	0.023	9.473	***
e10	0.311	0.028	11.06	***
e11	0.252	0.023	10.833	***
e12	0.246	0.023	10.744	***
e13	0.213	0.02	10.522	***
e14	0.299	0.027	11.047	***
e15	0.269	0.025	10.804	***
e16	0.284	0.028	9.976	***
e17	0.272	0.028	9.868	***
e18	0.311	0.030	10.244	***
e19	0.381	0.036	10.552	***
e20	0.301	0.030	10.142	***
e21	0.516	0.051	10.026	***
e22	0.479	0.050	9.638	***
e23	0.530	0.054	9.852	***
e24	0.462	0.048	9.589	***
e25	0.549	0.050	11.051	***
e26	0.515	0.047	11.001	***
e27	0.635	0.056	11.364	***
e28	0.621	0.055	11.249	***
e29	0.435	0.041	10.539	***
e30	0.422	0.040	10.614	***
e31	0.490	0.046	10.77	***
e32	0.420	0.040	10.477	***
e33	0.571	0.051	11.108	***
R1	0.456	0.082	5.581	***
R2	0.060	0.015	3.879	***
R3	0.046	0.014	3.347	***
R4	0.021	0.011	1.936	0.053
R5	0.177	0.026	6.930	***
R6	0.209	0.036	5.744	***
R7	0.203	0.042	4.806	***

Note: *** Sig (p) value is infinitesimally small (close to 0) hence cannot be exhibited

Table 6.4 Parameter estimates and standard errors

	Estimate	Stand Errors	Critical Ratio	p-value
PCC1← PCC	1.078	0.118	9.107	***
PCC2← PCC	1.015	0.113	9.006	***
PCF1← PCF	0.998	0.065	15.357	***
PCF2← PCF	1.008	0.061	16.598	***
PSI1 ← PSI	1.026	0.059	17.280	***
PSI2 ← PSI	1.030	0.060	17.231	***
PMCI1 ← PMCI	1.024	0.058	17.556	***
PMCI2 ← PMCI	0.994	0.059	16.861	***
PMCI3 ← PMCI	1.006	0.055	18.196	***
PMCI4 ← PMCI	0.997	0.057	17.607	***
PMCI5 ← PMCI	0.994	0.057	17.468	***
SRF2 ← SRF	1.004	0.056	17.82	***
SRF3 ← SRF	0.984	0.058	16.963	***
SRF4 ← SRF	0.999	0.061	16.340	***
SRF5 ← SRF	0.994	0.058	17.213	***
NGD2 ← NGD	1.043	0.093	11.244	***
NGD3 ← NGD	1.048	0.095	11.04	***
NGD4 ← NGD	1.038	0.092	11.325	***
SEF3 ← SEF	0.984	0.130	7.575	***
SEF5 ← SEF	0.916	0.132	6.945	***
SEF6 ← SEF	0.962	0.136	7.097	***
SEF7 ← SEF	1.056	0.130	8.091	***
SEF8 ← SEF	1.009	0.127	7.936	***
SEF9 ← SEF	1.043	0.133	7.848	***
SEF10 ← SEF	1.061	0.130	8.193	***
SEF14 ← SEF	0.994	0.133	7.461	***

Note: *** Sig (p) value is infinitesimally small (close to 0) hence cannot be exhibited

6.2.5 Reliability and validity

The validity of the research model should be assessed adequately from the results of SEM (Anderson & Gerbing, 1988). Given the above validation, the reliability and validity were further evaluated. Composite reliability, convergent validity and discriminant validity of the final research model were further assessed.

6.2.5.1 Composite reliability

Composite reliability is usually used to measure how well all the measurement indicators consistently represent the corresponding latent construct (Hair et al., 2010). Moreover, the evidence of composite reliability is established if the value of CR is more than 0.7 (Linn, 1989). The composite reliability can be calculated by Equation **6.1**. The results shown in Table **6.5** imply that the CR values of all the constructs exceed the rule of thumb value of 0.7, indicating the achievement of composite reliability on the model of adequacy and appropriateness.

$$CR = \frac{\sum \varphi_i^2}{\sum \varphi_i^2 + \sum \delta_i^2} \qquad \textbf{(6.1)}$$

Where

φ_i *is the regression factor loading for corresponding measurement indicator*

δ_i *is the measurement error of the corresponding measurement indicator*

Table 6.5 Composite reliability index

Influencing Factors	CR
PCC	0.500
PCF	0.739
PSI	0.750
PMCI	0.726
SRF	0.700
NGD	0.516
SEF	0.400
BDC	0.790

6.2.5.2 Convergent validity

The squared multiple correlation (SMC) was also used to examine the convergent validity. Likewise, the values of SMC for the latent constructs are greater than the threshold value of 0.5, except PCC (0.217) and SEF (0.113) with values less than the acceptable level. In short, as a whole, the SMC exhibits good values and is free from adverse impact estimates. This indicates the final research model offers evidence of convergent validity. Interestingly, the results demonstrate that the measurement indicators are reasonably converged on their corresponding latent constructs. The results are shown in Table **6.6**.

Table 6.6 Squared multiple correlations

Influencing Factors	SMC
PCC	0.113
PCF	0.874
PSI	0.915
PMCI	0.966
SRF	0.730
NGD	0.600
SEF	0.217

Moreover, the inter-indicator correlations should be checked to provide a more rigorous assessment of the convergent validity (Nunnally & Bernstein, 1994). If the inter-indicator correlations exceed the value of 0.3, convergent validity is achieved (Robinson et al., 1991). The results displayed in Table **6.7** suggest the attainment of convergent validity.

Table 6.7 Correlations among indicators

Construct	Number of measurement indicators	Indicator-to-indicator correlation range	Cronbach Alpha
Project Component Cost (PCC)	3	0.491-0.524	0.756
Project Characteristics Factor (PCF)	3	0.645-0.695	0.858
Project Stakeholders' Influences (PSI)	3	0.675-0.738	0.876
Property Market and Construction Industry (PMCI)	6	0.648-0.743	0.933
Statutory and Regulatory Factor (SRF)	5	0.644-0.715	0.713
National and Global Dynamics (NGD)	4	0.503-0.562	0.818
Socio-Economic Factor (SEF)	9	0.304-0.456	0.819

6.2.5.3 Discriminant validity

Discriminant validity was used to examine the shared variance between the constructs by computing the average variance extracted recommended by (Farrell, 2010; Fornell & Larcker, 1981). According to their recommendation, discriminant validity is achieved when the AVE is greater than the cut-off criterion 0.5. The Equation **6.2** was used to compute AVE.

$$AVE = \frac{\sum \varphi_i^2}{n} \tag{6.2}$$

Where

φ_i is the regression factor loading for corresponding measurement indicator

n is the number of measurement indicators of the corresponding construct

The results shown in Table **6.8** suggest the constructs in the final research model are distinctive and show good discriminant validity, as their values are all greater than the acceptable value of 0.5. The results suggest that they possess satisfactory discriminant validity. Only the value of the socio-economic factor is not satisfied; as the factor includes more indicators, this can be accepted.

Table 6.8 Average variance extracted value

Influencing Factors	**AVE**
PCC	0.51
PCF	0.67
PSI	0.70
PMCI	0.70
SRF	0.68
NGD	0.53
SEF	0.34
BDC	0.72

6.3 HYPOTHESIS TESTING

Structural equation modelling has been used to test the hypotheses in this study. The path diagram describes the hypothesised relationships among the latent constructs. The goodness-of-fit indices indicate the research model is reliable and can be used to test the hypothesised relationship set in this study. The analysis results shown in Figure **6.2** are based on the questionnaire data collected from the New Zealand construction industry.

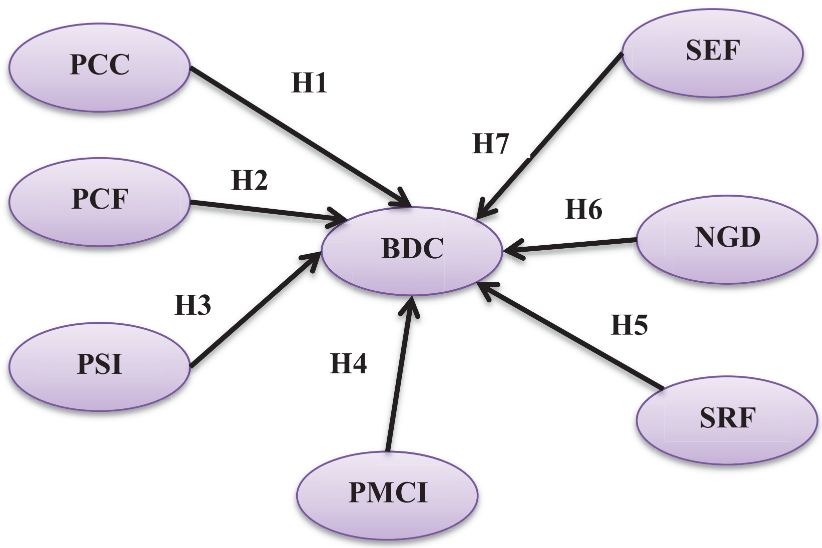


Figure 6.2 Hypothesis testing model

The standardised regression weights indicated in the path diagram were used to accept or reject the hypotheses. According to (Hair et al., 2005; Hung & Lu, 2008; Lattin et al., 2009), the hypotheses corresponding to a standardised regression weight less than 0.1 were rejected. The seven hypotheses were supported at the one percent level of significance shown in Table **6.9**.

Figure **6.2** presents the final structural research model of influencing factors for building development cost in New Zealand with standardised regression weights on the structural paths of the proposed hypothesised relationships. The proposed hypothesised relationships were tested by using standard regression weights, standard errors, critical ratios and their level of statistical significance to investigate whether the hypothesised relationships are supported by the collected data.

The questionnaire survey provides deep insights into the factors influencing building development cost in New Zealand. The standardized regression weight takes the highest value (0.771) of the property market and construction industry factor on the building development cost in New Zealand. As shown in Table **6.9**, the standard errors do not present with any extremely large or small values and all the hypothesised relationships are supported at the statistical significance level $p<0.05$. The hypothesised relationship between the property market and construction industry factors and building development cost with a CR value of 16.602 and regression coefficient 0.771 strongly support Hypothesis 4. Furthermore, the hypotheses H2 (15.069), H3 (15.834) and H5 (14.572) were supported by the analysis results shown in Table **6.9**.

In addition, H1, H6, and H7 are also supported by the results shown in Table **6.9**. They are supported by the structural path between project component costs factor and building development cost with a CR value of 4.811; national and global dynamics and building development cost with a CR value of 6.256; socio-economic factor and building development cost with a CR value of 10.639, respectively.

The analysis results suggest the existence of statistical relationships between the influencing factors and building development cost in New Zealand. This indicates that the respondents consider all the seven influencing factors as vital for the building development cost in New Zealand which are partly consistent with the previous findings. As reported in the preceding chapter, 12 indicators were removed from the model to achieve the best fitting including PCF4, PCF5, PSI4, PSI5, PMCI7, PMCI8, SEF1, SEF4, SEF11, SEF12, SEF13 and SEF15 which were eliminated during the model refinement/modification.

The results displayed in Table **6.9** indicate that all the proposed hypotheses (H1 to H7) are supported. As hypothesised, all the seven influencing factors directly affect building development cost in New Zealand.

Table 6.9 Hypothesised relationships testing in the research model

	Estimate	S.E.	C.R.	p-value	Direct Effects	Indirect Effects	Total Effects	Conclusion
H1	0.241	0.050	4.811	***	0.336	0	0.336	Supported
H2	0.644	0.043	15.069	***	0.935	0	0.935	Supported
H3	0.700	0.044	15.834	***	0.956	0	0.956	Supported
H4	0.771	0.046	16.602	***	0.983	0	0.983	Supported
H5	0.692	0.048	14.572	***	0.855	0	0.855	Supported
H6	0.560	0.053	10.639	***	0.774	0	0.774	Supported
H7	0.237	0.038	6.256	***	0.446	0	0.446	Supported

Note: *** Sig (p) value is infinitesimally small (close to 0) hence cannot be reported

6.4 EXPERT VALIDATION OF RESULTS

This subsection presents discussions on the design and implementation of a semi-structured interview of industry experts and analysis of the collected data. The aim of the external validation by an expert panel was to further ascertain the practical usefulness and applicability of the developed research model to real-world industry problems (Finlay et al., 1988). In the validation process, experts were also asked to comment on whether or not the translation of the causal relationships between the influential factors and building development cost into the model representation has been done correctly. In addition, the experts were asked to evaluate the appropriateness of the relations that constitute the model as recommended in the literature (Pelletier, 2010). Thus the external reliability and validity checks carried out actually involved two processes: verification and actual validation. In the words of Drucker (1974), verification is establishing that the thing is done right; validation, that the right thing is done.

In the verification process, the experts were able to provide deep insights into the research model. The data analysis results formed the basis for the semi-structured interviews with the key professionals from New Zealand's construction industry.

In the verification process, experts comprising highly experienced and highly placed construction professionals provided feedback on the degree of affect that the influencing factors has on building development cost in New Zealand. In the validation process, the results of the data analysis were presented to the expert panel for their judgment on the practical usefulness and ease-of-application of the model to real life problems in the industry. The following subsections present discussions on the recruitment of the expert panel, details about the semi-structured interviews and analysis of the responses received.

6.4.1 Recruitment of experts

Participants who signified willingness to participate in the interviews were sent a copy of the interview schedule comprising questions to be asked prior to the interview. This was done to enable the participants to have prior reflections on the questions so as to be able to give well-thought-out and informed responses to the questions during the interviews.

Previous studies recommended rigorous rules for selecting the experts and defined an industry expert as a person with extensive knowledge and skills based on broad and various industry experiences; and reinforced the importance of explaining the selection criteria (Galdeano & Rossi, 2006). The expert selection process was affected not only by the fact that the interview period (March to May 2017) was such a busy period in New Zealand's construction industry, but also by the existence of attendant difficulties, limitations, and uncertainties.

At the beginning of the interview planning, the key professionals were selected from the sampling frames that listed their contact details as registered members of the various trade and professional associations delineated for the study. . However, those approached were selected according to their professional role, current status in the organisation, and their industry experience. The selection criteria are presented in Table **6.10**. Experts were selected from the highest to the lowest score.

Table 6.10 Expert selection criteria

Criteria	Scoring
1. Professional Role	
• Developers and clients	3
• Consultants	3
• Contractors and Project Managers	3
• Other	0
2. Current Status	
• Executives	3
• Senior Management	2
• Management	1
• Other	0
3. Industry Experience	
• More than 25 years	3
• Range between 15-24 years	2
• Rang between 10-14 years	1
• Less than 10 years	0

After getting all the contact details of the selected experts, 52 invitations were sent by email requesting them to participate in the interview according to their management-level position and base in Auckland. The invitation involves a cover letter to state the objectives of the research, and a checklist of the questions relevant to the research model and the factors influencing building development cost in New Zealand and an acknowledgment of appreciation and honour to have them to participate. Twenty-five of 52 responded and said that they would like to participate in the interview and provide information. Then the interview schedule with three time-period options was sent to 25 respondents to ask them to choose the time-period that best fitted their schedule. Unfortunately, only 21 out of the 25 were available to participate in the interview. Therefore, there are a total 21 interviewees at this stage. The interviewees' profiles are described in Table **6.11**.

Table 6.11 Interviewee profile

Professional Field	Current Status			Professional Experience			Total	% Total
	Executives	Senior Manager	Manager	>25Y	16-24	10-15		
Clients	10			8	2		10	48%
Consultants		3	2	2	2	1	5	24%
Contractors		4	2	3	3		6	28%

6.4.2 Expert interviews

Semi-structured interviews were employed to validate the findings of the study from opinions of the management-level professionals across six trade and professional associations/institutions in New Zealand. The interviews aimed to obtain in-depth assessments of the research findings by the professionals.

During the interviews, the experts' feedback was examined by directly referencing, discussing, contrasting and comparing their qualitative responses against the results obtained from the quantitative model tests. At this point, there was sufficient consensus among the participants about the categories of the influencing factors and dimension of the research model.

The interview questions are shown in Appendix **H**.

6.4.3 Responses analysis

A total of 21 responses were gathered from experienced industry professionals with relevant backgrounds during the interviews. Prior to the interviews, the research aims and objectives were clearly explained to the experts, as well as the feedback sought from them. It should be noted that the spread of the experts across construction professions enhanced the reliability and validity of the data and information obtained for validating the model.

Furthermore, all the target respondents are regarded as having worked on different types of building projects and have collaborated or engaged with all the parties. The respondents included developers, construction clients, consultants, contractors and project managers, financial asset managers, and government policy-makers. Given the inherent difficulty in collecting data and information in construction management research, especially during this busy boom period, and coupled with the small number of qualified target respondents, the number of eligible respondents was severely limited. Furthermore, the Equation **6.4.3.1** below was used to calculate the mean value of the individual indicator.

$$Mean\ value = \sum_{i=1}^{5} \frac{n_i}{N} i$$

(6.4.3.1)

Where

i is the five-point Likert-Scale;

n_i is the number of respondents that have the same score for the indicator;

N is the total number of respondents for the indicator.

Table **6.12** shows the levels of consensus among the experts for the categories of the influencing factors and the dimensions of the research model.

Table 6.12 The consensus of the experts on the influencing level

Influencing Factors						**TR**	**IL**	**Rating**
	VS	S	M	W	VW			
PCC	26%	63%	11%	0%	0%	19	4.15	Strong
PCF	30%	30%	35%	5%	0%	20	3.85	Strong
PSI	29%	38%	33%	0%	0%	21	3.96	Strong
PMCI	24%	57%	14%	5%	0%	21	4.00	Strong
SRF	5%	62%	33%	0%	0%	21	3.72	Strong
NGD	0%	30%	45%	20%	5%	20	3.00	Medium
SEF	10%	35%	40%	10%	5%	20	3.35	Medium

Note: VS=very strong, S=strong, M=medium, W=weak, VW=very weak, TR=total responses, IL=influencing level

With regard to the validation of the research model, all the experts confirmed the model is a valuable instrument for understanding the relationships between the influencing factors and building development cost in New Zealand. They also confirmed that it is a comprehensive model as it includes most of the influencing factors of building development cost. Although some considered that the national and global dynamics or socio-economic factor might not impose significant effects on building development cost in New Zealand, they still saw the field of model application as being very broad. Because the study focuses on a theoretical model, the results are only seen as recommendations for the research model. Furthermore, the validation of viewpoints by the experts is susceptible to bias as it is divergent in nature and difficult to achieve consensus. This is only one form of validation that cannot be substantiated with scientific evidence or best practice. The merit of this study is that it is an attempt to provide a comprehensive and coherent model that describes the relationships between the influencing factors and building development cost in New Zealand.

In this study, the analysis of variance (ANOVA) approach was adopted to statistically check whether the means of several groups are all equal (Wang et al., 2017). ANOVA analyses the possible mean difference existing among the influencing factors from the perceptions of the experts. For example, if one influencing factor is significantly divergent from others, it indicates that the experts might possess different opinions on it and the factor might not significantly influence building development cost in New Zealand.

An important first step in ANOVA is to assess whether the variances of the groups are equal. Levene's test was employed to test whether the variances are equal for two or multiple groups (Kim & Cribbie, 2017). It first hypothesised that all the variances for the groups are equal; if the resulting p-value is less than the significant value of 0.05, then the null hypothesis is rejected, indicating there are significant differences in variances of the groups (Yiğit & Gökpinar, 2010). The analysis results are shown in Table **6.13**. From analysis results, the assumption of the ANOVA analysis that all the variances of the groups' variables ($p=0.153>0.05$) are equal is satisfied.

Table 6.13 Test result of homogeneity variances

Levene Statistic	df1	df2	Sig.
1.593	6	140	.153

The ANOVA analysis to test whether the mean differences existing among the influencing factors were first applied. The results are displayed in Table **6.14**. The results of the descriptive analysis for the influencing factors are also shown in Table **6.15**. Moreover, Figure **6.3** is used to visualise the mean differences. From the results, the statistical mean differences exist among the influencing factors. The following test is necessary to explore which factors are significant when compared to other influencing factors.

Table 6.14 ANOVA test result for the influencing factors

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19.129	6	3.188	4.954	.000
Within Groups	90.095	140	0.644		
Total	109.224	146			

Table 6.15 Descriptive analysis results

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Project Component Costs	21	4.05	0.67	0.15	3.74	4.35	3	5
Project Characteristics	21	3.81	0.93	0.20	3.39	4.23	2	5
Project Stakeholders' Influences	21	3.95	0.81	0.18	3.59	4.32	3	5
Property Market and Construction Industry	21	4.00	0.78	0.17	3.65	4.35	2	5
Statutory and Regulatory Factor	21	3.71	0.56	0.12	3.46	3.97	3	5
National and Global Dynamics	21	3.00	0.84	0.18	2.62	3.38	1	4
Socio-Economic Factor	21	3.33	0.97	0.21	2.89	3.77	1	5
Total	147	3.69	0.87	0.07	3.55	3.83	1	5

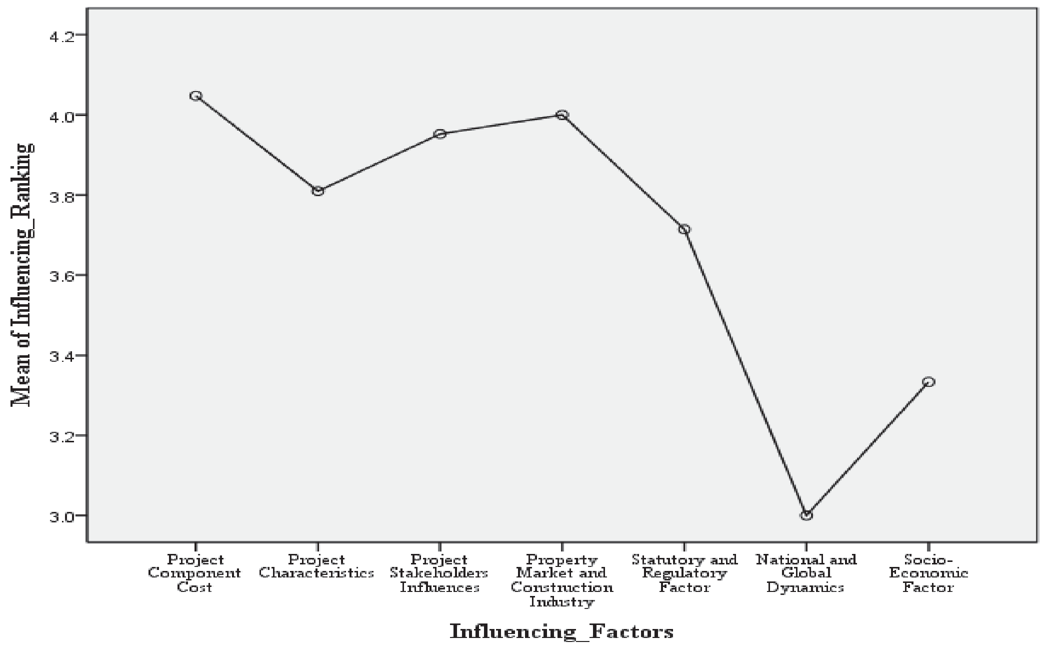


Figure 6.3 Mean plot for the influencing factors

Tukey's honestly significant difference (HSD) test that is a multiple comparison procedure was further used to explore whether the mean for every influencing factor is significant from every other influencing factor. When appraising the mean difference among the influencing factors, the response scale variable can be considered as a dependent variable. If the *sig* value is less than the statistical significant value of 0.5, it suggests that there is a significant mean difference between the two groups. The analysis results are described in Table **6.16**. From the results, only the influencing factor of national and global dynamics is statistically different from every other influencing factor ($p<0.05$), except for the statutory and regulatory factor ($p=0.066$) and the socio-economic factor ($p=0.829$). This is also proved from the above mean plot. This indicates that the experts might possess different opinions on these influencing factors, or the experts might not consider these to have the same level of influence on building development cost in New Zealand as other influencing factors.

Table 6.16 Mean difference results of the influencing factors

Influencing Factors		Mean	Sig.	95% Confidence	
				Lower Bound	Upper Bound
Project Component Costs	Project Characteristics	0.238	0.961	-0.50	0.98
	Project Stakeholders Influences	0.095	1.000	-0.65	0.84
	Market and Industry	0.048	1.000	-0.69	0.79
	Statutory and Regulatory Factor	0.333	0.829	-0.41	1.07
	National and Global Dynamics	1.048*	0.001	0.31	1.79
	Socio-Economic Factor	0.714	0.066	-0.03	1.45
Project Characteristics	Project Component Cost	-0.238	0.961	-0.98	0.50
	Project Stakeholders Influences	-0.143	0.997	-0.88	0.60
	Market and Industry	-0.190	0.987	-0.93	0.55
	Statutory and Regulatory Factor	0.095	1.000	-0.65	0.84
	National and Global Dynamics	0.810*	0.022	0.07	1.55
	Socio-Economic Factor	0.476	0.468	-0.26	1.22
Project Stakeholders' Influences	Project Component Cost	-0.095	1.000	-0.84	0.65
	Project Characteristics	0.143	0.997	-0.60	0.88
	Market and Industry	-0.048	1.000	-0.79	0.69
	Statutory and Regulatory Factor	0.238	0.961	-0.50	0.98
	National and Global Dynamics	0.952*	0.003	0.21	1.69
	Socio-Economic Factor	0.619	0.167	-0.12	1.36
Property Market and Construction Industry	Project Component Cost	-0.048	1.000	-0.79	0.69
	Project Characteristics	0.190	0.987	-0.55	0.93
	Project Stakeholders Influences	0.048	1.000	-0.69	0.79
	Statutory and Regulatory Factor	0.286	0.910	-0.45	1.03
	National and Global Dynamics	1.000*	0.002	0.26	1.74
	Socio-Economic Factor	0.667	0.108	-0.07	1.41
Statutory and Regulatory Factor	Project Component Cost	-0.333	0.829	-1.07	0.41
	Project Characteristics	-0.095	1.000	-.084	0.65
	Project Stakeholders Influences	-0.238	0.961	-0.98	0.50
	Market and Industry	-0.286	0.910	-1.03	0.45
	National and Global Dynamics	0.714	0.066	-0.03	1.45
	Socio-Economic Factor	0.381	0.721	-0.36	1.12
National and Global Dynamics	Project Component Cost	-1.048*	0.001	-1.79	-0.31
	Project Characteristics	-0.810*	0.022	-1.55	-0.07
	Project Stakeholders Influences	-0.952*	0.003	-1.69	-0.21
	Market and Industry	-1.000*	0.002	-1.74	-0.26
	Statutory and Regulatory Factor	-0.714	0.066	-1.45	0.03
	Socio-Economic Factor	-0.333	0.829	-1.07	0.41
Socio-Economic Factor	Project Component Cost	-0.714	0.066	-1.45	0.03
	Project Characteristics	-0.476	0.468	-1.22	0.26
	Project Stakeholders Influences	-0.619	0.167	-1.36	0.12
	Market and Industry	-0.667	0.108	-1.41	0.07
	Statutory and Regulatory Factor	-0.381	0.721	-1.12	0.36
	National and Global Dynamics	0.333	0.829	-0.41	1.07

6.5 DISCUSSION OF THE FINDINGS IN RELATION TO THE RESEARCH OBJECTIVES

The study has investigated the causal relationships among the seven influencing factors and building development cost in New Zealand by employing structural equation modelling. This advanced method was employed to test the statistical adequacy of the proposed research model in order to confirm whether or not the hypothesised relationships were true reflections of practical realities in the industry, as well as the practical usefulness and ease of application of the model by the industry practitioners. By using SEM, the direct or indirect effects of the influencing factors on building development cost in New Zealand were examined and explained. The analysis result statistically proved that the seven factors worked collectively to influence building development cost in New Zealand.

The second focus of the analysis was on whether or not the identified factors significantly influenced building development cost in New Zealand. Path models and cognitive mapping were used to describe and explain the various factors and indicators that significantly influence building development cost. The reliability and validity of the seven latent constructs in this study are adequate. Moreover, the goodness-of-fit indices of the structural research model are quite satisfactory. The hypothesised relationships in the structural model were tested by AMOS 23. The strength of the relationship between the constructs is represented by the statistical significance of the path coefficient. Maximum likelihood method was employed to estimate path coefficients.

In testing the conceptual research model, after identifying the underlying structure based on the existing literature, the seven influencing factors: project component costs factor, project characteristics factor, project stakeholders' influences factor, property market and construction industry factor, statutory and regulatory factor, national and global dynamics factor, and socio-economic factor, were retained in the final model but 12 measurement indicators were deleted from the final research model.

6.5.1 Findings in relation to Hypothesis 1

The findings in relation to the evaluation on whether or not project component cost factor has significant effects on building development cost showed a positive outcome. The results were consistent with similar findings by (Chan & Park, 2005b; Iyer & Jha, 2004) that project component costs constitute significant drivers of overall building development cost. The findings are also in line with the observations of (Cheung et al., 2008) that to investigate the overall building development costs, the first step is to evaluate the immediate component costs – materials, labour, equipment and supervision. Furthermore the findings were in agreement with the research conducted by Love et al. (2005) which concluded that it is unlikely that building cost will be estimated properly if the component costs are not well evaluated. In other words, the project component costs factor is critical. Therefore, it is wise for construction professionals to adequately understand the cost components so as to best estimate and manage the overall project costs.

6.5.2 Findings in relation to Hypothesis 2

Project characteristics factor was found to be another important factor of building development cost in New Zealand. This finding corroborated the conclusions of (Flyvbjerg et al., 2004) that projects with distinctive features could significantly influence project cost. The findings also underscored the results of the work by Trost and Oberlender (2003) which indicated that project locations with different requirements make greater contributions to project costs when facing challenging situations during the project process. The external factors, such as weather conditions and health and safety risks would worsen the situations. The findings also expand the knowledge that a project with a high level of complexity has been found to have significantly higher building development costs (Baloi & Price, 2003). Complicated projects mean more inherent risks than simple projects. They might encourage construction professionals to adopt new techniques which are more challenging. In short, all the above-mentioned existing research findings corroborate well with all the results of the study that the project characteristics factor plays a key role in building development cost in New Zealand.

6.5.3 Findings in relation to Hypothesis 3

Project stakeholders refer to people or organisations who possess a vested interest in the project environment, performance, and outcomes (APM, 2000). The findings in relation to Hypothesis 3 showed the strong influence of the project stakeholders on building development costs. These findings reinforced the point made by Mansfield et al. (1994) that if the clients or owners satisfy the project costs management, the motive for any variations may be perceived as arbitrary. Understandably, if clients need to do some variations and the consultants attempt to sell them the need for the variations; the likelihood of the building project embracing variations would be relatively high. Consultants can enable clients to be aware of the need for variation by identifying problems and dissatisfaction with the current situation.

This result confirmed the findings by (Akintoye, 2000; Frimpong et al., 2003) which addressed the fact that one of the main reasons causing building cost overruns and poor cost performance is misunderstandings among parties involved in the project. The understanding of the clients and technical competency and experience have significant influences on project cost performance, which supports the results of studies by Hicks (1992). Moreover, the management capacity of the project team and communication among parties also significantly impacts building cost. This is consistent with the research findings by (Bresnen & Marshall, 2000; Cheung et al., 2008; Doloi et al., 2012; Frimpong et al., 2003).

6.5.4 Findings in relation to Hypothesis 4

The analysis results explored that the most significant influencing factor for building development cost in New Zealand is the property market and construction industry factor which is consistent with (Ball, 2006) who said that the transition of goods and services in the construction industry predominantly takes place by market exchange. Furthermore, the demand for construction products is not inherent as that requirement is derived from the demands of new housing, offices, education facilities, and hospitals and infrastructure. This derived demand is subject to the fluctuations of the property market and its cyclical nature as identified by Rosenberg (1982).

6.5.5 Findings in relation to Hypothesis 5

Moreover, the analysis result also explored whether the statutory and regulatory factor has a significant effect on building development cost in New Zealand. This is in line with the study findings conducted by Glaeser and Gyourko (2005) where it is stated that the regulatory factor accounted for a sharp increase in building cost. Construction activities consume massive resources and influence the local regions significantly and greatly impact people's health and safety. Therefore, a building regulation system is very important. A building regulation system consists of building regulations and building control systems (Pedro, 2009). Building regulations establish the foundation of the regulatory standards to ensure that the building is healthy, safe, energy efficient and accessible for people who work and live in it, whilst building control systems make sure that these standards are compulsory and implemented (Communities and Local Government, 2008). The regulatory pressures impose constraints on housing supply as they reinforce inefficiencies in construction (Ashenfelter et al., 1997).

6.5.6 Findings in relation to Hypothesis 6

The national and global dynamics factor was also found to be another significant factor of building development cost in data analysis results, whereas the factor was found to be non-significant as an important predictor for building development cost in the results of the experts' opinion. To a large extent, the matter lies in the fact that New Zealand tends to be an isolated and independent market, is a relatively small power in world trade, has no great influence in the world market, and also is shielded from the influence of outside forces. This phenomenon was observed by (Hillebrandt, 2000; Hughes et al., 2006; Jaffe, 2016; Wilkinson, 2010) that explored the role of New Zealand in world-wide trades. This situation results in New Zealand being seen in the global context only as a team member but not as a team player.

6.5.7 Findings in relation to Hypothesis 7

The importance of understanding the macro-economic fluctuations has been highlighted due to the Global Financial Crisis (GFC) in 2008. The socio-economic factor also has a significant effect on building development cost in New Zealand. The findings underpin a previous study by Rosenberg (1982) where it is stated that the supply and demand of construction products are significantly subject to the fluctuation of the social environment and general economic climates. It is not difficult to understand that the building development cost is decided by the law of supply and demand. Furthermore, the socio-economic factor strongly correlate with real estate investments which also underpin the findings from the previous study from (Hebb et al., 2010). Investment is one of the main reasons to bolster the construction industry (Symes, 2006), then the booming construction industry would drive up building cost because it is a fierce competitor for resources (labour, material, and plant).

6.5.8 The difference between analysis results and findings of the experts' opinions

Dissimilar with the data analysis results from the previous chapter, instead of seven significant influencing factors of building development cost in New Zealand, only five were found in the findings of the experts' opinion, namely, project component costs factor, project characteristics factor, project stakeholders' influences factor, property market and construction industry factor, and the statutory and regulatory factor, all of which have significant effects on building development cost in New Zealand. The study believes that, although the findings did not fully support the data analysis results' yield from structural equation modelling, it provides a different and meaningful perspective to the previous data analysis results.

The research model is an empirically-tested model derived from the existing literature and empirical findings. Moreover, the accepted step-by-step analysis procedure for testing the research model leads to a high degree of reliability and validity. In addition, the sample is relatively large (n=283) and the adopted structural equation modelling is a comprehensive analysis tool in the academic research field. It is undoubtedly a scientifically valid model to improve the understanding of the relationships between the influencing factors and building development cost in New Zealand.

The findings of the experts' opinion provide practical insights about how construction professionals perceive the relationships between the influencing factors and building development cost in New Zealand. The data analysis provides the results which might alter the traditional conceptions of the relationships between the influencing factors and cost. The construction professionals may be more attentive to how they interact with the changes in building development cost in New Zealand and endeavour to consciously shape their knowledge and understanding of the relationships between influencing factors and building development cost in New Zealand. Creating conditions to promote and enhance the knowledge through robust and strategic professional development or management practices would improve their understanding the movement of building development cost in New Zealand. Importantly, the data analysis results might alter the traditional approach to cost management.

Besides, the socio-economic factor, which refers to the macro-economic influences that affect extrinsically and intrinsically the construction industry and project cost, was also found to be non-significant for building development cost on the analysis results of the experts' opinion. One possible reason is that basically a building project is an economic activity, the project cost has to absorb the influences initiated from the top-down approach, regardless of whether the influences are valuable, or whether the rewards or benefits are realized from adopting influences. Clearly, even if the influences are undesirable or worthwhile, the project has to accept the influences.

Second, unlike other industries in the macro economy, the fragmented nature that exists in the construction industry in New Zealand somewhat provides comparatively fewer opportunities for professionals to have access to the knowledge of the relationship between the construction industry and the macro-economic conditions. The lack of knowledge and understanding of the macro-economic conditions of the construction professionals contributes to why the socio-economic factor is not relevant to building development cost in New Zealand.

CHAPTER 7 CONCLUSIONS AND RECOMMENDATIONS

7.1 OVERVIEW

This chapter summarises the conclusions on the key findings of the study in relation to the research objectives. The chapter also highlights the key contributions to knowledge and the implications for research and industry practice. The limitations of the study were outlined and recommendations were put forward to guide industry application of the findings. To enable uptake of the findings by practitioners, a pathway model was provided.

7.2 KEY CONCLUSIONS

This study has explored the factors that influence building development cost in New Zealand and the causal relationships between them. The key findings in relation to the research questions are as follows.

7.2.1 The key factors that influence BDC in the New Zealand construction industry

Findings in relation to this research question showed that there are seven key factors that influence building development cost in New Zealand. The factors are as follows: project component cost (PCC), project characteristics factor (PCF), project stakeholders' influences (PSI), property market and construction industry factor (PMCI), statutory and regulatory factor (SRF), national and global dynamics (NGD), and socio-economic factor (SEF).

The findings indicated that all the influencing factors have statistically significant effects on building development cost in New Zealand. These relationships suggest that obtaining information about all seven influencing factors is a precondition for performing effective and efficient cost management in the construction industry. Failure to holistically and adequately address the influencing factors relating to development cost in building construction projects would prevent cost management efforts from achieving the desired results.

7.2.2 The relative levels of influences of the identified factors on BDC

The model explored the importance level of the influencing factors of building development cost based on the empirical studies undertaken in New Zealand. This also showed that relationships or linkages exist between the influencing factors and building development cost. In other words, the construction professional can manage cost properly by effectively coping with these influencing factors. Although the previous studies addressed that there are unidentified cost drivers beyond control, they do not elaborate upon them and exploit their relationships with building development cost. However, the proposed model not only identifies the influencing factors but also quantifies their level of influence. Therefore, the construction professional can select appropriate managing practices and strategies to handle the major cost drivers in order to achieve project success.

The model revealed that construction professionals can properly manage the building development cost if they can establish a proper management system by means of considering the critical influencing factors. Especially, the professionals should concentrate on comparative advantages, procurement management, risk management, and key stakeholders' management which in turn can lead to an effective cost management system. Indeed, these findings are in line with previous studies (Iyer & Jha, 2004; Odeh &

Battaineh, 2002; Singh, 2010). Similarly, understanding the various interests of the involved stakeholders and better management of them would be beneficial; particularly in improving the understanding of the client's needs and satisfying their objectives. These findings are also confirmed by Mbachu and Nkado (2006) where it is suggested that client satisfaction is one of the most important contributors to project success.

Furthermore, the impacts of SRF and NGD on building development cost are quite noteworthy. The industry practitioners who try to properly manage cost should also enhance their understanding of the regulations related to building construction projects, particularly building codes and compliances and health and safety issues. These findings are supported by previous studies (KPMG & PMI, 2012; Singh, 2010). Moreover, unexpected shocks such as natural majeure and political or financial chaos also pose pressures on cost management through their effects on the inelastic relationship of supply and demand. This is consistent with the studies have been undertaken by Jaffe (2016); Wilkinson (2010).

It is apparent that those professionals who aim to properly manage project cost should allocate their limited resources properly so as to avoid cost overruns and delays in their construction schedule. Moreover, practitioners should also emphasise that professional fees and cost of consents are an important indicator of project component cost based on the factor loading. These findings were upheld by previous studies (AbouRizk et al., 2002; Lopez & Love, 2012). Finally, a focus on the socio-economic environment is necessary to properly manage building development cost in respect of their influence on the supply of construction resources and the demand for construction products. For example, population growth with increasing income would drive up the demand for construction products. And an increasing number of applications for building consents would impose great pressure on the supply of construction resources. All these factors together increase building development cost dramatically. These findings are clearly evident in some previous studies (Hebb et al., 2010; Rosenberg, 1982).

The influencing level is an effective indicator for construction professionals to assess the levels of influences in their specific building projects. They can better anticipate potential risks and uncertainties in building projects and better manage project cost. As a result, the resources will be allocated wisely for their projects, thereby improving project cost performance.

Based on this diagram model as shown in Figure 7.1, the New Zealand construction industry can identify the major drivers of building development cost and select appropriate management practices and strategies to handle these drivers for achieving project success.

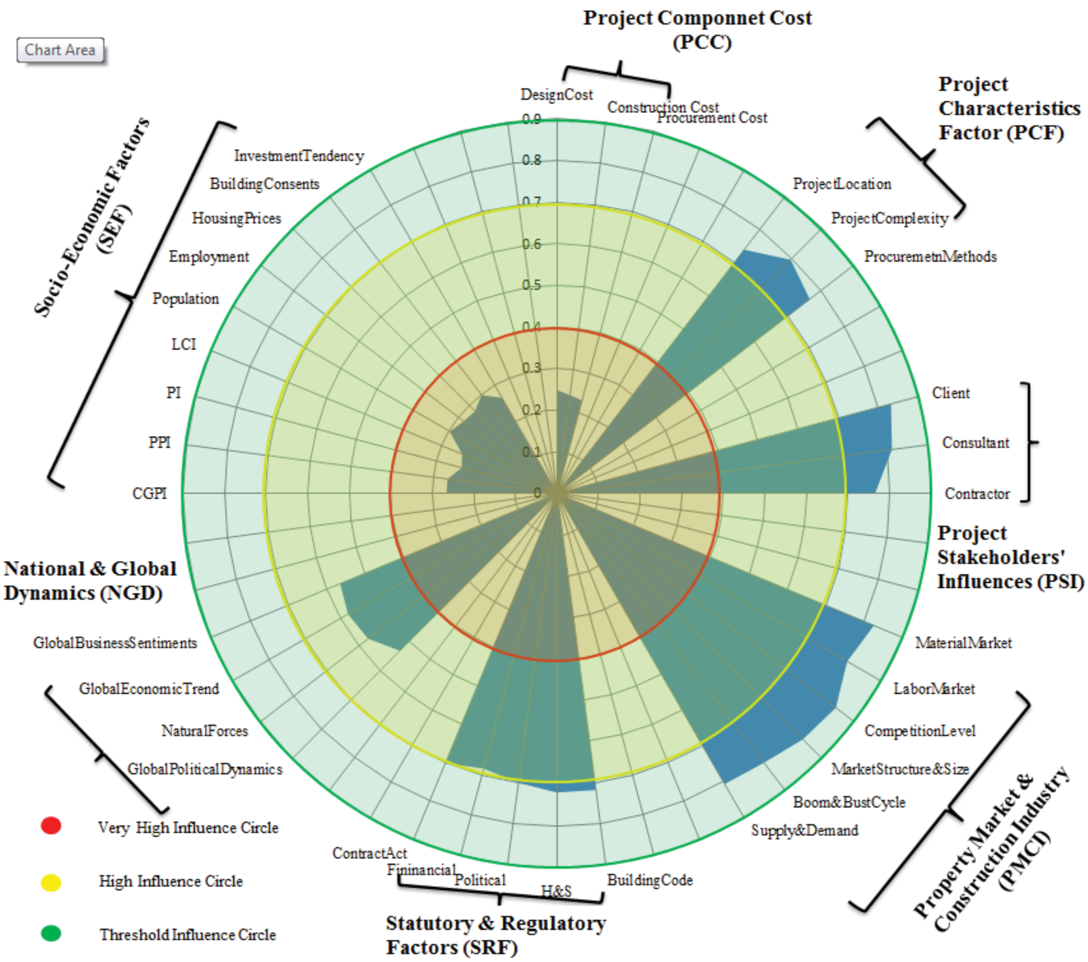


Figure 7.1 Relative importance of influencing factors

7.2.3 Causal relationships exist between the factors and BDC

The final SEM model explored that all the seven influencing factors have significant effects on building development cost in New Zealand. Furthermore, the analysis results also indicated that the property market and construction industry factor is the most significant influencing factor in respect of building development cost in New Zealand, and the project stakeholders' influences factor is the second-most significant influencing factor , with the project characteristics factor being the third-most influential factor. Based on the path coefficients of the influencing factors, statutory and regulatory factor, national and global dynamics factor, and socio-economic factor, in descending order, can also significantly affect building development cost in New Zealand. The project component cost factor is considered the least significant influencing factor for building development cost.

7.2.4 The validity and practical relevance of the model from the experts' perspectives

Grounded in the existing literature, a conceptual model, based on previous theories and findings, was developed and tested using information and data collected by interview and a questionnaire survey covering the main factors influencing building development cost. This study employed structural equation modelling to empirically test and validate the proposed causal relationships between the influencing factors and building development cost in New Zealand. This permitted testing all the relationships simultaneously. The analysis results are also shared with the industry key professionals to obtain their perceptions on the findings. They agree with the analysis results, but they might well possess different ideas on the influencing levels of two factors, namely national and global dynamics and socio-economic factor. However, the study still adopts the data analysis results as its conclusion due to the fact that key professionals might have different opinions so as to gain consensus. And they might just make quick decisions without considering all the factors seriously.

7.3 CONTRIBUTIONS TO KNOWLEDGE

By conceptualizing the influencing factors and NZ building development cost as a structural model, this study provides a better understanding of the properties of the process. This study contributes to the new knowledge by comprehensively detailing those factors influencing building development cost in New Zealand. Failure to identify the significant influencing factors might produce inaccurate costs estimating. Unlike previous research, this study views influencing factors of building development cost in a more precise manner, by grouping them into seven categories instead of involving them in a general setting. In short, the proposed dimensions of the influencing factors for building development cost permit the researchers to consider and understand the essence of the movement of such development cost in New Zealand in a more meaningful context. For example, the findings provide clients and policy-makers with strategic insights into the movements of building development cost in New Zealand.

Although some studies have been done on the factors influencing building development cost, there are no studies grouping the influencing indicators, which use structural equation modelling to investigate cost-influencing factors in New Zealand's construction industry. The analysis results offer insight on cost influencing factors and illustrate their relative importance to construction professionals, which would assist them to make appropriate strategical decisions and take proper actions toward the most significant factors.

Nevertheless, it provides a better understanding of the movement of building development cost in New Zealand by exploring the most significant cost drivers. It also offers the model and empirical basis for explaining the causal relationships between the influencing factors and New Zealand's building development cost.

The previous research revealed the influencing factors of building development cost but did not fully explore the relative importance of them. This study extends that earlier line of effort by quantifying the relative importance of the influencing factors.

This study takes stock of the influencing factors of building development cost in New Zealand. The literature review was conducted to identify the relevant factors nationally and internationally. The study assumes that the factors have strong relationships with building development cost in New Zealand.

This study then groups the various cost drivers into seven categories; it asserts that it is useful to categorise the cost drivers, and analysis of the grouped factors can provide strategic insights into the movement of building development cost. Re-examination of the cost drivers can be achieved based on the previous research findings and theories, but that is not the only path to gain such insights since these findings and theories typically emphasize a particular cluster of cost drivers. Instead of focusing exclusively on different "molecules" (the individual cost drivers), the study can carefully investigate various cost drivers. Thinking in this way regarding cost drivers themselves can open a theoretical space for cost movements to emerge.

Although cost overruns are common to all projects, identifying the main factors influencing costs and then taking preventative action are the bases for resolving cost overrun problems. Unlike previous studies that focused on the main cost drivers by employing various indices, this study evaluates the effects of different influencing factors on the relevant important scores. The study presents a novel approach that adopts structural equation modelling to quantify the effects of the different influencing factors. In a New Zealand context, the property market and construction industry factor has the most significant impacts on building development cost and, in that category, the measurement indicator of competition level is the most significant indicator. Therefore, the competition level is seen as being the most prominent influencing indicator in this empirical study. The constructive findings help cost analysts to locate cost overrun problems. Users can manage cost overrun problems by taking into account the size of their coefficients and investigating individual influencing indicators and their relationships with other influencing indicators.

Furthermore, the study supports the opinion that SEM can quantify comprehensive relationships among examining factors. The SEM approach has great potential in resolving experience-oriented problems in the construction research domain.

The main contribution of this study to the existing knowledge is the empirical evidence of the relationships between the measurement indicators and building development cost in New Zealand through their corresponding latent constructs which is described in the best-fitting structural research model.

7.4 IMPLICATIONS FOR RESEARCH AND INDUSTRY PRACTICES

This study enhances the understanding of the effects of the influencing factors on building development cost in New Zealand. The property market and construction industry factor shows a significant effect on cost. This presents evidence of the importance of these factors in respect of the movement of building development cost, particularly in New Zealand.

The findings have important implications for practitioners in the building construction industry in New Zealand. Industry professionals must consider the property market and construction industry factor in their cost-estimating endeavours. This is important, since this study has demonstrated the significant effects of this factor on building development cost. In the construction industry, the industry practitioners should recognize the need to meticulously manage their costs so as to gain a competitive advantage.

This study has identified the socio-economic factor that has a significant effect on such cost. It is a good sign to see an increasing awareness of the effects of this factor on building development cost among developers, investors, and consultants. It was evident in both the interview and questionnaire survey that socio-economic factor is being taken more seriously within New Zealand's property and construction industry.

It is advisable that investors and developers incorporate the socio-economic factor as an important aspect of their investment approach in their total portfolio. The study suggests that those investors who have a long-term share view should integrate socio-economic factor in their real estate portfolio so as to protect their real estate investments from reputation, regulatory, and financial risks. If investors do not already include socio-economic factor in their investments, they should pay greater attention to socio-economic factor in their real estate portfolios.

The study's findings are also valuable from the point of view of considering key managerial implications. Managers can proactively take into account the significant influencing factors of NZ building development cost that enable cost minimization and the generation of firm-level strategy. For example, managers have opportunities to provide their cost views for a project in a business situation where market uncertainty exists and other signals are not sufficient. Thus, the managerial strategy should include outer-firm spill-over benefits and costs.

Indeed, both practitioners and researchers can gain more penetrating insights from considering fundamental cost drivers than from the relatively less precise concepts. Finally, the study's findings support the premise that designing operational solutions to mitigate or leverage the frictions from market and industry, the regulatory factor and the socio-economic factor so as to minimize cost and create value, is at the core of the economic foundations of strategy.

The findings of the study as presented would help both developers and clients in identifying the areas where they should necessarily focus their attention so as to improve the cost estimation or cost performance practices of building projects. Additionally, the findings show the significant effects of the property market and construction industry factor on building development cost in New Zealand, thereby assisting professionals to account for its indicators, for example, boom and bust cycles, the materials market, and the labour market.

The study is directed towards finding out the dominant influencing factors or major drivers of building development cost in New Zealand. It focuses on making clients and related key professionals aware of factors that demand close attention. After the theoretical model is developed, validation is carried out by collecting the opinions of key professionals in New Zealand's construction industry.

Results indicate the effects of each proposed construct on building development cost. The analysis results show that project component costs factor, the project characteristics factor, project stakeholders' influences factor, property market and construction industry factor, and statutory and regulatory factor are of primary importance, while the industry experts appear to lack agreement on what effect national and global dynamics and socio-economic factors will have on this country's building development cost. Practitioners need to handle issues relating to these constructs in order to reduce the probability of project failure due to cost performance.

The findings should serve as a guide to key construction professionals or industry-responsible practitioners for successfully undertaking cost management in building construction projects. From the analysis reports, all seven influencing factors and their corresponding measurement indicators should be given adequate consideration. Nonetheless, the 11 most important measurement indicators are project complexity (PCF2), construction cost (PCC2), net immigration and population growth (SEF7), project location (PCF1), level of competition (PMCI3), clients (PSI1), consultants (PSI2), material market (PMCI1), labour market (PMCI2), investors' confidence (SEF14), and contractors (PSI3).

7.5 PATHWAY FOR INDUSTRY UPTAKE OF THE RESEARCH FINDINGS

To prevent any negative effects on a project's cost performance, it is necessary to recognise the influencing factors of the building development cost in the initial stages. The external factors which affect building development cost are usually dynamic. It is important to monitor the influencing factors regularly to attempt to prevent them impairing the project cost performance.

The project stakeholders are strongly recommended to examine and assess the project cost performance and, if necessary, rearrange the resource allocation of the project, based on the result of examination and assessments. Regular examination and management of project cost performance does not place limits only on the project itself and the project environment but also on the socio-economic and national and global dynamics aspects.

The indicators of property market and construction industry factor affecting building development cost are found to be of three aspects: resource market (material and labour market), the capacity and limitation of the property market and construction industry (market structure and size and level of competition), and the cycle location in the property market and construction industry (boom and bust cycle and relationship of demand and supply). Taking these indicators into account should improve the accuracy and efficacy of project cost estimating. For example, sufficient resource supply should improve the efficacy of resource allocation and decrease project cost. Furthermore, the capacity of the construction industry would provide cost equilibrium. Additionally, the cycle in the property market and construction industry should be carefully monitored before conducting the cost estimating as it is usually regarded as a highly cyclic sector.

Project stakeholders play a key role in the completion of a complex construction project within its specific budget. The effective management of the project stakeholders is able to reduce operational costs with improved performance and cost transparency. To enhance the cost performance of the project, the stakeholders' influences should be taken into account. Understanding and collaboration among project stakeholders can improve work efficiency (Lingard & Francis, 2006). Thus, it was recommended to organise the stakeholders gathering to share their interests and opinions to facilitate understanding and collaboration among them (Leung et al., 2009).

Besides, the statutory and regulatory factor is a significant influencing factor for building development cost in New Zealand. What this implies is that project cost performance depends on the impacts of the statutory and regulatory factor on building development cost. The indicators involved in this factor comprise mainly two aspects, the regulations in the construction industry (building code and compliance, health and safety regulations, and construction contracts act) and government and fiscal policy pertaining to the construction industry and related sectors (political policy and financial regulations). Better understanding the regulations in the construction industry would reduce additional litigation costs. Moreover, the evaluation and examination of the policies relevant to the construction industry leads to a better understanding of the position of the construction industry in the economy and thus can result in avoiding unnecessary expenditure.

The impacts of the socio-economic factor on building development cost in New Zealand should not be ignored as it affects the whole economy which includes the construction industry and related sectors. Some indicators of the socio-economic factor could influence the demands of construction projects like labour cost, net migration, employment rate and investors' confidence, while some indicators are used to describe the state of the construction industry and the price of the construction products, such as capital goods' prices, producers' prices, productivity in the construction industry, housing prices and the number of building consents, and the indicator—consumer price index-- to represent the inflation rate. It recommends that professionals who possess knowledge about these indicators are capable of linking the trend of building development cost with these indicators, and then better understand the construction industry and better control project cost based on these public socio-economic indicators.

The findings of the research also confirm that national and global dynamics impose significant effects on building development cost. Although the industry practitioners express different opinions, they still agree that the Global Financial Crisis (GFC) negatively impacted on the construction industry in New Zealand. Moreover, it cannot be denied that the Christchurch earthquake was one of three main drivers for the rocketing demand for housing. Careful evaluation and examination of the indicators can produce a better understanding of the construction industry and project work environment, and thus would impose positive effects on a project's cost performance.

7.6 LIMITATIONS OF THE STUDY

There are limitations to this study; the proposed conceptual model has been tested and validated by gathering data and information from key associations/institutions in New Zealand. Owing to this fact and the self-reported methods of data collection, there is a possibility of bias existing in the results of the study.

This study aims to explore the influencing factors as deeply as possible without defining the building development cost for typical buildings like residential, commercial, educational and retail, etc. As the influencing factors affect different construction building products in differing amplitudes and at times in opposite directions, further research will concentrate on a particular building type, such as residential or commercial.

Although the study attempts to encompass as much about the influencing factors of building development cost as possible, potential limitations do exist. Data collection is from the construction industry in New Zealand; therefore, the data set may be a good representation in this context only. Moreover, measurement indicators of non-significant constructs may be re-defined in order to re-evaluate their significance in the research model.

The main limitation of this study is that only the opinions of the industry's key professionals were considered. Furthermore, the study was conducted in New Zealand; hence the findings might have only described the construction professionals' opinions in a New Zealand context. However, the theoretical principles and methodologies on which the study was based are general and can be applied to other regions. For such applications, the results might differ from the presented findings. Nevertheless, this limitation should not nullify the theory contributions and practical implications derived from the empirical findings in this study. Moreover, the structural research model can be tested in real life projects.

The potential limitations of this study and hence the suggestions for future studies require to be addressed. First, common-method bias might have occurred due to the data gathered from the questionnaire being self-assessed even though considerations were given to avoid social desirability bias when devising the questionnaire. For example, different respondents might have different interpretations about what are the factors influencing building development cost or the influencing level of the factors for building development cost. In spite of this limitation, this study provides empirical support for the conceptual research model showing the relationships between the influencing factors and building development cost. This builds a foundation for further studies.

7.7 RECOMMENDATIONS FOR FURTHER RESEARCH

Using the findings of this study as a starting point, future studies should explore further the established causal relationships between building development cost and the key influencing factors with a view to examining the potential for cause-and-effect prediction models. Such models could guide more accurate and more reliable building cost estimation that takes into consideration changes in the underlying causation factors. Perhaps it might be necessary to develop predictive models for each of the building types and for particular locations. In this way, the influence of the dimensions of building types and locations on the reliability of the model prediction could be minimised.

Although the seven key influencing factors are discussed separately in this study, correlations and even trade-off relationships might exist among them. Further studies could look at the inter-relationships among the factors and the impact on the current results.

The challenge of the implementation of the model is that most of the influencing factors are difficult to fully comprehend from an operational viewpoint as the project type is not specific. Any future study will use the key influencing factors to perform a thorough examination that is tailored to the characteristics of the construction project. A broader examination and evaluation is required in future studies on individual building types.

Future study could also employ more advanced artificial intelligence tools such as Bayesian analysis to investigate complex issues affecting building development cost. An example is the uncertainty in the forecast and management of construction cost. Additionally, the factual evidence relied on in this study was mainly subjective (i.e. opinion-based). An experimental research method could be carried out to examine the influence of objectively quantified causation factors on building development cost.

Finally, it should be noted that the scope of the study was limited to feedback received from trade and professional organisations that participated in the survey, namely, Property Institute of New Zealand (PINZ), Property Council of New Zealand (PCNZ), Association of Consulting Engineers of New Zealand (ACENZ), New Zealand Institute of Building (NZIOB), New Zealand Institute of Quantity Surveyors (NZIQS) and others. However, there was no feedback from clients because of the lack of an association for construction clients in New Zealand. The existing Construction Client Group (CCG) is merely a pan-industry organisation that does not represent actual construction clients in New Zealand. Clients' perspectives on the study were inferred from the feedback of the professional consultants that represent them. Further study should focus on surveying construction clients' perspectives on the subject matter.

The research only provides a snapshot or window view of the building development cost in New Zealand within the data gathering period; it does not holistically address the changing range of factors through the boom and bust cycle that characterises the construction industry. A longitudinal study may be required to examine the influences through the boom-bust cycle phases.

7.8 SUMMARY OF KEY FINDINGS

This chapter states the factors which significantly influence building development cost in New Zealand, the relative level of effect for the cost, and their relationships with the building development cost in New Zealand. Their contributions to the knowledge of, and their implications for, the construction industry are also addressed. And recommendations for further research - and the limitations of this study - are also discussed.

The final SEM model explored that all the seven influencing factors have significant effects on building development cost in New Zealand. Furthermore, the analyzed results show that the property market and construction industry factor is the most significant influencing factor for building development cost in New Zealand. The project stakeholders' influences factor is the second-most significant influencing factor and the project characteristics factor is the third-most influential factor. Based on the path coefficients of the influencing factors, statutory and regulatory factor, national and global dynamics, and the socio-economic factor - in descending order - can also have a significant effect on building development cost in New Zealand. The project component costs factor is the least significant influencing factor.

Industry professionals can easily adapt these figures to their specific situations and include the influencing factors having significant effects on project cost so as to achieve successful cost performance. Many professionals will see these figures as a tool for better understanding those factors which significantly influence building development cost.

Previous studies have been conducted to investigate the measuring of building development cost. Structural equation modelling of such influencing factors is, however, scanty in construction management literature. The technique is useful in describing the relationship between the influencing factors and building development cost in New Zealand. The final model is a relationship network that can be adopted to facilitate decision-making and improve understanding of the subjects.

While the SEM model revealed that all seven factors can significantly affect building development cost in New Zealand, the experts might possess different opinions on the affecting level of the national and global dynamics and socio-economic factor. They stated that the two factors might impose effects on building development cost, but not as importantly as other factors. Although the professionals may provide different perceptions, the study still employed the results from the SEM analysis because the experts may have arrived at their opinions without considering them seriously.

Although the findings are exclusively in respect of building development cost in New Zealand, they can be used internationally by whoever may be concerned with the analysis of project cost in New Zealand. Also, they can be used as a guide by those industry professionals who are undertaking project cost management, estimating and control.

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APPENDICES

APPENDIX A: LOW RISK NOTIFICATION

MASSEY UNIVERSITY

20 October 2015
Lin Lin Zhao
20 Killybegs Drive
Pinehill
Auckland, 0632

Dear **Lin Lin**

Re: Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

Ethics Notification Number: 4000015096

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our system which is reported in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director (Research Ethics), email humanethics@massey.ac.nz. "

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish require evidence of committee approval (with an approval number), you will have to complete the application form again answering yes to the publication question to provide more information to go before one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

You are reminded that staff researchers and supervisors are fully responsible for ensuring that the information in the low risk notification has met the requirements and guidelines for submission of a low risk notification.

Yours sincerely

Dr Brian Finch
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

APPENDIX B: PARTICIPANT CONSENT FORM

MASSEY UNIVERSITY

School of Engineering & Advanced Technology

Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Project Title:

Building Development Cost Drivers in the New Zealand Construction Industry: A Multilevel Analysis of the Causal Relationships

PARTICIPANT CONSENT FORM - INDIVIDUAL

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the interview being sound recorded. *(if applicable include this statement)*

I agree/do not agree to the interview being image recorded. *(if applicable include this statement)*

I wish/do not wish to have my recordings returned to me. *(if applicable include this statement)*

I wish/do not wish to have data placed in an official archive. *(if applicable include this statement)*

I agree to participate in this study under the conditions set out in the Information Sheet.

Signature: .... **Date:** ....

Full Name - printed ....

APPENDIX C: AUTHORITY TO RELEASE THE TRANSCRIPT

MASSEY UNIVERSITY

School of Engineering & Advanced Technology

Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Project Title:

Building Development Cost Drivers in the New Zealand Construction Industry: A Multilevel Analysis of the Causal Relationships

AUTHORITY FOR THE RELEASE OF TRANSCRIPTS

I confirm that I have had the opportunity to read and amend the transcript of the interview(s) conducted with me.

I agree that the edited transcript and extracts from this may be used in reports and publications arising from the research.

Signature: .... **Date:** ....

Full Name - printed ....

APPENDIX D: RESEARCH ASSISTANT CONFIDENTIALITY AGREEMENT

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Project Title:

Building Development Cost Drivers in the New Zealand Construction Industry: A Multilevel Analysis of the Causal Relationships

CONFIDENTIALITY AGREEMENT

I .... (Full Name - printed)

agree to keep confidential all information concerning the project ....

I will not retain or copy any information involving the project.

Signature: .... **Date:** ....

APPENDIX E: TRANSCRIBER'S CONFIDENTIALITY AGREEMENT

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Project Title:

Building Development Cost Drivers in the New Zealand Construction Industry: A Multilevel Analysis of the Causal Relationships

TRANSCRIBER'S CONFIDENTIALITY AGREEMENT

I .... (Full Name - printed) agree to transcribe the recordings provided to me.

I agree to keep confidential all the information provided to me.

I will not make any copies of the transcripts or keep any record of them, other than those required for the project.

Signature: .... **Date:** ....

APPENDIX F: E-MAIL REQUESTING PARTICIPATION IN PILOT SURVEY

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Dear Respondent (example)

Subject: Participation in piloting a questionnaire

I kindly request your participation in piloting a questionnaire of a research project for my Ph.D. Construction Management degree is undertaken in the School of Engineering and Advanced Technology at the Massey University. The study is entitled "**Building development cost drivers in the New Zealand construction industry: a multilevel analysis of the causal relationships.**"

The purpose of this pilot survey is to attain your constructive input before sending it to construction professionals who are the registered members of the institutions/associations of the construction industry in New Zealand, including clients and developers, consultants, and contractors. I might have left out some relevant information or variables applying to your professional expertise and experience. Please complete the questionnaire and add any relevant information at the bottom of the questionnaire. Please provide as more detail information as possible.

The attached Excel file has to be completed during the interview. Please indicate a convenient time to participate the interview.

I am looking forward to hearing from you.

Regards

Lin Lin Zhao

APPENDIX G: QUESTIONNAIRE SURVEY PACKAGE

Appendix G1 (Cover Letter)

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND
School of Engineering and Advanced Technology
P/bag 102904, Auckland 0745
T: 09 414 0800 x43577; mobile: 0277888880; email: L.L.Zhao@massey.ac.nz

Date: 21 August 2015

Attention: Marilyn Moffatt
Executive Director
New Zealand Institute of Quantity Surveyors (NZIQS)
Wellington
New Zealand

Dear Marilyn Moffatt,

***Research survey*: Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships**

Building development costs have increased dramatically over the last decade. The impact of this on housing affordability in New Zealand is huge, with the latter occupying prime position as the priority agenda in the political, social and economic discussion forums in the country. Unfortunately, the key directions of the building development cost trend are uncertain, and the key drivers are not well understood. Understanding the root factors which significantly influence building development costs is an essential step to reliable estimation of building development costs and the future directions of the trend. This study aimed to bridge existing knowledge gap by examining a range of potential factors that influence building development costs with a view to ascertaining the significantly influential factors. The outcome of the study is expected to benefit construction professionals by widening their understanding of building development cost drivers and trends and how to incorporate these in making more reliable and accurate building cost estimation and budget forecasts.

To meet the objectives of the research, the attached questionnaire has been designed to obtain feedback from construction professionals. It will take approximately 10-15 minutes to complete. We would like you to participate in the survey by completing the questionnaire. Your responses will be treated in strict confidence, and will be used solely for the purpose of the study. Kindly fill-out and email the questionnaire to the address indicated. If you would be interested in the key findings of this study and prefer anonymity, kindly fill the attached Summary Request Form and return it separately. Thank you in anticipation of your helpful response.

Yours sincerely,

Lin Lin Zhao (Researcher)

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 10/014. If you have any concerns about the conduct of this research, please contact Dr Dianne Gardner, Acting Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x41225, email humanethicsnorth@massey.ac.nz.

Appendix G2 (Questionnaire)

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND
School of Engineering and Advanced Technology
P/bag 102904, Auckland 0745
T: 09 414 0800 x43577; mobile: 0277888880; email: L.L.Zhao@massey.ac.nz

QUESTIONNAIRE SURVEY

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

This questionnaire comprises 2 sections. Section 1 focuses on the main factors influencing building development costs. Section 2 is on the demographic profiles, which will help to compare respondents' ratings across various demographic profiles. It will be appreciated if all the sections are completed.

Section 1: Main Questions

1.1 The following major- and sub-factors have been identified as key influencers of building development cost trends. Please rate the relative levels of influence of the sub-factors using the 5 point scale ranging from 5 = Very strong to 1 = Very weak. If you think there are other factors which are not included in the list, please add them in the textbox provided below.

	Factors influencing building development costs	Relative levels of influence					Not sure
		Very strong	Strong	Medium	Weak	Very weak	
		5	4	3	2	1	
A	*Component-related factors*						
A1	Procurement costs						
A2	Construction costs						
A3	Design costs						
	Other? (Please specify):						
B	*Project-related factors*						
B1	Project location						
B2	Project complexity						
B3	Procedures Methods						
B4	Contract types						
B5	Technological innovations						
	Other? (Please specify):						
C	*People influence*						
C1	Clients						
C2	Consultants						
C3	Contractors						
C4	Suppliers						
C5	Building officials						
	Other? (Please specify):						
D	*Property market & construction industry-related factors*						
D1	Material market						
D2	Labour market						
D3	Level of competition						
D4	Market structure and size						

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D5	Boom-bust cycle						
D6	Supply and demand relationship (Property)						
D7	Investment tendency						
D8	Houses sell/rental prices						
	Other? (Please specify):						
E	*Statutory/Regulations*						
E1	Building Code & compliance						
E2	Health & safety regulations						
E3	Political Policies						
E4	Financial regulations						
E5	Construction Contracts Act						
	Other? (Please specify):						
F	*National & Global factors*						
F1	Increasing energy costs						
F2	Natural forces (earthquakes, tornadoes, bush fires, flooding).						
F3	Global economic trend						
	Other? (Please specify):						

1.2 Major factor categories influencing building development costs

		Relative levels of influence					
	Major factor categories influencing building development costs	Very strong	Strong	Medium	Weak	Very weak	Not Sure
		5	4	3	2	1	
A	*Component factors*						
B	*Project-related factors*						
C	*Property market/ Industry-related factors*						
D	*National & Global factors, including socio-economic factors*						
	Other? (Please specify):						

1.3 Socio-Economic Indicators influencing building development costs

	Socio-Economic Indicators	Relative levels of influence					
		Very strong	Strong	Medium	Weak	Very weak	Not sure
		5	4	3	2	1	
A1	Gross Goods Production (GDP)						
A2	Capital Goods Prices Index (CGPI)						
A3	Customer Prices Index (CPI)						
A4	Production Produces Index (PPI)						
A5	Productivity Index (PI)						
A6	Labour Cost Index (LCI)						
A7	Urban Population						
A8	Employment						

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A9	Unemployment						
A10	Housing Prices						
A11	Building Value						
A12	Energy prices						
A13	Exchange rate						
A14	Official Cash Rate (OCR)						
A15	90 day rate						
A16	Mortgage interest rate						
A17	Small & Medium Enterprises overdraft rate						
A18	Business lending rate						
	Other? (Please specify):						

Section 2 Respondent's Demographic Background

1. What is the length of your experience in the construction industry?

☐ <5 yrs ☐ 5-10 yrs ☐ 11-15 yrs

☐ >15 yrs

2. Which job category most closely represents your primary role in the industry?

☐ Owner/ developer ☐ Architect ☐ Engineer

☐ Project manager ☐ Main contractor ☐ Specialist tradesperson

☐ Quantity surveyor ☐ Building official/Inspector

☐ Other? (Please specify): ____

3. Please indicate the city in which you work

☐ Auckland ☐ Wellington

☐ Christchurch ☐ Others (please specify): __________________

4. Please indicate your position in your organisation?

☐ CEO/MD ☐ Senior manager/Partner

☐ Manager/ Supervisor ☐ Tradesman/ worker/ trainee

☐ Other? (please specify): ____

Page 3 of 4

Appendix G3 (Request for Research Findings)

Form for requesting summary of the key research findings

ATTENTION: LINDA ZHAO

FAX: +64 9 443 9774; Email: L.L.Zhao@massey.ac.nz

REASEARCH ON:

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

I would like to receive a summary of the key findings of the research. My contact details are as follows.

Name and address of company (optional):______________________________

____

____

____

Fax:

Attention:

E-mail:

Appendix G4 (Online Survey)

Massey University

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

Cover Leter

Building development costs have increased dramatically over the last decade. The impact of this on housing affordability in New Zealand is huge, with the latter occupying prime position as the priority agenda in the political, social and economic discussion forums in the country. Unfortunately, the key directions of the building development cost trend are uncertain, and the key drivers are not well understood. Understanding the root factors which significantly influence building development costs is an essential step to reliable estimation of building development costs and the future directions of the trend.

This survey complements a quantitative study being carried out as part of a postgraduate research in the School of Engineering and Advanced Technology, Massey University, Albany campus. The study aimed to bridge existing knowledge gap by examining a range of potential factors that influence building development costs with a view to ascertaining the significantly influential factors. The outcome of the study is expected to benefit construction professionals by widening their understanding of building development cost drivers and trends and how to incorporate these in making more reliable and accurate building cost estimation and budget forecasts.

To meet the objectives of the research, the attached questionnaire has been designed to obtain feedback from construction professionals. It will take approximately 10-15 minutes to complete. We would like you to participate in the survey by completing the questionnaire. Your responses will be treated in strict confidence, and will be used solely for the purpose of the study. Kindly fill-out the questionnaire. If you would be interested in the key findings of this study please supply your contact details in the section provided. If you refer anonymity, kindly fill the attached Summary Request Form and return it separately. Thank you in anticipation of your helpful response.

Yours sincerely,

Linda Zhao (Researcher)

Note: By clicking the next button, you consent to participating in this survey voluntarily. You are at liberty not to answer

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

Questionnaire Survey

Some factors have been identified during a pilot study as having key influence on building development cost trends. The factors have been grouped under categories that ranged from cost-component to socio-economic dynamics. Please rate the relative levels of influence of the factors under each category using the scale provided; the scale ranges from 1 (i.e. 'Very weak') to 5 (i.e. 'Very strong'). If you think there are other factors within each category which are missing in the list, please add them in the text box area.

1. Component related factors influencing building development costs

	Very weak	Weak	Medium	Strong	Very strong	Not sure
Procurement costs	○	○	○	○	○	○
Construction costs	○	○	○	○	○	○
Design costs	○	○	○	○	○	○

Other (please specify)

2. Project related factors influencing building development costs

	Very weak	Weak	Medium	Strong	Very strong	Not sure
Project location	○	○	○	○	○	○
Project complexity	○	○	○	○	○	○
Procedures methods	○	○	○	○	○	○
Contract types	○	○	○	○	○	○
Technological innovations	○	○	○	○	○	○

Other (please specify)

3. Project stakeholders' influences affecting building development costs: Acts or omissions of the following stakeholders

	Very weak	Weak	Medium	Strong	Very strong	Not sure
Clients	○	○	○	○	○	○
Consultants	○	○	○	○	○	○
Contractors	○	○	○	○	○	○
Suppliers	○	○	○	○	○	○
Building officials	○	○	○	○	○	○

Other (please specify)

4. Property market and construction industry related factors influencing building development costs

	Very weak	Weak	Medium	Strong	Very strong	Not sure
Material market	○	○	○	○	○	○
Labor market	○	○	○	○	○	○
Level of competition	○	○	○	○	○	○
Market structure and size	○	○	○	○	○	○
Boom-bust cycle	○	○	○	○	○	○
Property supply and demand relationship	○	○	○	○	○	○
Investment tendency	○	○	○	○	○	○
Houses sell/rental prices	○	○	○	○	○	○

Other (please specify)

5. Statutory and regulations related factors influencing building development costs

	Very weak	Weak	Medium	Strong	Very strong	Not sure
Building code and compliance	○	○	○	○	○	○
Health and safety regulations	○	○	○	○	○	○
Political policies	○	○	○	○	○	○
Financial regulations	○	○	○	○	○	○
Construction contracts Act	○	○	○	○	○	○

Other (please specify)

6. National and global factors influencing building development costs

	Very weak	Weak	Medium	Strong	Very strong	Not sure
Global political dynamics	○	○	○	○	○	○
Natural forces (earthquakes, tornadoes, bush fires, flooding)	○	○	○	○	○	○
Global economic trend	○	○	○	○	○	○
Global business sentiments	○	○	○	○	○	○

Other (please specify)

7. SOCIO-ECONOMIC FACTORS INFLUENCING BUILDING DEVELOPMENT COSTS: Please rate the relative levels of influence of the following socio-economic indicators on building development costs

	Very weak	weak	Medium	Strong	Very strong	Not sure
Gross Domestic Product (GDP)	○	○	○	○	○	○
Capital Goods Price Index (CGPI)	○	○	○	○	○	○
Consumer Price Index (CPI)	○	○	○	○	○	○
Producer Price Index (PPI)	○	○	○	○	○	○
Productivity Index (PI)	○	○	○	○	○	○
Labor Cost Index (LCI)	○	○	○	○	○	○
Net Migration or Population Growth	○	○	○	○	○	○
Employment Rate	○	○	○	○	○	○
House Prices	○	○	○	○	○	○
Building Consents Issued	○	○	○	○	○	○
Energy Prices	○	○	○	○	○	○
Exchange rate of local currency against major currencies	○	○	○	○	○	○
Monetary policies including Official Cash Rate (OCR), Mortgage and business lending rates	○	○	○	○	○	○
Investor/ business confidence	○	○	○	○	○	○
Government fiscal policies including taxation and capital spending,	○	○	○	○	○	○

Other (please specify)

8. RELATIVE LEVELS OF INFLUENCE OF THE MAJOR FACTOR CATEGORIES ON THE BUILDING DEVELOPMENT COSTS: Please rate the relative level of each major factor category using the scale provided.

	Very weak	Weak	Medium	Strong	Very strong	Not sure
Project cost component factors	○	○	○	○	○	○
Project characteristic-related factors	○	○	○	○	○	○
Project stakeholder influences	○	○	○	○	○	○
Property market and industry related factors	○	○	○	○	○	○
Statutory and regulations	○	○	○	○	○	○
National and global dynamics	○	○	○	○	○	○
Socio-economic factors (at micro- and macro-levels)	○	○	○	○	○	○

Other (please specify)

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

Demographics

To enable your responses to be grouped along similar demographic profiles, it will be appreciated if you could indicate in the questions below the option that best describes you.

9. Please indicate your current occupation/industry role.

- ◯ Owner/developer
- ◯ Architect
- ◯ Engineer
- ◯ Project manager
- ◯ Main contractor
- ◯ Specialist tradesperson
- ◯ Quantity surveyor
- ◯ Building official
- ◯ Inspector
- ◯ Other (please specify)

10. Which of the following best describes your current status in your organisation?

- ◯ Owner/Executive/C-Level
- ◯ Senior Management
- ◯ Middle Management
- ◯ Intermediate status
- ◯ Junior/trainee status
- ◯ Other (please specify)

11. Which city do you currently work in?

- ◯ Auckland
- ◯ Wellington
- ◯ Christchurch
- ◯ Other (please specify)

12. Which option below best represents your length of experience in the industry?

- ◯ Less than 3 years
- ◯ 3-5 years
- ◯ 6-10 years
- ◯ 11-20 years
- ◯ 21-30 years
- ◯ Above 30 years
- ◯ Other (please specify)

13. To which professional or trade organisation do you primarily belong? PLEASE SELECT ONLY ONE OPTION THAT BEST REPRESENTS YOUR PRACTICE OR INDUSTRY ROLE

- ◯ NZIA (New Zealand Institute of Architects)
- ◯ NZIQS (New Zealand Institute of Quantity Surveyors)
- ◯ NZIOB (New Zealand Institute of Building)
- ◯ ACENZ (Association of Consulting Engineers of New Zealand)
- ◯ CNBRL: Architect (*This option is for architect members of CNBRL that are not New Zealand-based*);
- ◯ CNBRL: Quantity Surveyor (*This option is for quantity surveyor members of CNBRL that are not New Zealand-based*);
- ◯ CNBRL: Construction Project Manager (*This option is for construction project manager members of CNBRL that are not New Zealand-based*);
- ◯ CNBRL: Other (*This option is for other professional members of CNBRL that are not New Zealand-based; if so, please specify the professional discipline in the textbox below*);
- ◯ Other (please specify) (*This option is for all other members of trade or professional organisations not listed above or for 'CNBRL Other' groups)*

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

APPRECIATION

Thank you very much for your time and valuable input; much appreciated.

14. SUMMARY OF KEY FINDINGS

Should you wish to receive a summary of the key findings of this survey, please provide your email address in the field below. (As stated earlier, your responses will not be linked to your email address).

15. ADDITIONAL FEEDBACK

Should you wish to provide the researcher with additional feedback or comments, you may do so in the field below.

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

DISCLAIMER

This project has been evaluated by peer review and judged to be low risk. Consequently it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director (Research Ethics), email humanethics@massey.ac.nz.

Should you wish to direct any questions or feedback to the researcher, please do not hesitate to do so via the contact listed below.

Miss Lin Lin Zhao (L.L.Zhao@massey.ac.nz) (Researcher)
Dr Jasper Mbachu (j.i.mbachu@massey.ac.nz) (Primary Supervisor)
Dr Niluka Domingo (N.D.Domingo@massey.ac.nz) (Co-supervisor)

Appendix G5 (Questionnaire Reminder Letter)

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Dear Participant (example)

Research survey:

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

I sent you an email in which I attached a copy of questionnaire on key cost drivers. However, I have not got your feedback or response.

Your response is very valuable for my research; I would really appreciate it if you could arrange some time (about 20-30 minutes) to complete the questionnaire survey (attached document) and send it back to me by email attachment. Otherwise, you can directly click the web-link to complete the questionnaire. Your comments on the relevance or clarity of the questions will also be appreciated.

Thank you for your participation and assistance, I look forward to your feedback.

Best regards,

Lin Lin Zhao

School of Engineering and Advanced Technology

Massey University

Auckland, New Zealand

APPENDIX H: INTERVIEW PACKAGE

Appendix H1 (Cover Letter 1)

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Dear Officer,

It is such a pleasure to have an opportunity to contact your team. I am a PhD student from Massey University. I am doing a research on building costs in New Zealand, a topic relevant to all the sectors in construction and property asset management.

I want to know your people's opinions – they are likely to contribute to the construction research in New Zealand – and answers to just a few questions about the influencing factors of building costs in New Zealand.

Would you mind helping me to do the research just by answering several questions? If you think it is OK for you to participate on behalf of your organization, the following email will be sent to you first and then you can send it to the relevant people in your organization, especially at the management level. If you think it is not appropriate for you, you can just tell me. No bother.

Kind regards

Appendix H2 (Cover Letter 2)

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Dear Sir/Madam,

I really appreciate your kindness to help by providing your opinion by answering the survey on Survey Monkey. The survey title is "Key factors influencing building development costs: A New Zealand exploratory study."

At this stage, the research model has been structured and verified by the data you provided. The following stage would be validating the research model by consulting the experts in the construction industry. According to the provided data, the influencing factors for building development costs can be grouped into seven categories, namely project component costs, project characteristics factor, project stakeholders' influences, the property market and construction industry factor, statutory and regulatory factor, national and global dynamics, and the socio-economic factor.

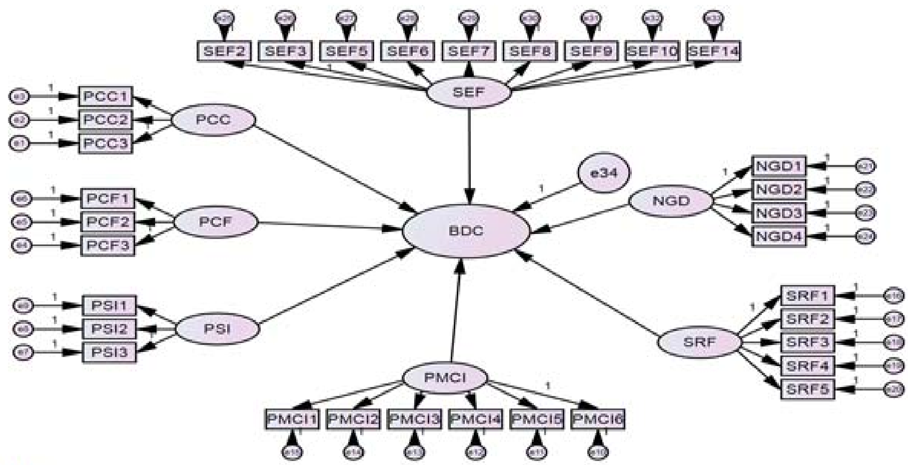
These are the findings based on the data you previously provided. I really appreciate your help to contribute to construction management research in New Zealand. The research will be all the better because you have provided your opinions. Hope everything is going well for you.

The attached questions are used to validate the research model; I hope you can still find time to provide your opinions.

Kind regards

Appendix H3 (Previous Information Related to Research)

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand



Note:

BDC: building development cost

PPC: project component costs, PCC1: design cost, PCC2: construction cost, PCC3: procurement cost

PCF: project characteristics factor, PCF1: project location, PCF2: project complexity, PCF3: procedure methods

PSI: project stakeholders influences, PSI1: clients, PSI2: consultants, PSI3: contractors

PMCI: property market and construction industry factor, PMCI1: material market, PMCI2: labour market, PMCI3: level of competition, PMCI4: market structure and size, PMCI5: boom and bust cycle, PMCI6: relationship of supply and demand

SRF: statutory and regulatory factor, SRF1: building code and compliance, SRF2: health and safety regulations, SRF3: political policies, SRF4: financial regulations, SRF5: construction contract Act

NGD: national and global dynamics, NGD1: global political dynamics, NGD2: natural forces, NGD3: global economic trend, NGD4: global business sentiments

SEF: Socio-economic factor, SEF2: capital goods prices, SEF3: producers prices, SEF5: productivity in construction industry, SEF6: labour cost, SEF7: net migration, SEF8: employment rate, SEF9: housing prices, SEF10: building consents, SEF14: investors' confidences

Appendix H4 (Interview Questions)

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Question/Statement	Score
1. The structure of the model is easy to comprehend.	
2. The seven dimensions of the model accurately and substantially describe the influencing factors for building development costs in New Zealand	
3. The model adequately represents the relationships between the influencing factors and building development costs in New Zealand	
4. All in all, great potential exists for application of the model in real industry practices	
5. All of the influencing factors are relevant and the proposed relationships are set appropriately	
6. Project component costs significantly affect building development costs in New Zealand	
7. The project characteristics factor significantly affects building development costs in New Zealand	
8. The project stakeholders' influences factor significantly influences building development costs in New Zealand	
9. The property market and construction industry factor significantly influences building development costs in New Zealand	
10. The statutory and regulatory factor significantly affects building development costs in New Zealand	
11. National and global dynamics significantly affect building development costs in New Zealand	
12. The socio-economic factor significantly affects building development costs in New Zealand	
13. With respect to the research model, what would you especially recommend?	
14. Do you have any further comments?	

Note: Five point Likert-scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Appendix H5 (Interview Reminder Letter)

MASSEY UNIVERSITY
School of Engineering & Advanced Technology
Private Bag 102 904, North Shore City 0745, Auckland, New Zealand

Dear Participant (example)

Research survey:

Building development cost drivers in the New Zealand construction industry: A multilevel analysis of the causal relationships

I sent you an email in which I attached a copy of the interview questions (see attached documents) on analysis the relationship between the key influencing factors and building development costs in New Zealand. However, I have not received your feedback or response.

Your response is very valuable for my research; I would appreciate it if you could find some time (about 20-30 minutes) to participate the interview on your preferred date and time.

Otherwise, if you are unable to participate in the interview, it would be much appreciated if you could spend no longer than 15 minutes to share your opinions on the issues according to your professional expertise and experience, by completing the interview questions (see attached documents) and send it back to me via email.

Thank you for your assistance and participation; I look forward to your response at your earliest convenience.

Best regards,

Lin Lin Zhao

School of Engineering and Advanced Technology

Massey University

Auckland, New Zealand

APPENDIX I: PRIMARY STATISTICAL ANALYSIS

Appendix I1 (Descriptive Statistics)

Descriptive Statistics

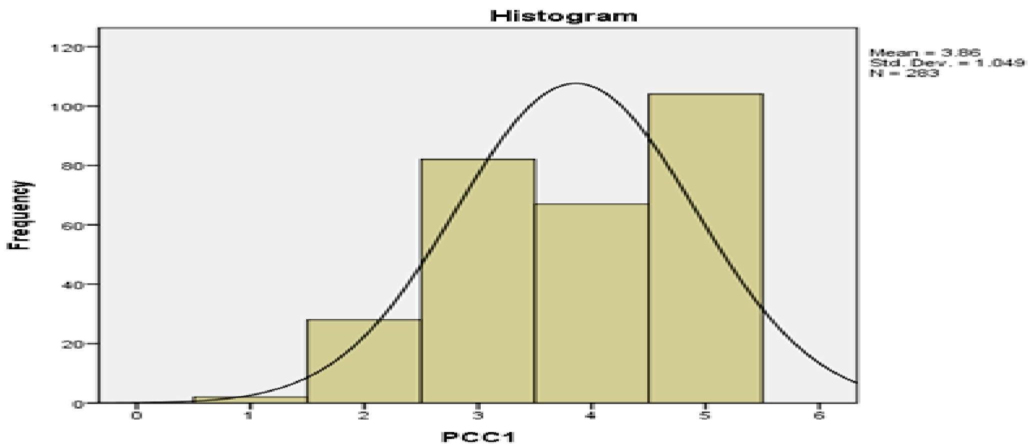
	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PCC1	283	1	5	3.86	1.049	1.101	-.382	.145	-.972	.289
PCC2	283	1	5	3.89	1.025	1.051	-.408	.145	-.889	.289
PCC3	283	1	5	3.79	1.066	1.137	-.406	.145	-.741	.289
PCF1	283	1	5	4.23	.854	.729	-1.141	.145	1.550	.289
PCF2	283	1	5	4.27	.825	.681	-1.001	.145	.791	.289
PCF3	283	1	5	4.23	.859	.738	-1.171	.145	1.594	.289
PCF4	283	1	5	3.72	.979	.959	-.382	.145	-.165	.289
PCF5	283	1	5	3.66	.903	.815	-.317	.145	.283	.289
PSI1	283	1	5	4.10	.892	.796	-.883	.145	.844	.289
PSI2	283	1	5	4.09	.898	.807	-.743	.145	.292	.289
PSI3	283	1	5	4.07	.908	.825	-.827	.145	.610	.289
PSI4	283	1	5	3.37	.953	.909	-.342	.145	-.108	.289
PSI5	283	1	5	3.35	.908	.824	-.291	.145	-.293	.289
PMCI1	283	1	5	4.06	.970	.940	-.937	.145	.571	.289
PMCI2	283	1	5	4.01	.949	.901	-.856	.145	.565	.289
PMCI3	283	1	5	4.06	.925	.855	-.817	.145	.369	.289
PMCI4	283	1	5	4.02	.938	.879	-.796	.145	.282	.289
PMCI5	283	1	5	4.08	.935	.873	-.943	.145	.701	.289
PMCI6	283	1	5	4.00	.962	.926	-.859	.145	.494	.289
PMCI7	283	1	5	3.47	1.099	1.207	-.254	.145	-.509	.289
PMCI8	283	1	5	3.41	1.083	1.172	-.146	.145	-.400	.289
SRF1	283	1	5	3.65	.969	.939	-.184	.145	-.734	.289
SRF2	283	1	5	3.65	.968	.936	-.181	.145	-.734	.289
SRF3	283	1	5	3.55	.986	.972	-.144	.145	-.718	.289
SRF4	283	1	5	3.58	1.006	1.011	-.210	.145	-.686	.289
SRF5	283	1	5	3.64	.962	.926	-.209	.145	-.693	.289
NGD1	283	1	5	3.17	1.031	1.063	-.130	.145	-.472	.289
NGD2	283	1	5	3.11	1.034	1.070	-.105	.145	-.494	.289
NGD3	283	1	5	3.10	1.034	1.068	-.180	.145	-.491	.289
NGD4	283	1	5	3.15	1.017	1.035	-.179	.145	-.343	.289
SEF1	283	1	5	3.86	.865	.748	-.708	.145	.511	.289
SEF2	283	1	5	3.78	.907	.822	-.653	.145	.388	.289
SEF3	283	1	5	3.80	.866	.750	-.522	.145	-.105	.289
SEF4	283	1	5	3.76	.836	.699	-.594	.145	.301	.289
SEF5	283	1	5	3.77	.914	.835	-.575	.145	-.011	.289
SEF6	283	1	5	3.73	.933	.871	-.521	.145	.038	.289
SEF7	283	1	5	3.77	.863	.745	-.405	.145	-.089	.289
SEF8	283	1	5	3.83	.825	.680	-.477	.145	.034	.289
SEF9	283	1	5	3.74	.881	.775	-.656	.145	.389	.289
SEF10	283	1	5	3.77	.860	.740	-.474	.145	.015	.289
SEF11	283	1	5	3.75	.857	.735	-.650	.145	.717	.289
SEF12	283	1	5	3.78	.797	.635	-.384	.145	.050	.289
SEF13	283	1	5	3.82	.820	.673	-.548	.145	.363	.289
SEF14	283	1	5	3.75	.920	.846	-.645	.145	.266	.289
SEF15	283	1	5	3.78	.846	.716	-.635	.145	.823	.289

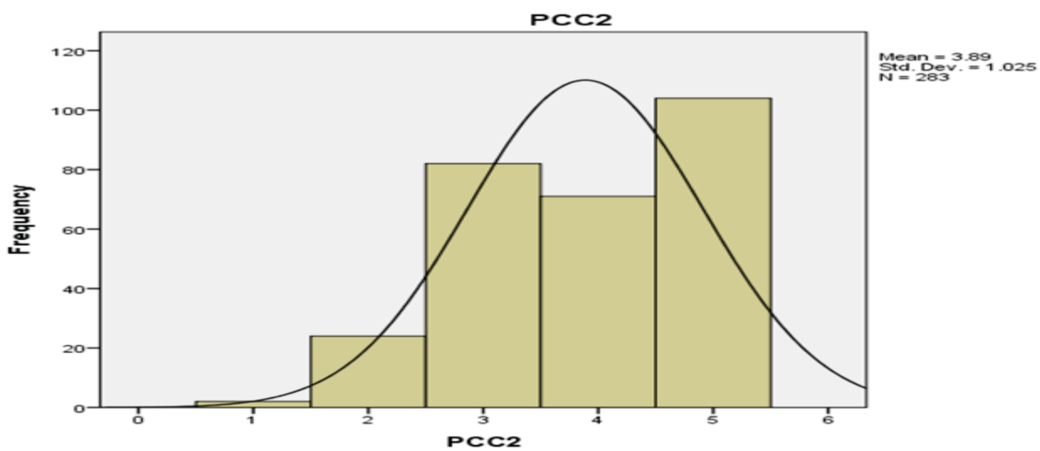
Appendix I2 (Test of Normality)

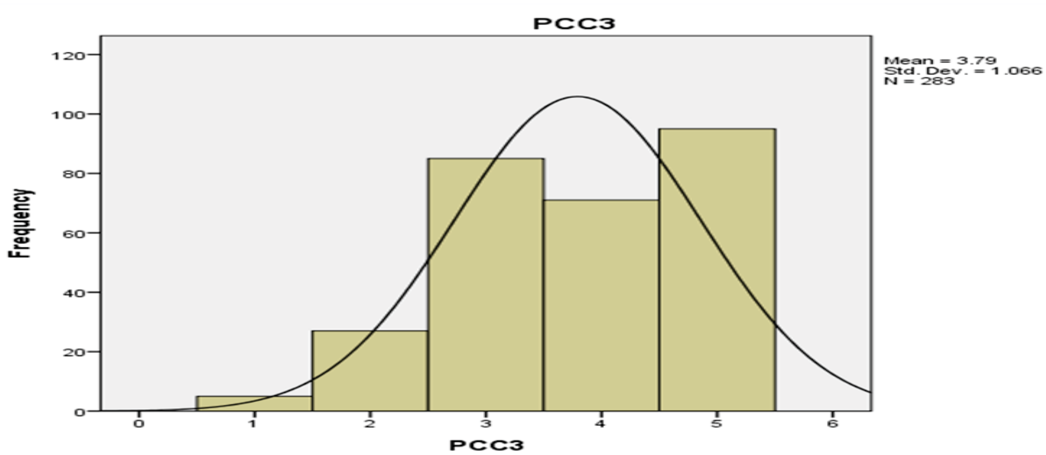
Tests of Normality

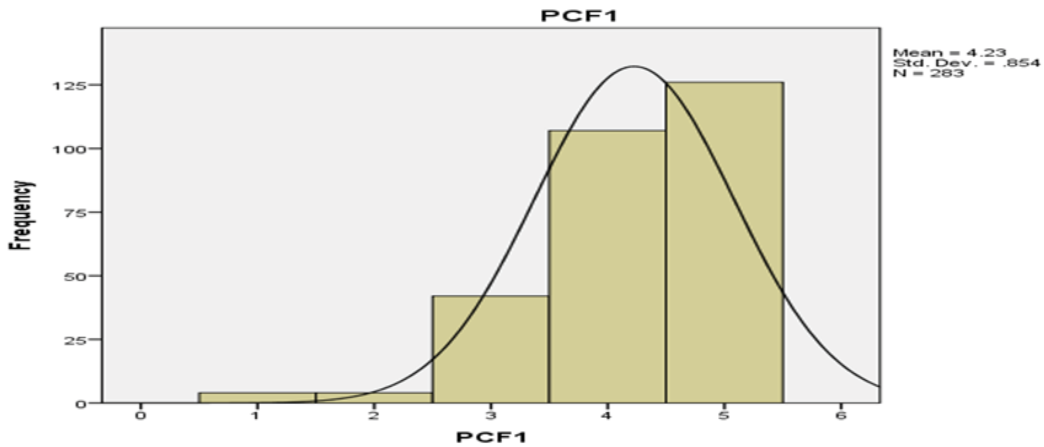
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PCC1	.229	283	.000	.849	283	.000
PCC2	.229	283	.000	.848	283	.000
PCC3	.207	283	.000	.864	283	.000
PCF1	.263	283	.000	.786	283	.000
PCF2	.288	283	.000	.782	283	.000
PCF3	.264	283	.000	.784	283	.000
PCF4	.201	283	.000	.870	283	.000
PCF5	.223	283	.000	.858	283	.000
PSI1	.230	283	.000	.816	283	.000
PSI2	.243	283	.000	.816	283	.000
PSI3	.229	283	.000	.821	283	.000
PSI4	.214	283	.000	.894	283	.000
PSI5	.233	283	.000	.887	283	.000
PMCI1	.231	283	.000	.824	283	.000
PMCI2	.222	283	.000	.834	283	.000
PMCI3	.224	283	.000	.831	283	.000
PMCI4	.226	283	.000	.839	283	.000
PMCI5	.227	283	.000	.822	283	.000
PMCI6	.229	283	.000	.838	283	.000
PMCI7	.199	283	.000	.896	283	.000
PMCI8	.238	283	.000	.884	283	.000
SRF1	.197	283	.000	.886	283	.000
SRF2	.196	283	.000	.886	283	.000
SRF3	.195	283	.000	.894	283	.000
SRF4	.197	283	.000	.894	283	.000
SRF5	.208	283	.000	.888	283	.000
NGD1	.184	283	.000	.911	283	.000
NGD2	.186	283	.000	.912	283	.000
NGD3	.190	283	.000	.910	283	.000
NGD4	.202	283	.000	.908	283	.000
SEF1	.291	283	.000	.848	283	.000
SEF2	.269	283	.000	.863	283	.000
SEF3	.285	283	.000	.857	283	.000
SEF4	.301	283	.000	.850	283	.000
SEF5	.273	283	.000	.866	283	.000
SEF6	.246	283	.000	.876	283	.000
SEF7	.255	283	.000	.870	283	.000
SEF8	.281	283	.000	.855	283	.000
SEF9	.292	283	.000	.857	283	.000
SEF10	.271	283	.000	.866	283	.000
SEF11	.279	283	.000	.854	283	.000
SEF12	.281	283	.000	.855	283	.000
SEF13	.287	283	.000	.852	283	.000
SEF14	.274	283	.000	.865	283	.000
SEF15	.272	283	.000	.851	283	.000

Appendix I3 (Histograms)








PCF1
Mean = 4.23
Std. Dev. = .854
N = 283
Frequency
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125
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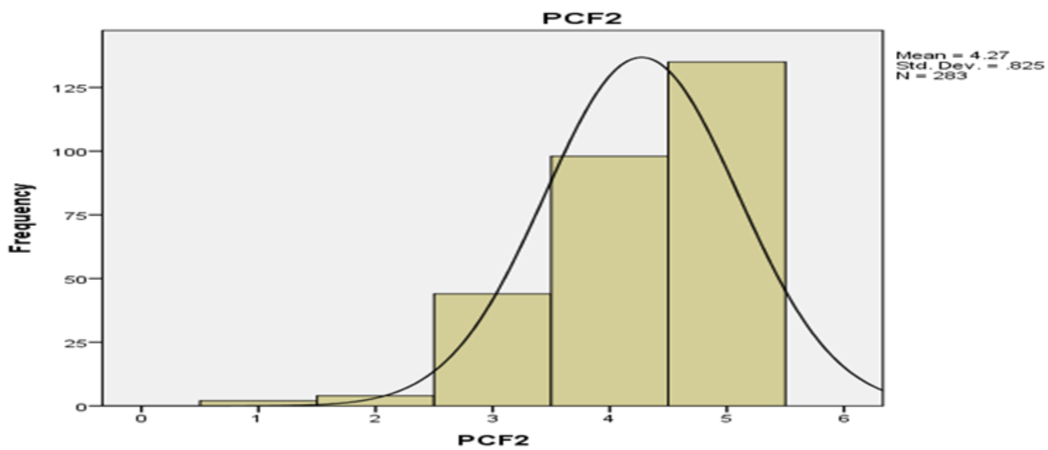
2
3
4
5
6
PCF1


PCF2
Mean = 4.27
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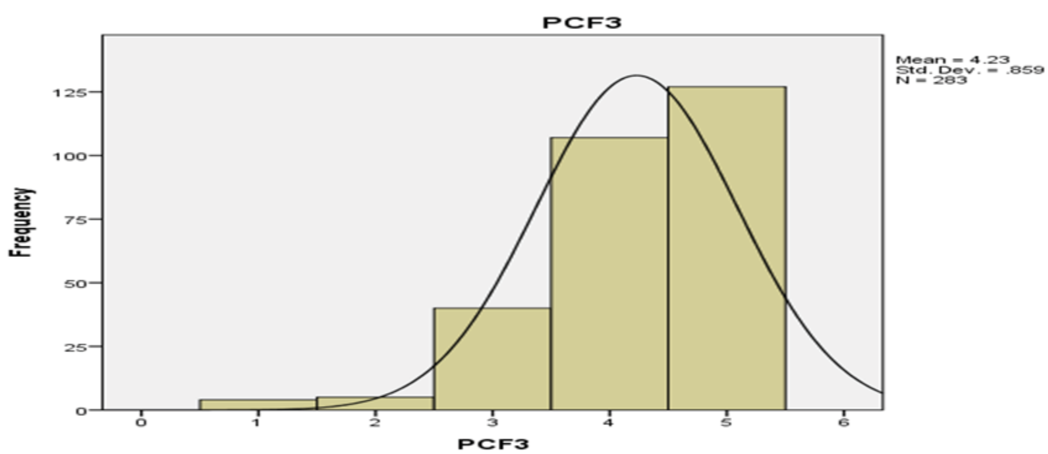
4
5
6
PCF2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Std. Dev. = .859
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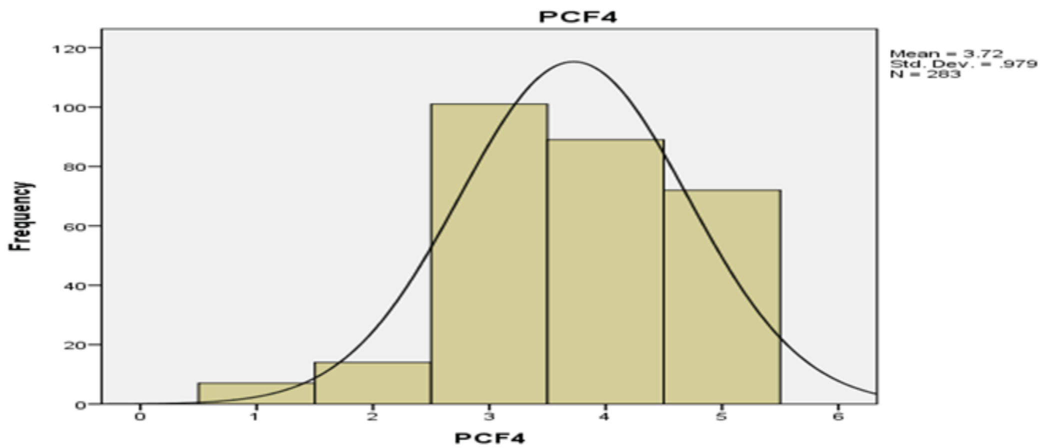
4
5
6
PCF3


PCF4
Mean = 3.72
Std. Dev. = .979
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20
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0
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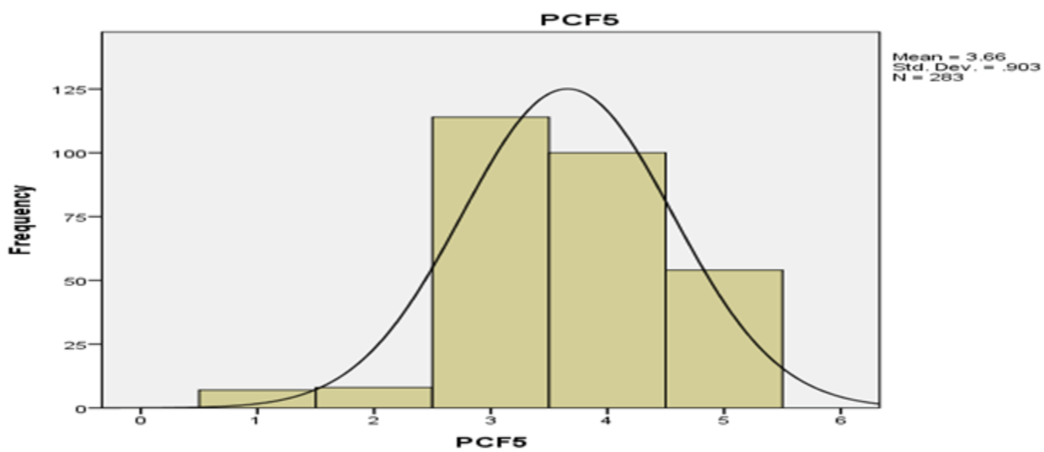
2
3
4
5
6
PCF4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Std. Dev. = .903
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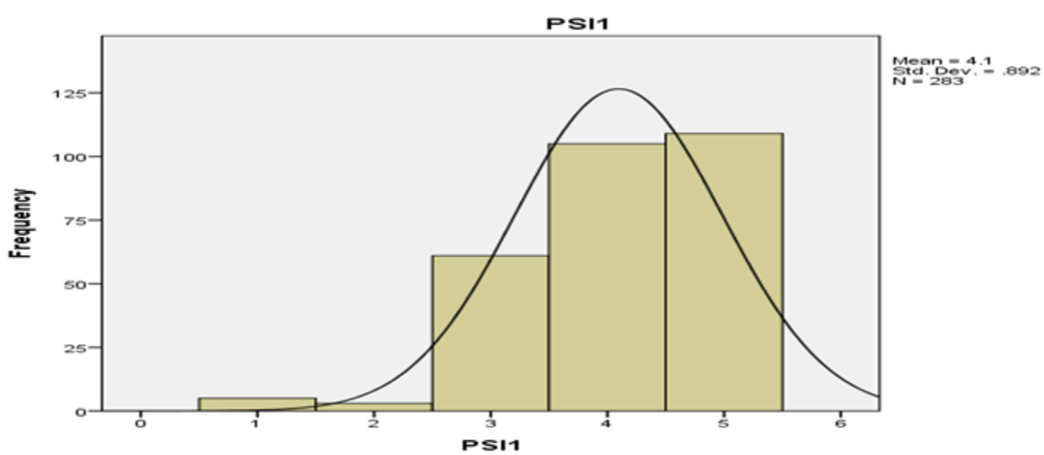
4
5
6
PCF5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Std. Dev. = .892
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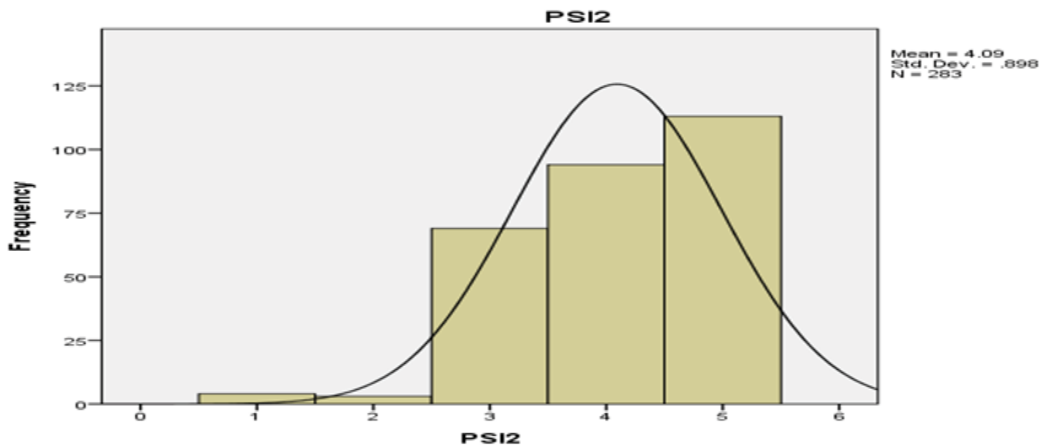
4
5
6
PSI1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4
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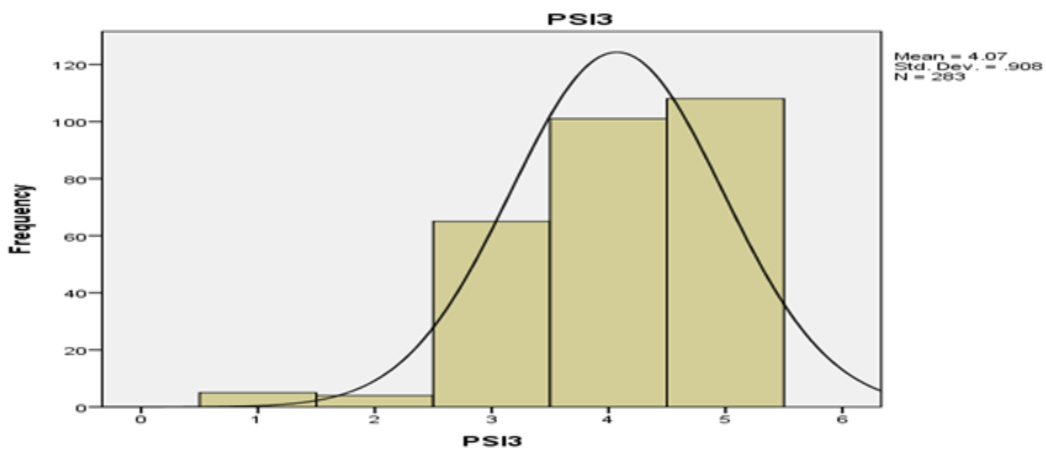
6
PSI2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Std. Dev. = .908
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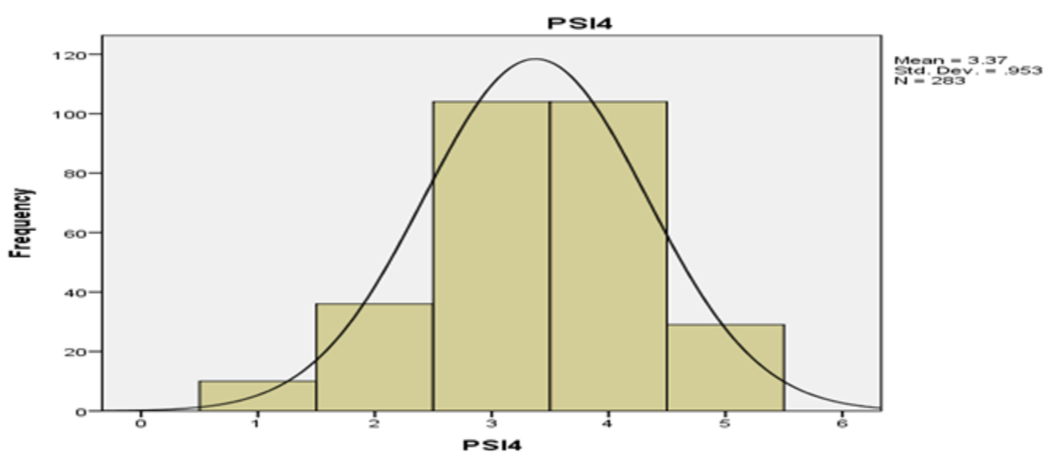
4
5
6
PSI3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Std. Dev. = .953
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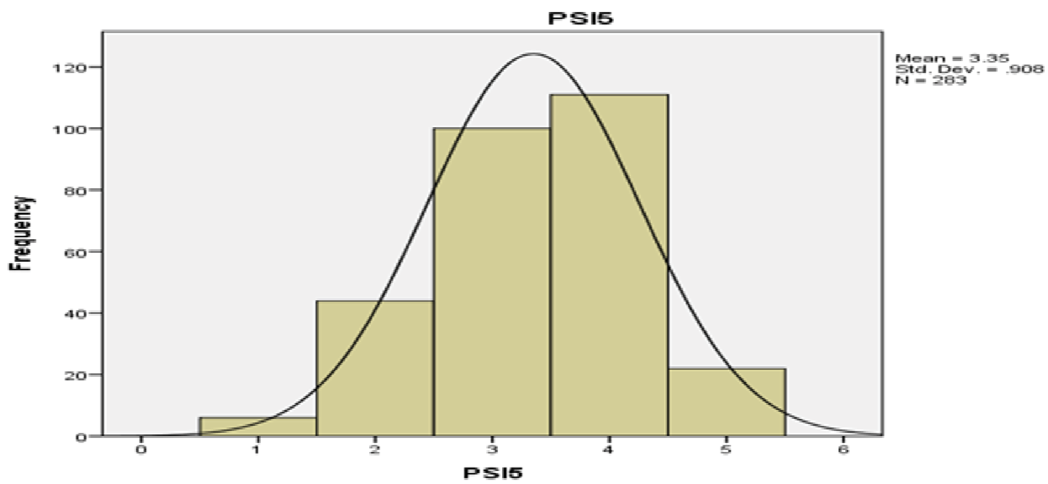
4
5
6
PSI4


PSI5
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Std. Dev. = .908
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Frequency
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40
20
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1
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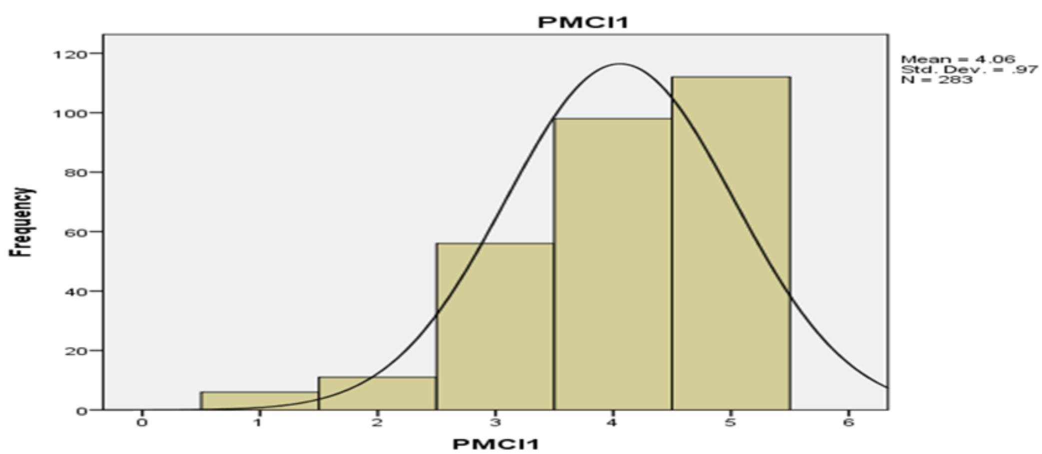
3
4
5
6
PSI5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Std. Dev. = .97
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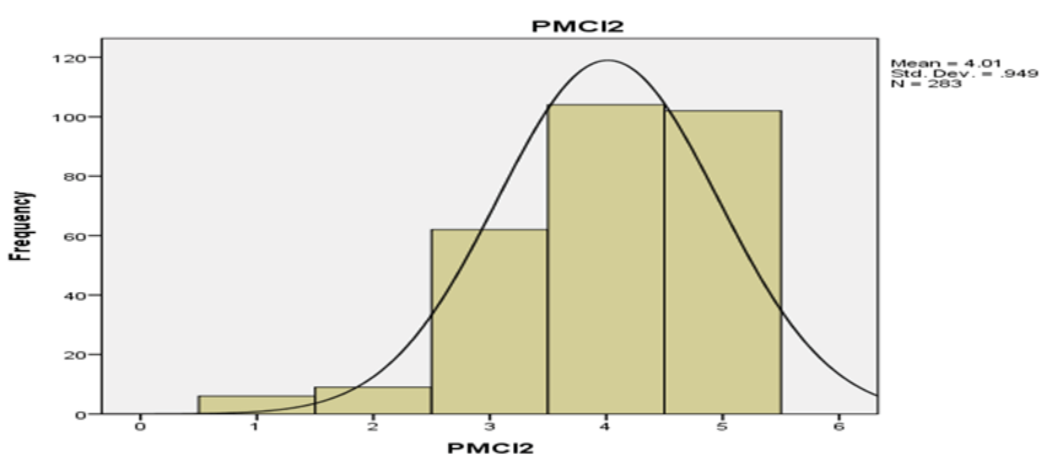
5
6
PMCI1


PMCI2
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Std. Dev. = .949
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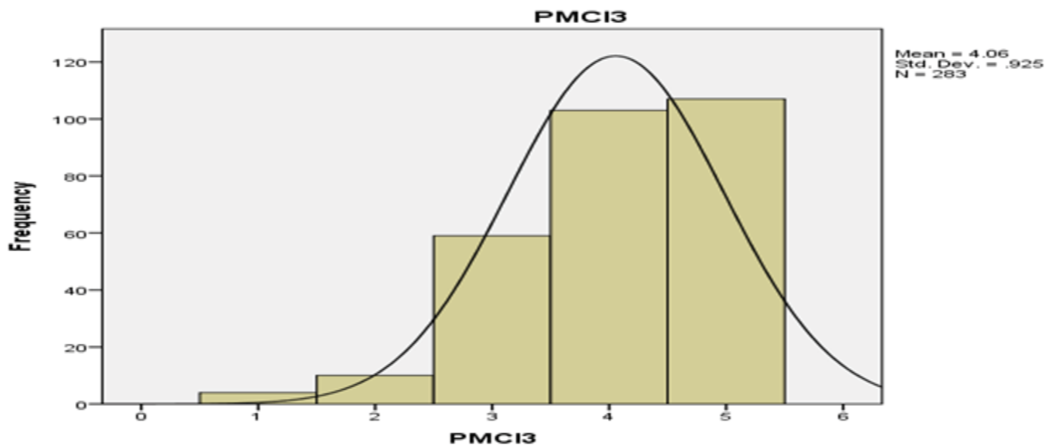
3
4
5
6
PMCI2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Std. Dev. = .925
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100
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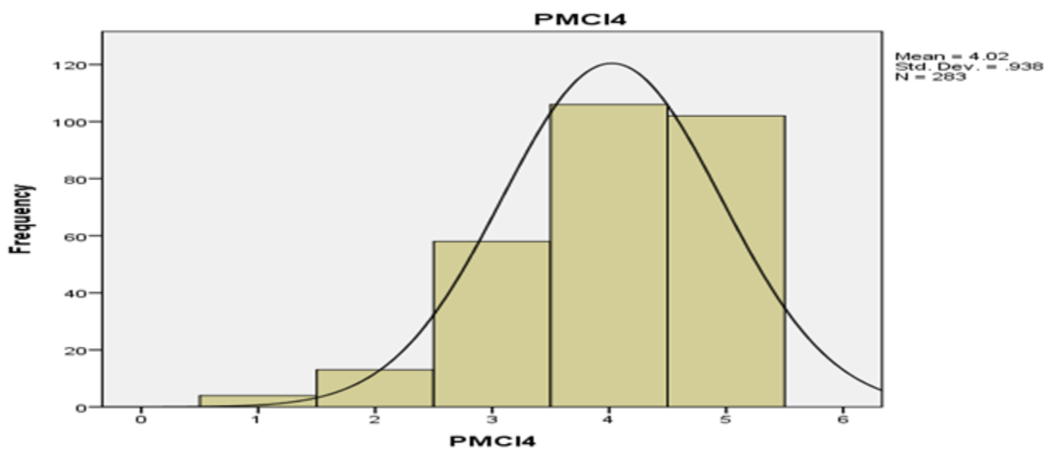
3
4
5
6
PMCI3


PMCI4
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Std. Dev. = .938
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Frequency
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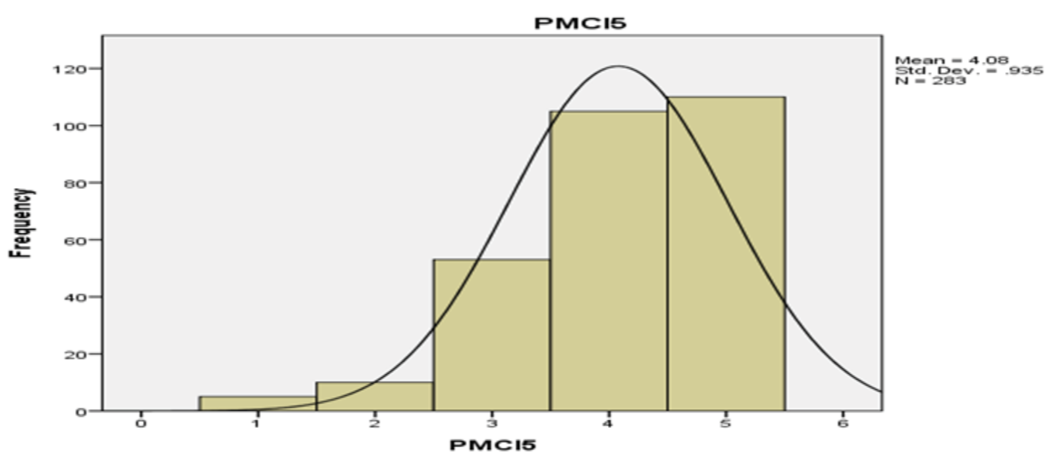
4
5
6
PMCI4


PMCI5
Mean = 4.08
Std. Dev. = .935
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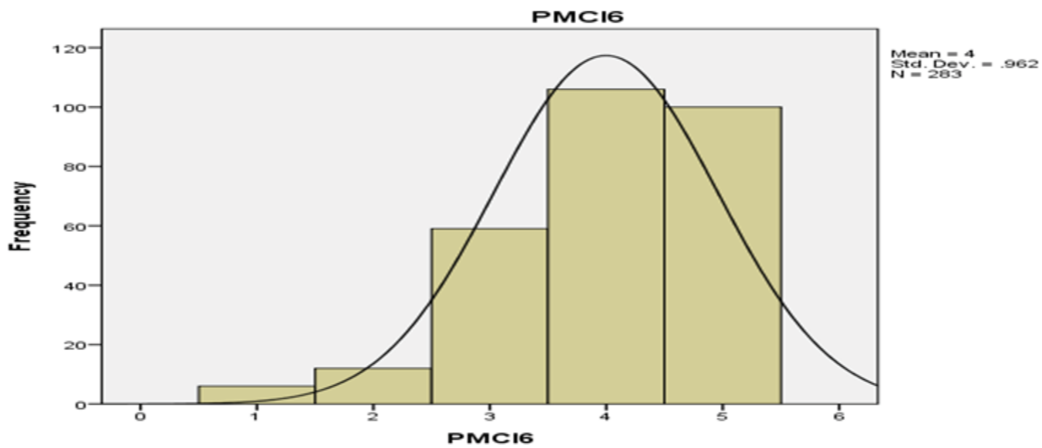
3
4
5
6
PMCI5


PMCI6
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Std. Dev. = .962
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Frequency
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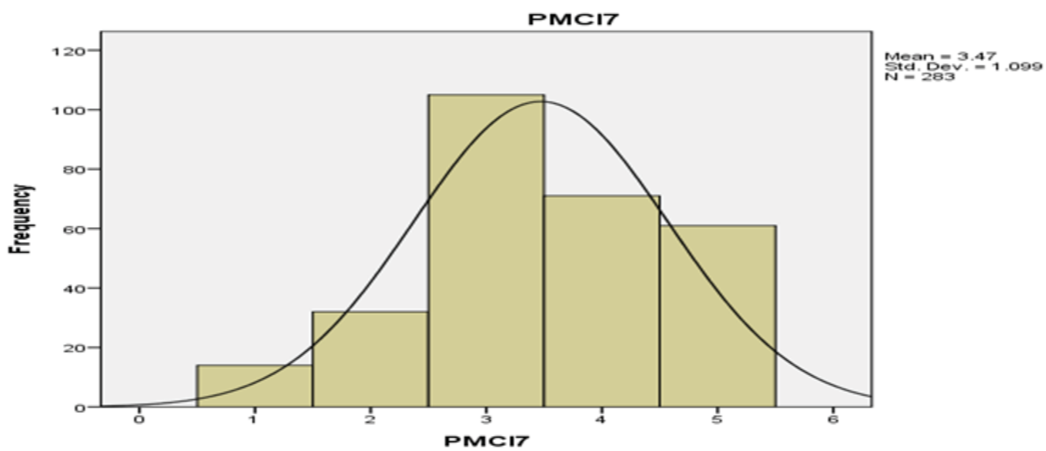
3
4
5
6
PMCI6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Std. Dev. = 1.099
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Frequency
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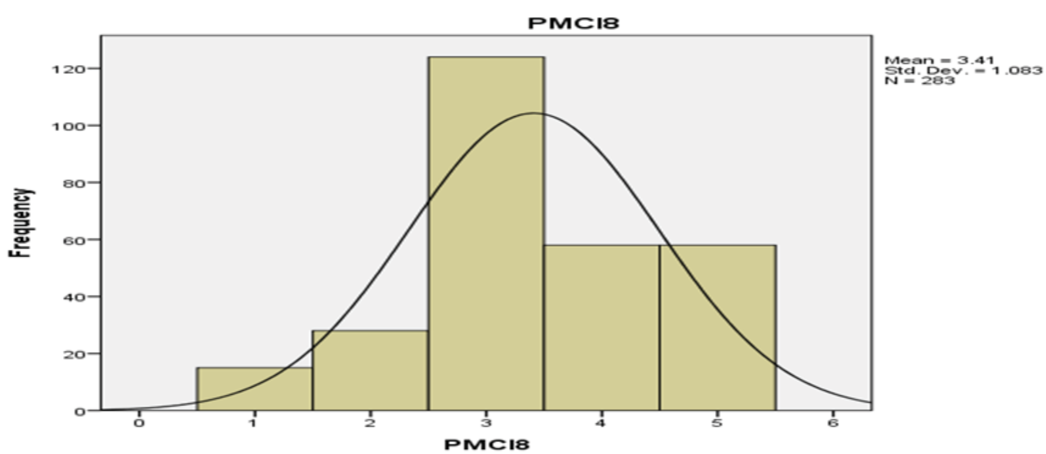
3
4
5
6
PMCI7


PMCI8
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Std. Dev. = 1.083
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100
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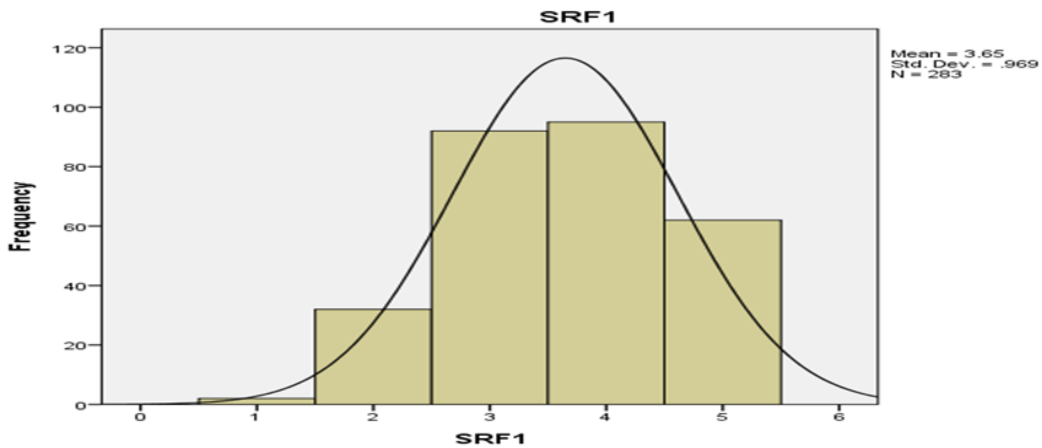
3
4
5
6
PMCI8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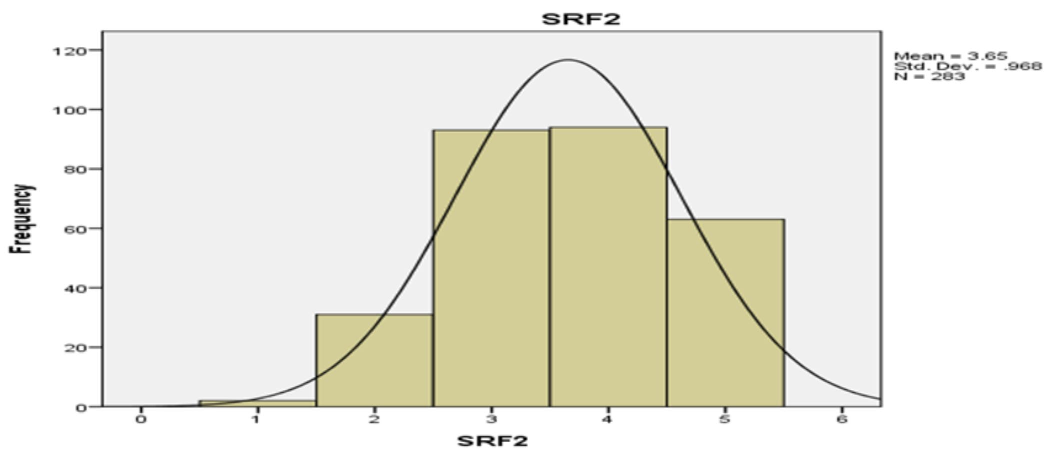
SRF1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Std. Dev. = .968
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Frequency
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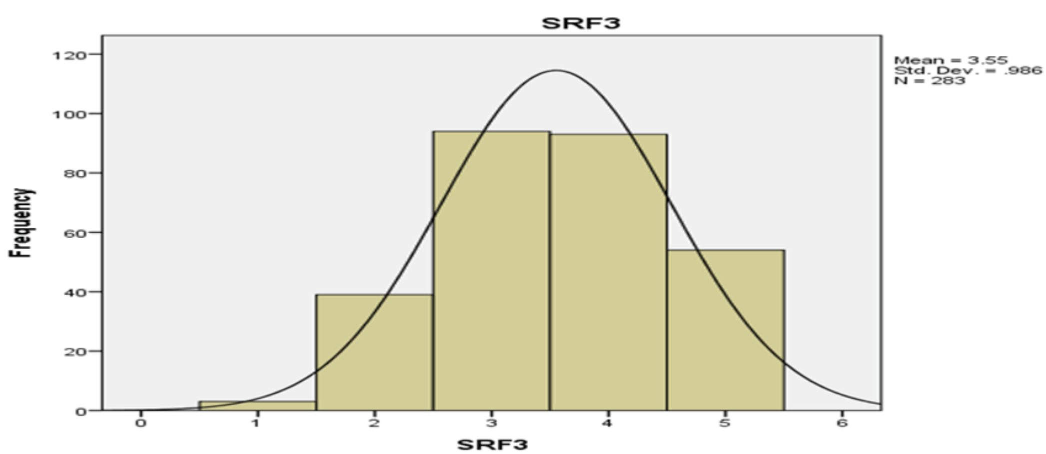
SRF2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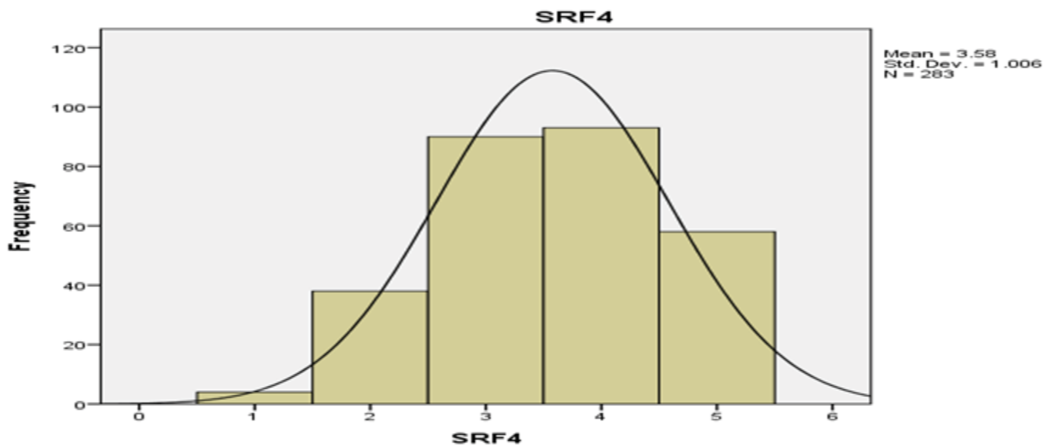
SRF3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Std. Dev. = 1.006
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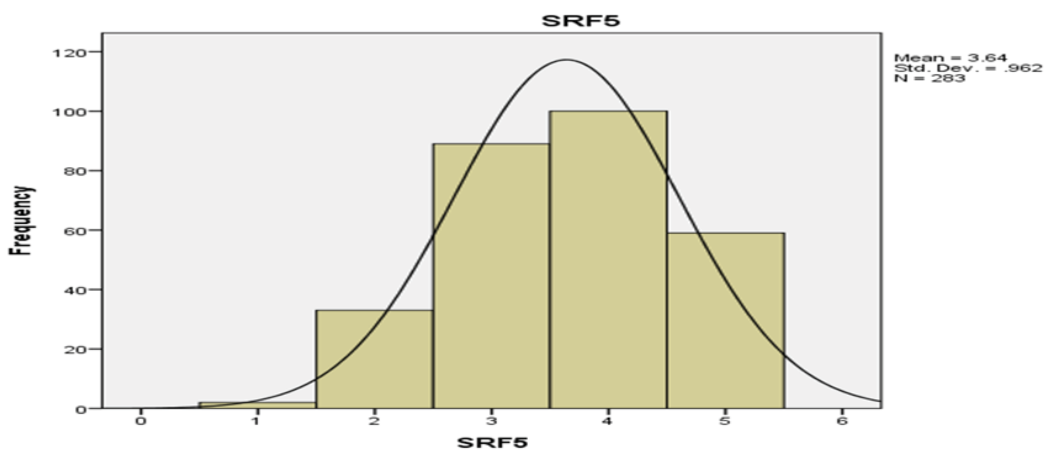
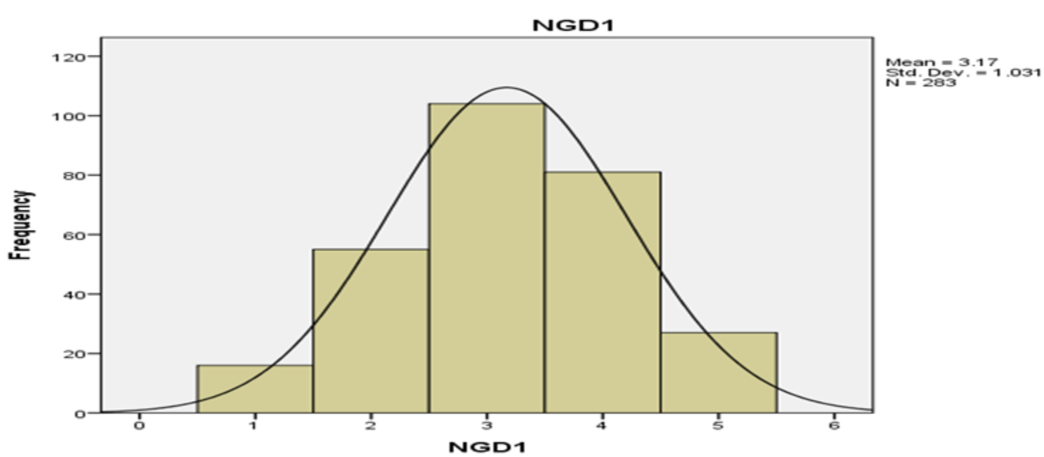
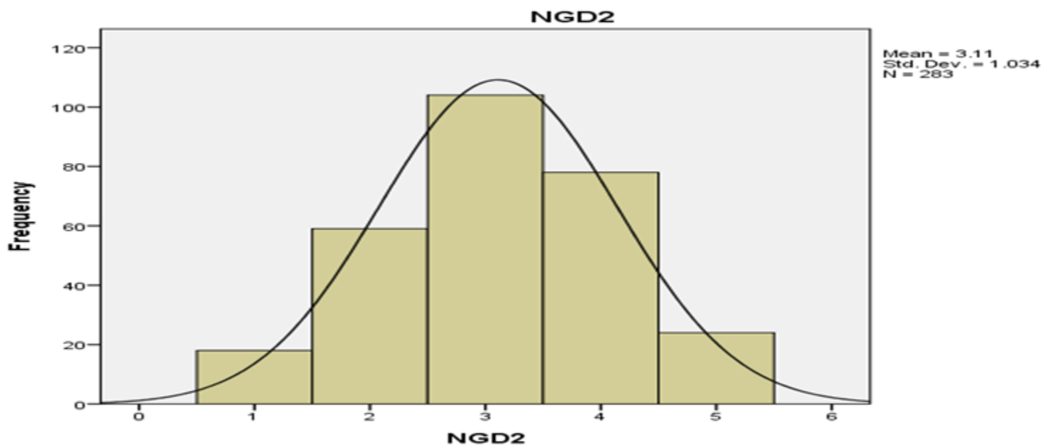
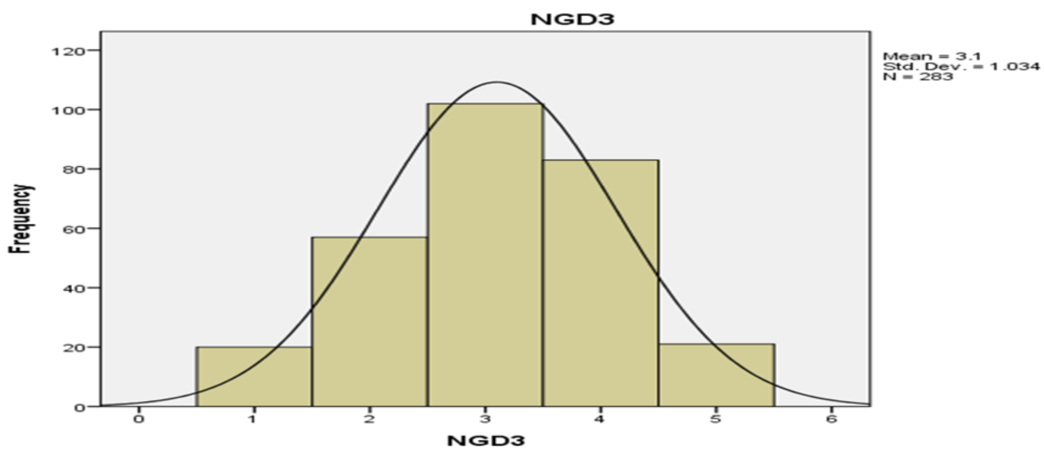
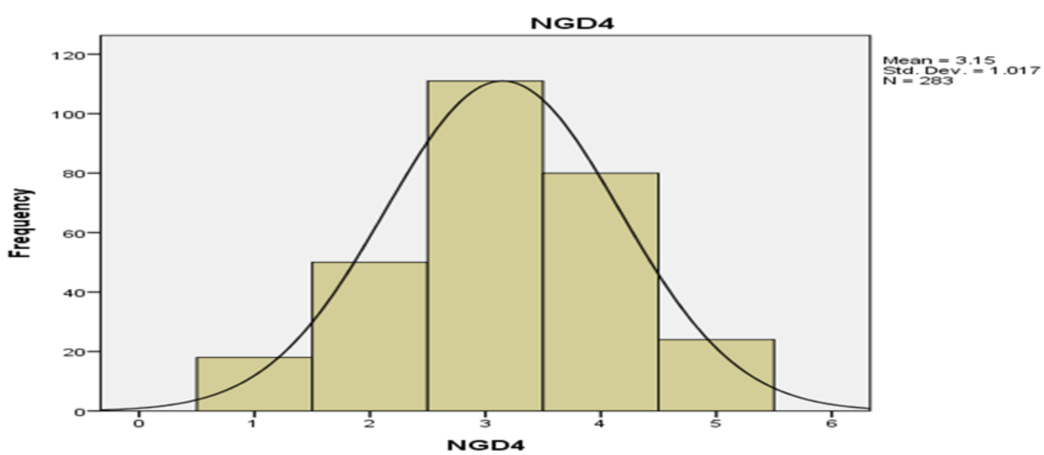
60
80
100
120
0 1 2 3 4 5 6
SRF4

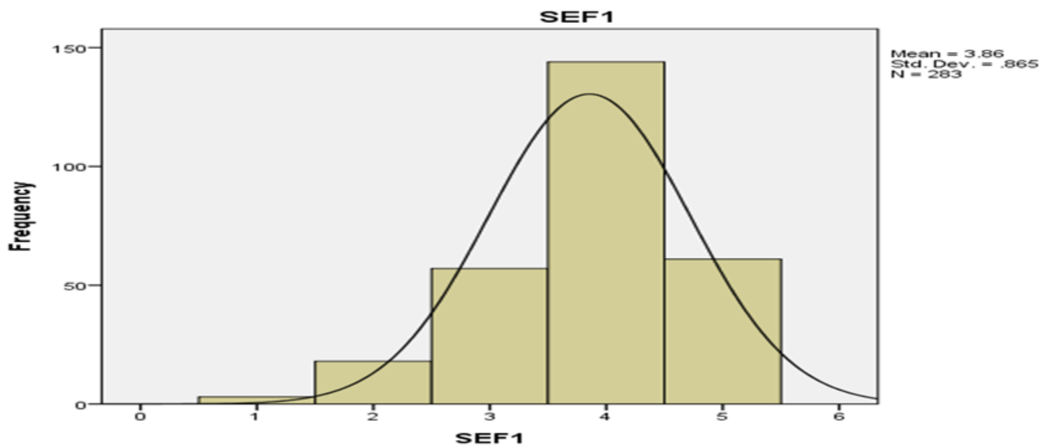

SRF5
Mean = 3.64
Std. Dev. = .962
N = 283
Frequency
0
20
40
60
80
100
120
0 1 2 3 4 5 6
SRF5

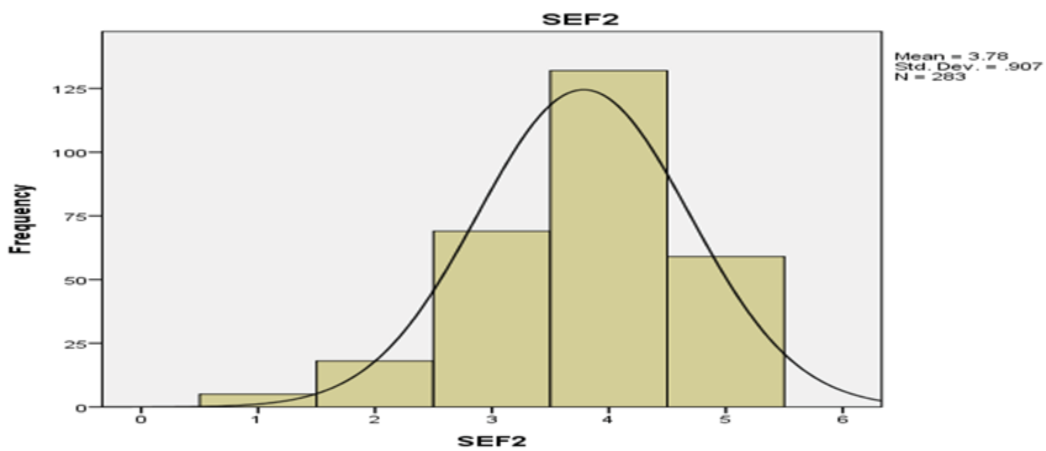

NGD1
Mean = 3.17
Std. Dev. = 1.031
N = 283
Frequency
0
20
40
60
80
100
120
0 1 2 3 4 5 6
NGD1

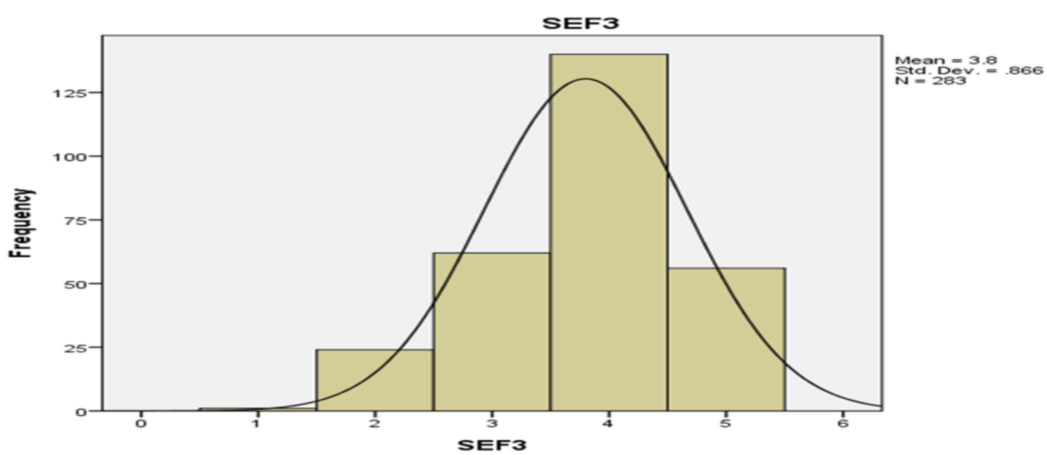

NGD2
Mean = 3.11
Std. Dev. = 1.034
N = 283
Frequency
NGD2

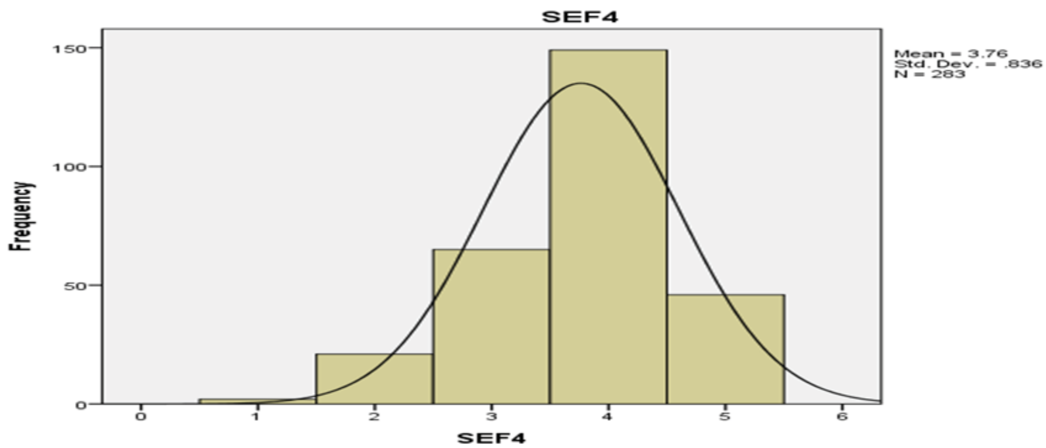

NGD3
Mean = 3.1
Std. Dev. = 1.034
N = 283
Frequency
NGD3

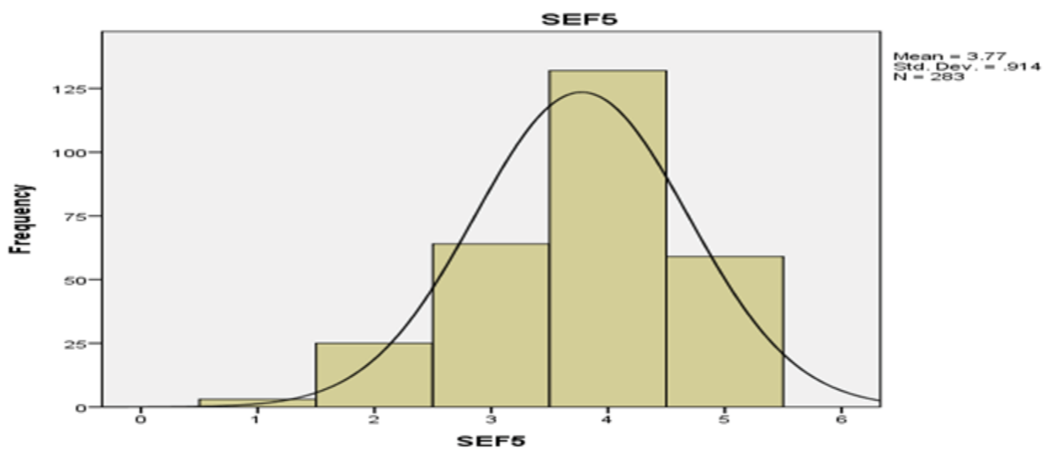

NGD4
Mean = 3.15
Std. Dev. = 1.017
N = 283
Frequency
NGD4

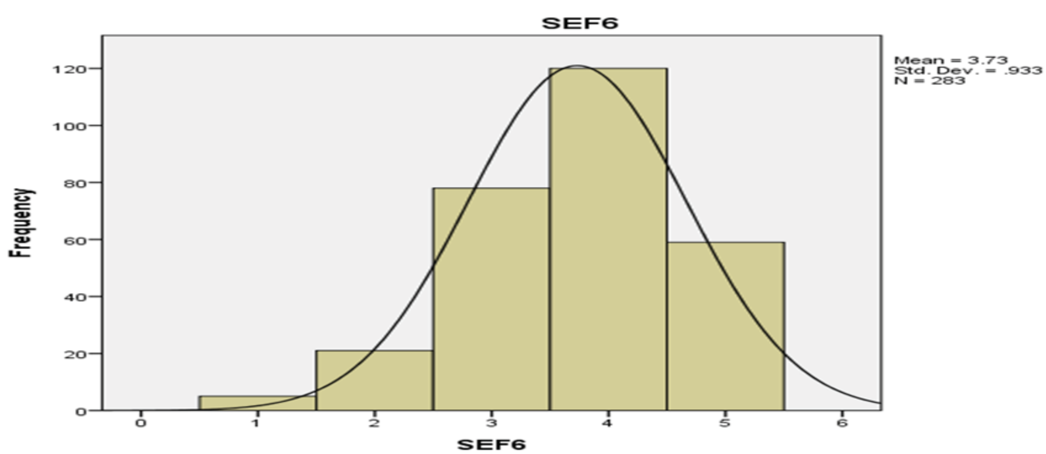

SEF1
Mean = 3.86
Std. Dev. = .865
N = 283
Frequency
150
100
50
0
0 1 2 3 4 5 6
SEF1

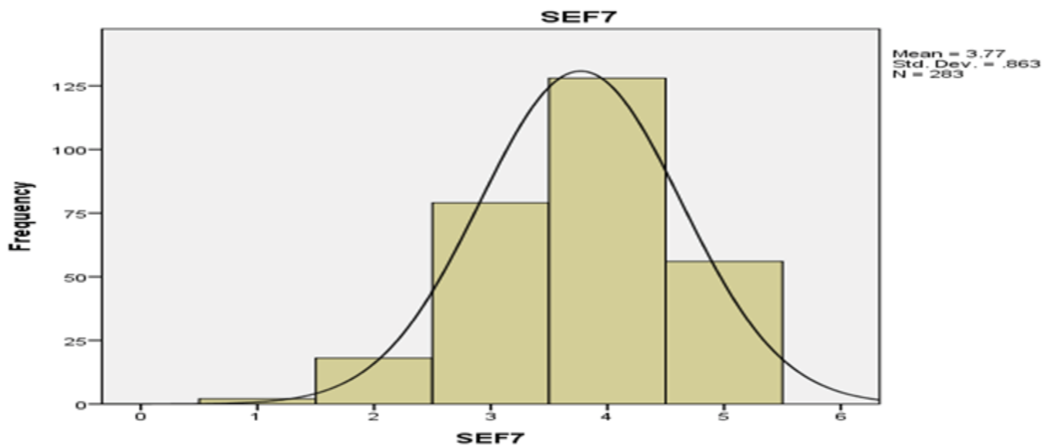

SEF2
Mean = 3.78
Std. Dev. = .907
N = 283
Frequency
125
100
75
50
25
0
0 1 2 3 4 5 6
SEF2

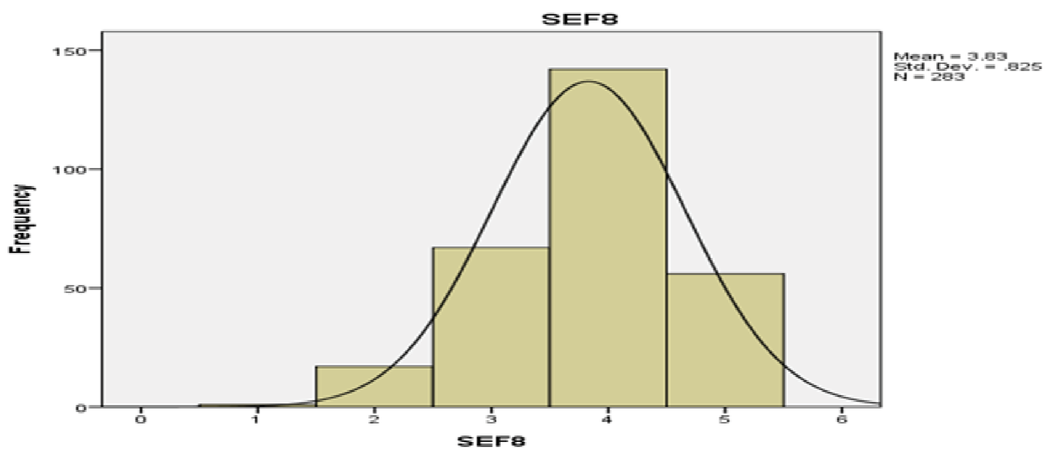

SEF3
Mean = 3.8
Std. Dev. = .866
N = 283
Frequency
125
100
75
50
25
0
0 1 2 3 4 5 6
SEF3

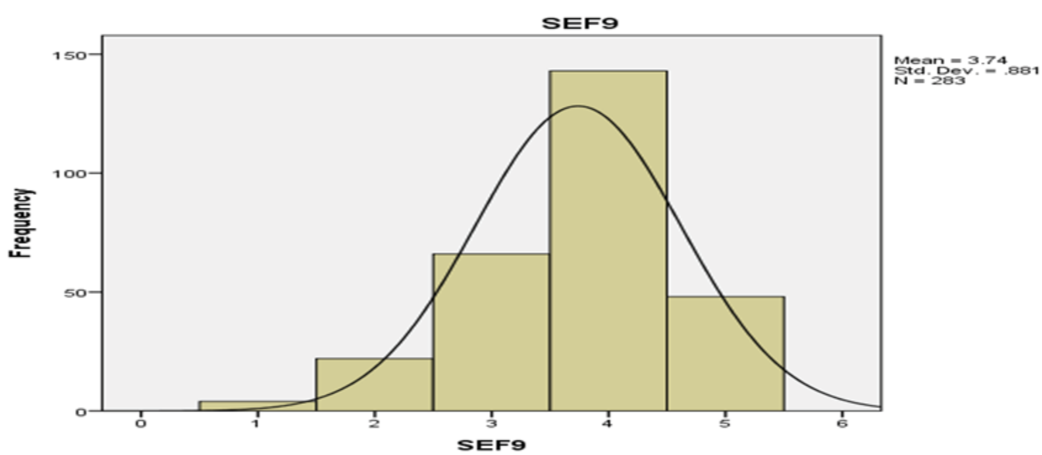

SEF4
Mean = 3.76
Std. Dev. = .836
N = 283
Frequency
SEF4

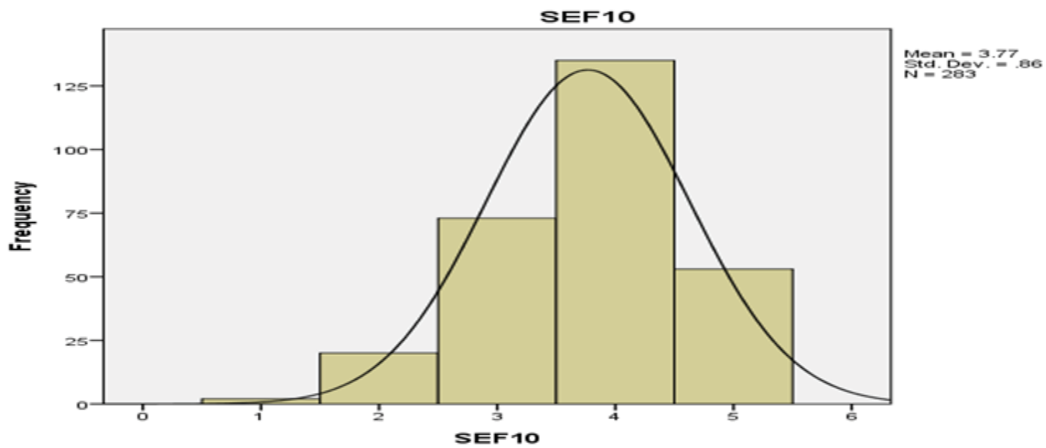

SEF5
Mean = 3.77
Std. Dev. = .914
N = 283
Frequency
SEF5

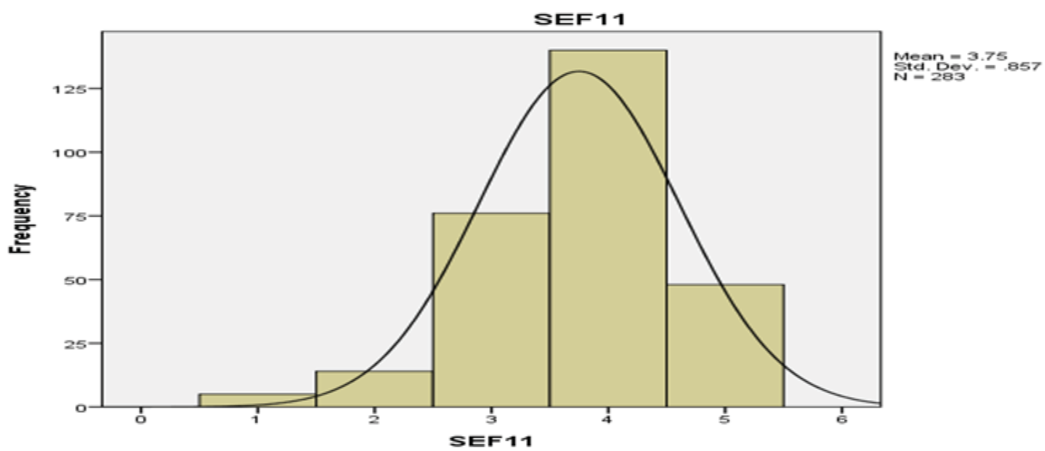

SEF6
Mean = 3.73
Std. Dev. = .933
N = 283
Frequency
SEF6

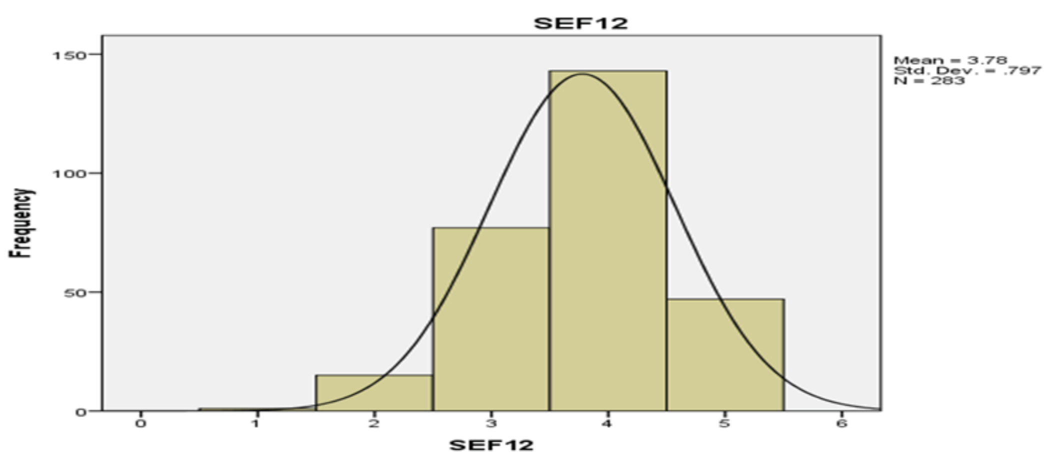

SEF7
Mean = 3.77
Std. Dev. = .863
N = 283
Frequency
SEF7

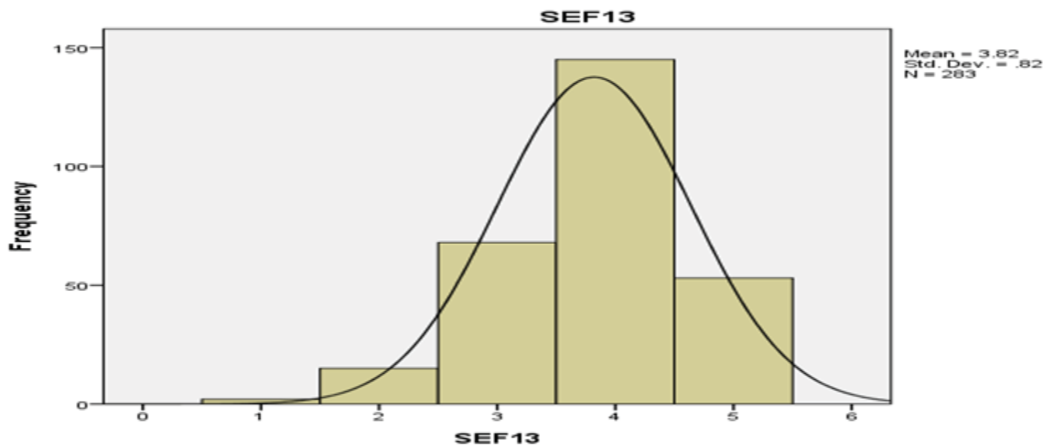

SEF8
Mean = 3.83
Std. Dev. = .825
N = 283
Frequency
SEF8

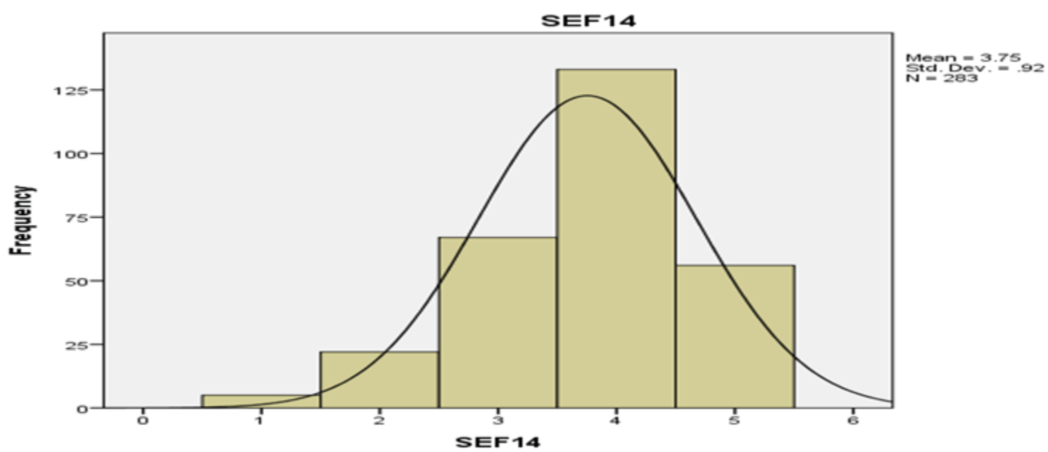

SEF9
Mean = 3.74
Std. Dev. = .881
N = 283
Frequency
SEF9

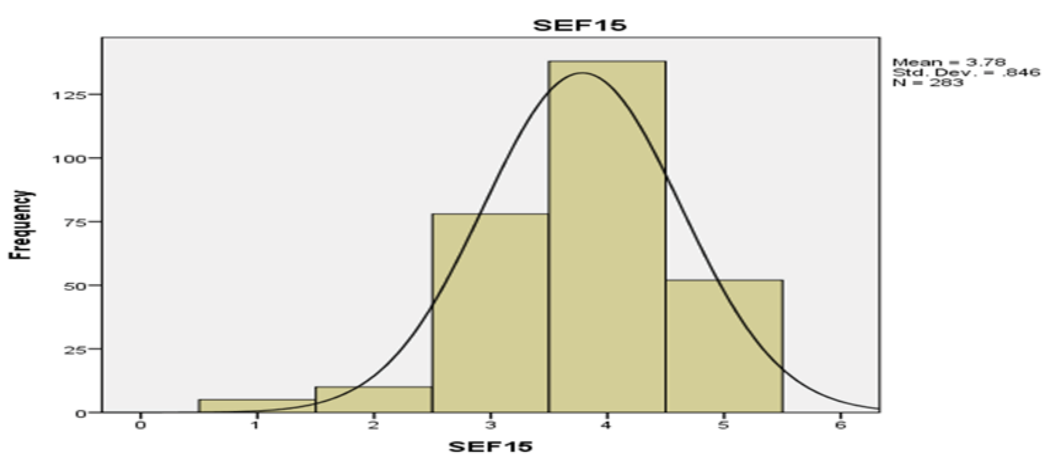

SEF10
Mean = 3.77
Std. Dev. = .86
N = 283
Frequency
0
25
50
75
100
125
0
1
2
3
4
5
6
SEF10


SEF11
Mean = 3.75
Std. Dev. = .857
N = 283
Frequency
0
25
50
75
100
125
0
1
2
3
4
5
6
SEF11

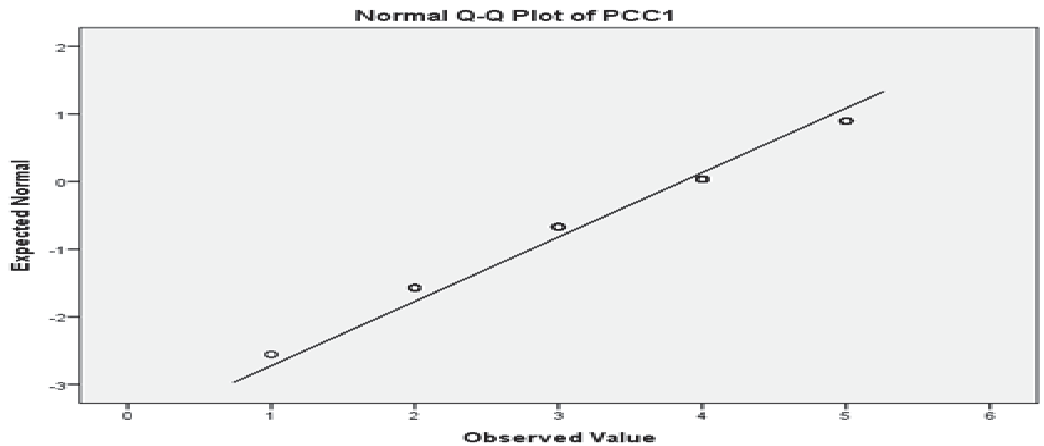

SEF12
Mean = 3.78
Std. Dev. = .797
N = 283
Frequency
0
50
100
150
0
1
2
3
4
5
6
SEF12

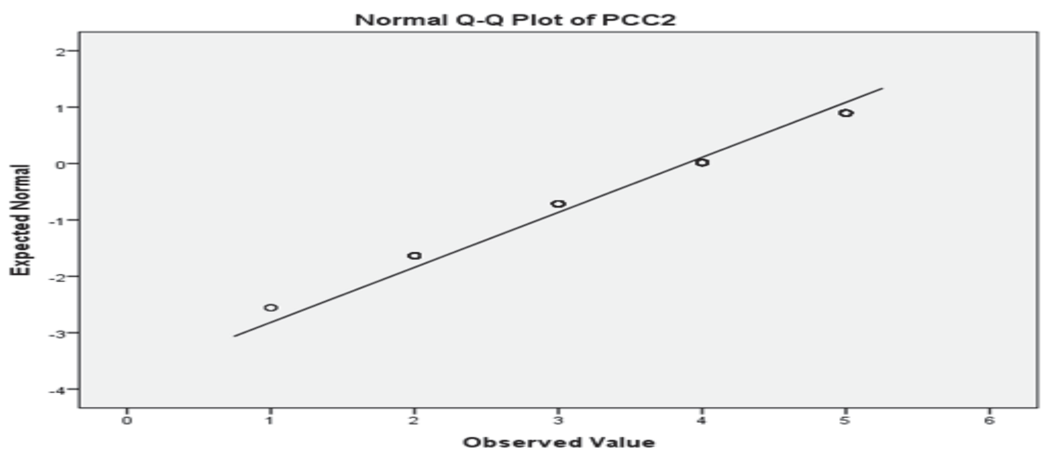

SEF13
Mean = 3.82
Std. Dev. = .82
N = 283
Frequency
150
100
50
0
0
1
2
3
4
5
6
SEF13

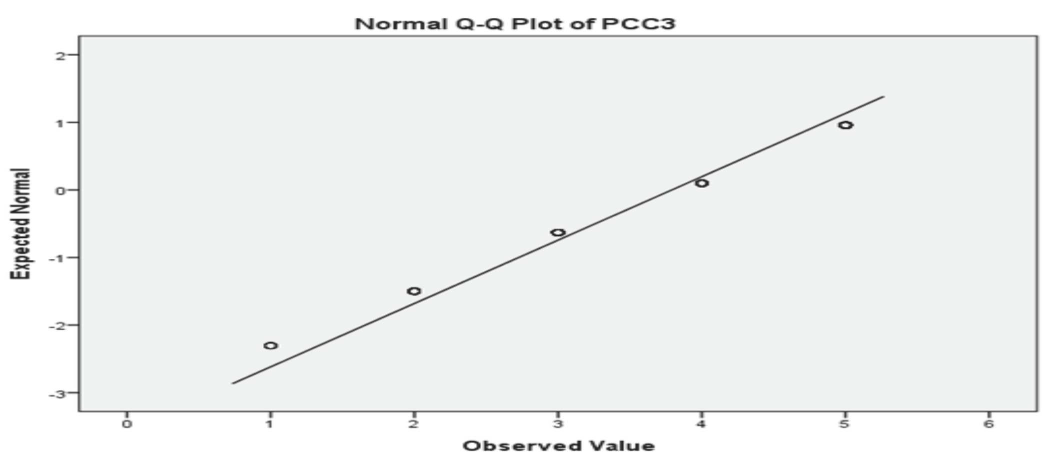

SEF14
Mean = 3.75
Std. Dev. = .92
N = 283
Frequency
125
100
75
50
25
0
0
1
2
3
4
5
6
SEF14

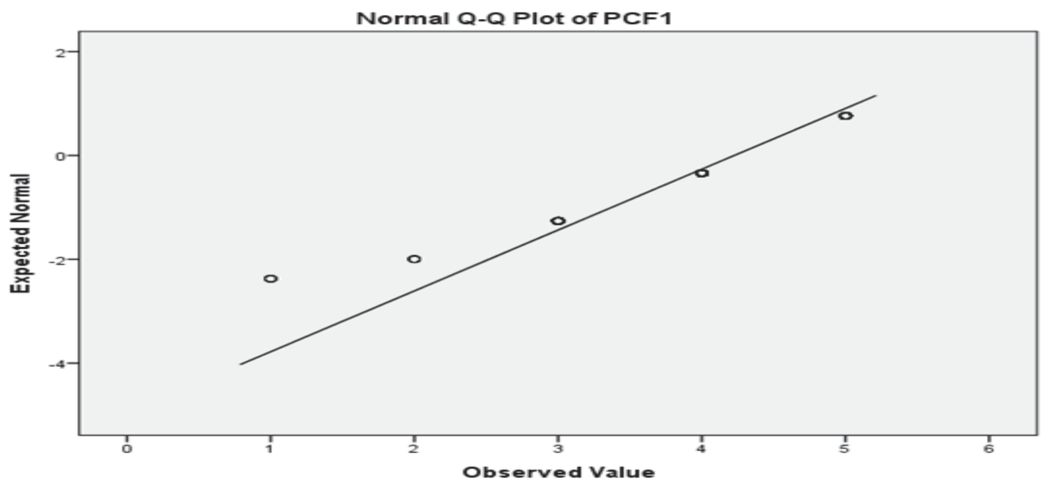

SEF15
Mean = 3.78
Std. Dev. = .846
N = 283
Frequency
125
100
75
50
25
0
0
1
2
3
4
5
6
SEF15

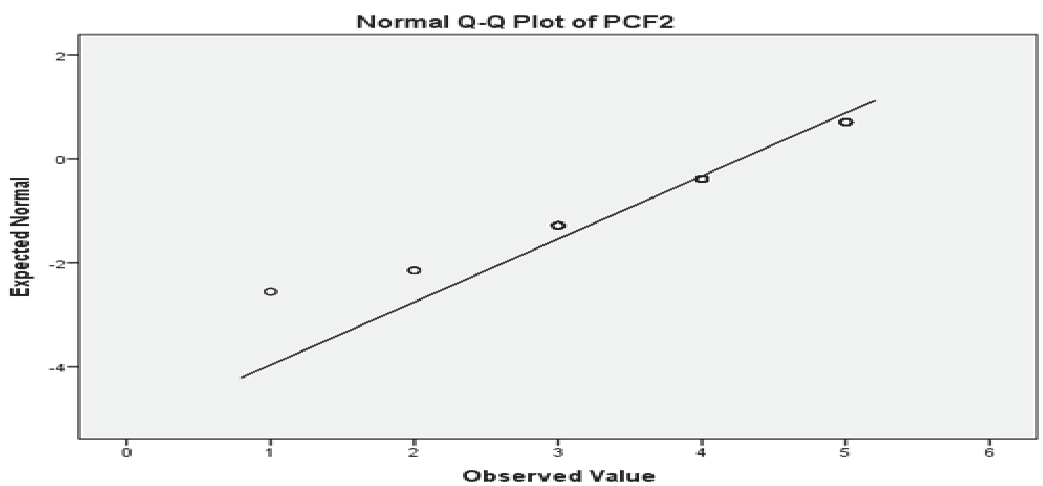
Appendix I4 (Q-Q Plot)

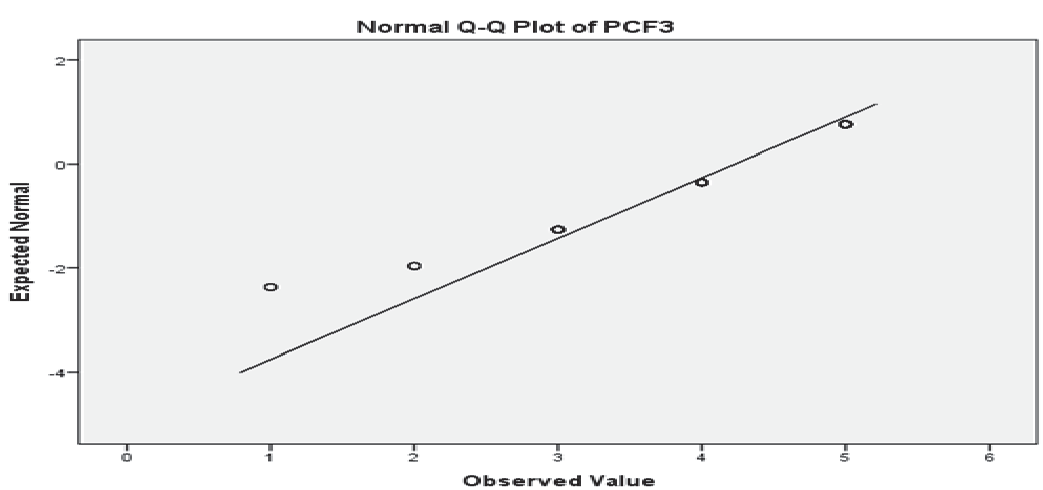


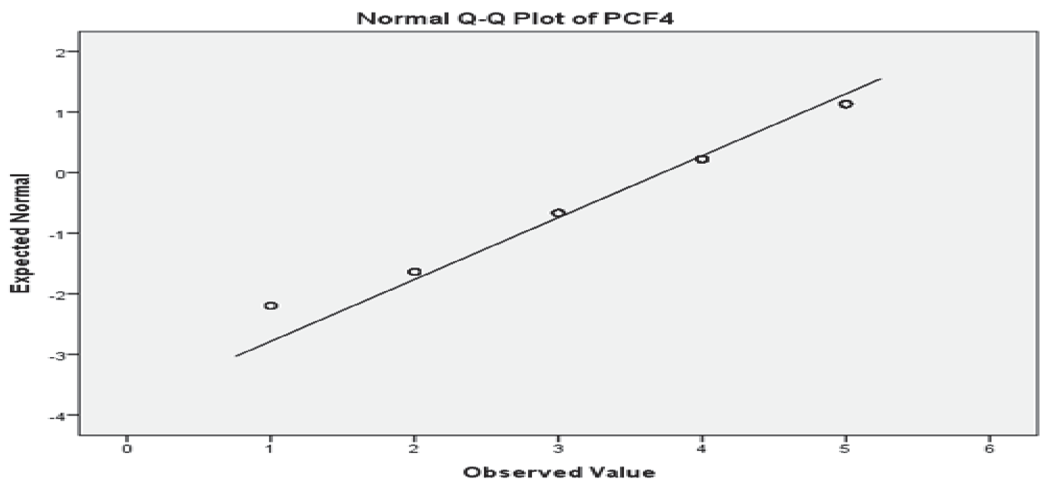


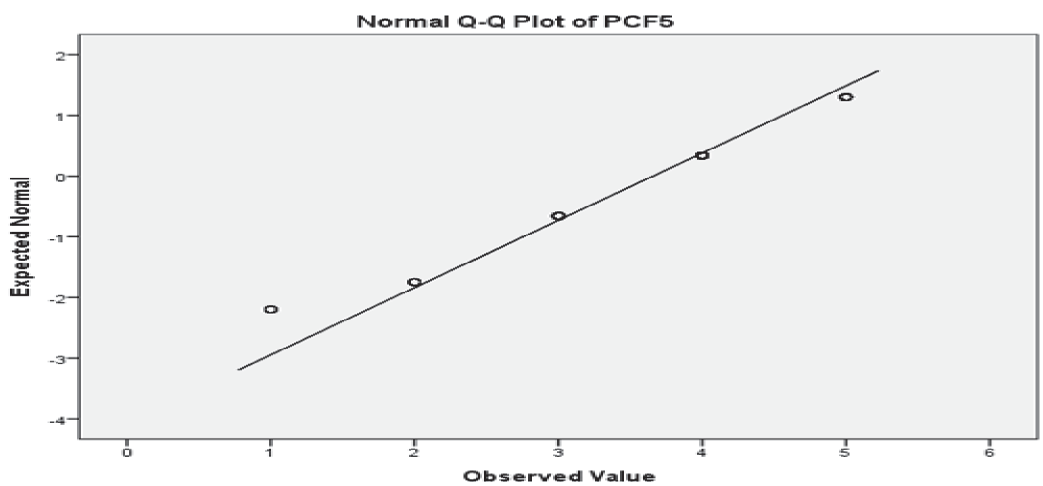


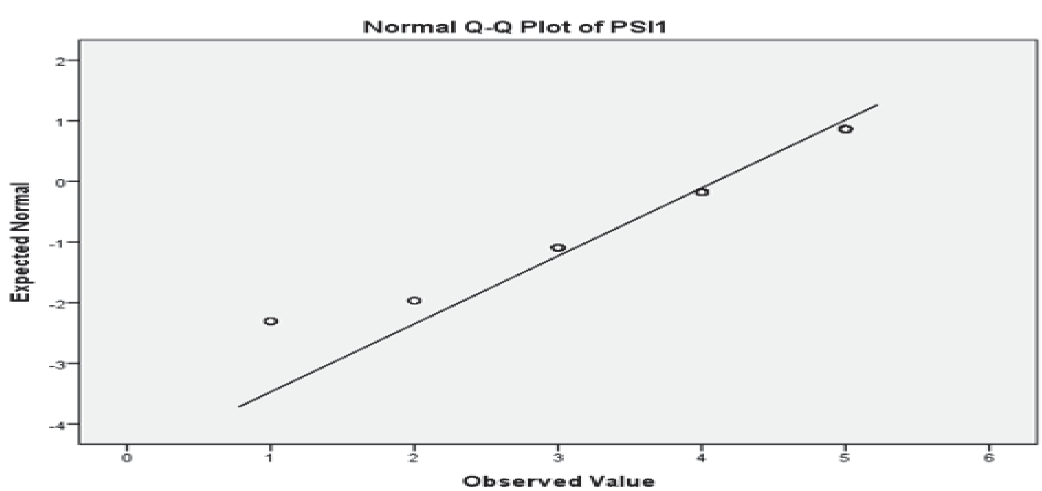

Normal Q-Q Plot of PCF1
Expected Normal
Observed Value
2
0
-2
-4
0
1
2
3
4
5
6

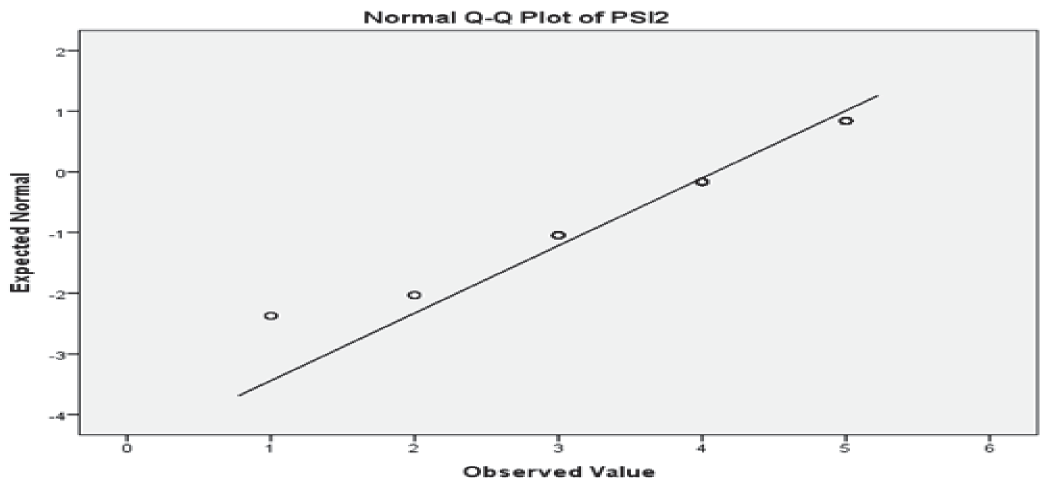

Normal Q-Q Plot of PCF2
Expected Normal
Observed Value
2
0
-2
-4
0
1
2
3
4
5
6

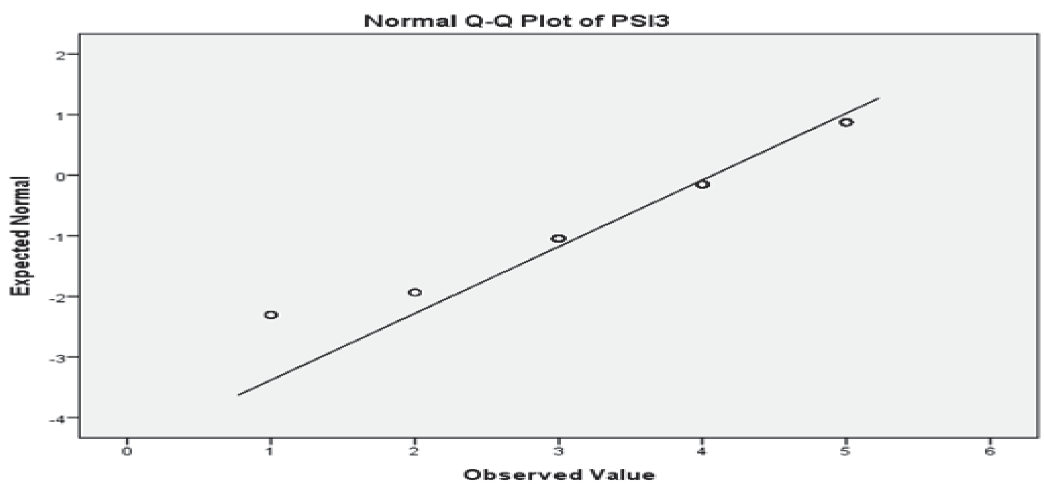

Normal Q-Q Plot of PCF3
Expected Normal
Observed Value
2
0
-2
-4
0
1
2
3
4
5
6

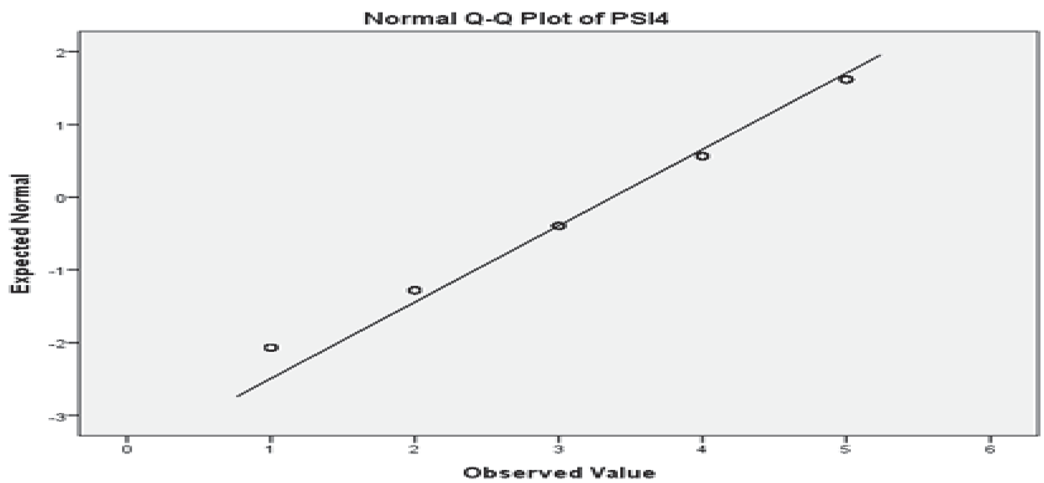

Normal Q-Q Plot of PCF4
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

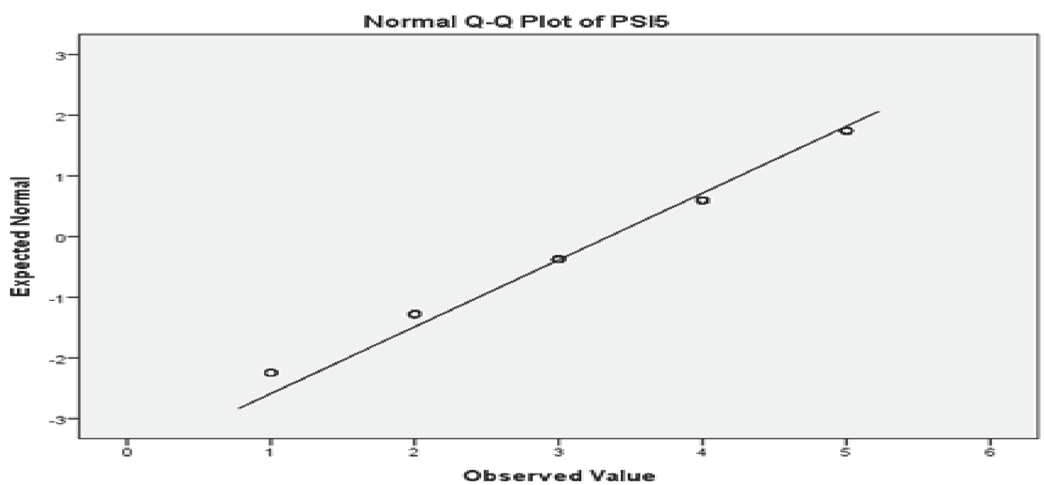

Normal Q-Q Plot of PCF5
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

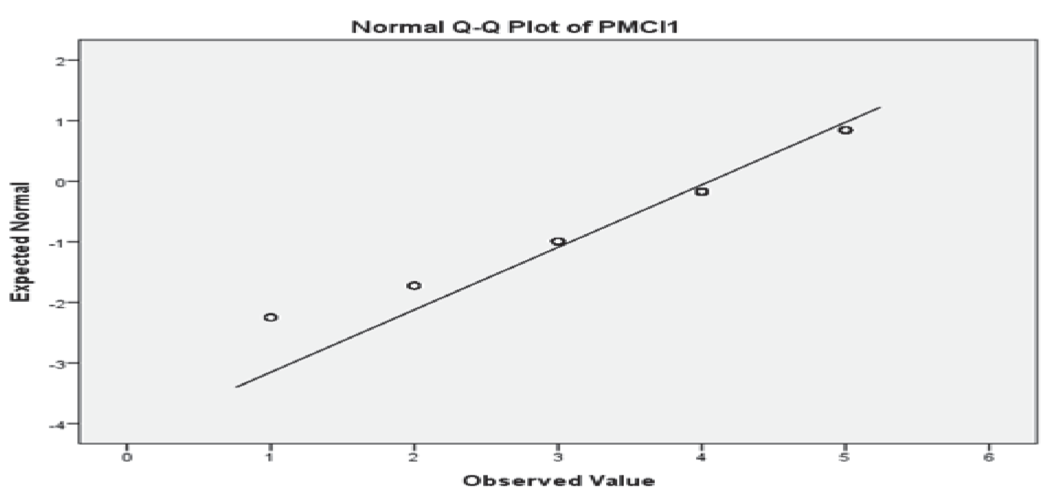

Normal Q-Q Plot of PSI1
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

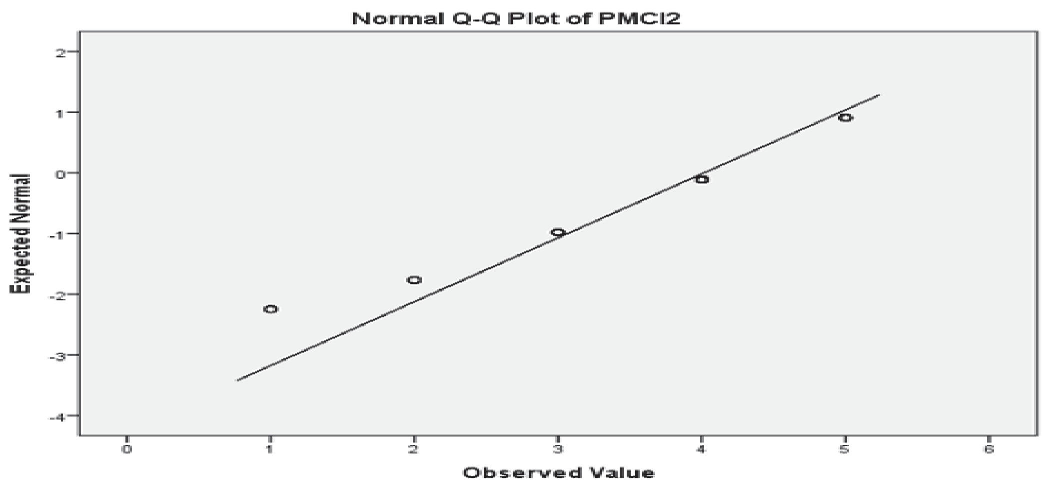

Normal Q-Q Plot of PSI2
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

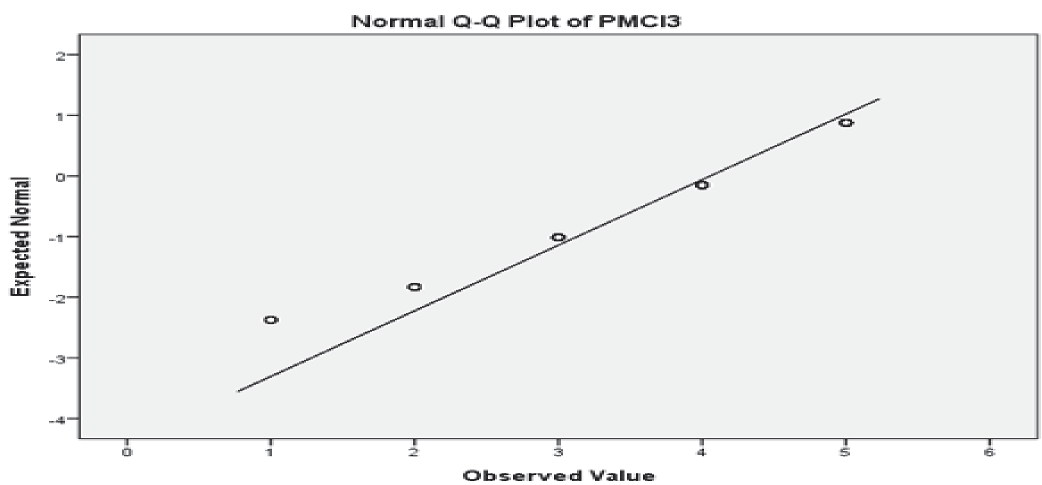

Normal Q-Q Plot of PSI3
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

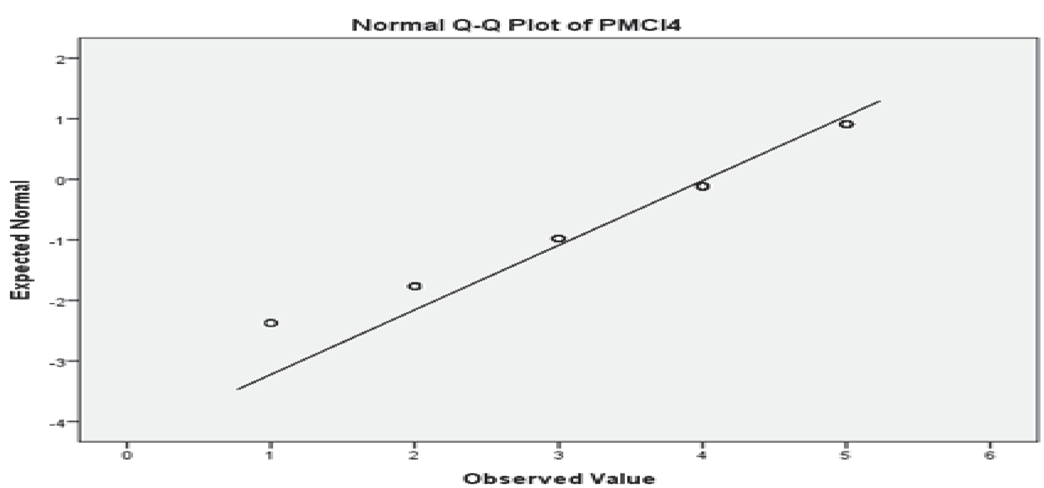

Normal Q-Q Plot of PSI4
Expected Normal
Observed Value

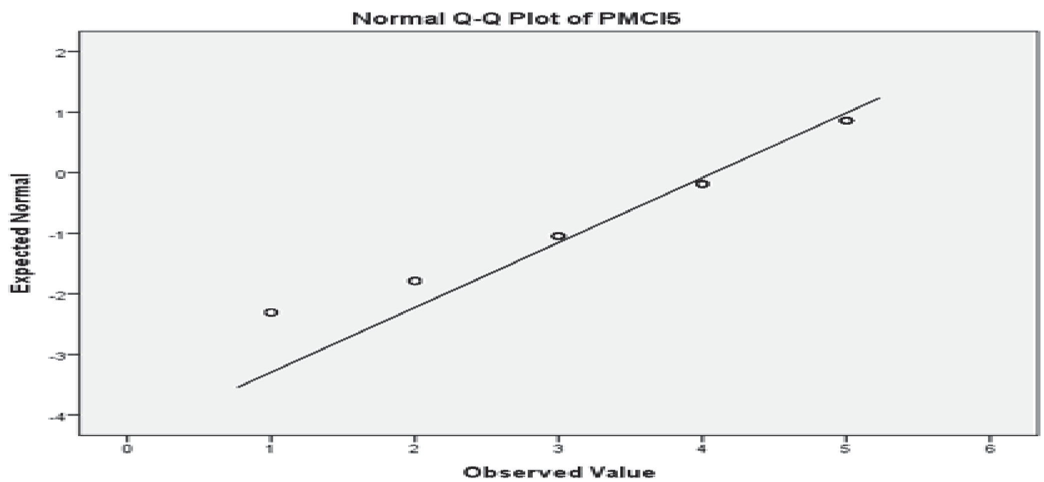

Normal Q-Q Plot of PSI5
Expected Normal
Observed Value

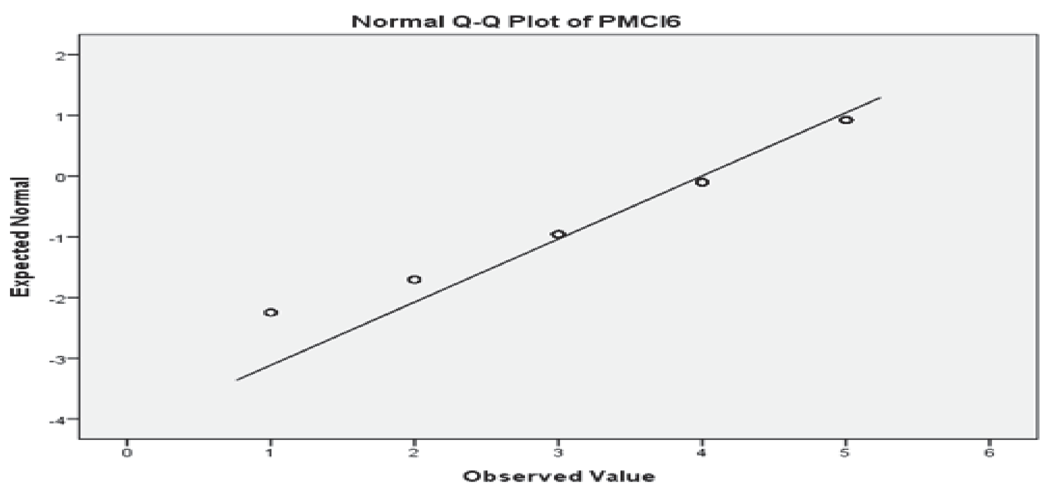

Normal Q-Q Plot of PMCI1
Expected Normal
Observed Value

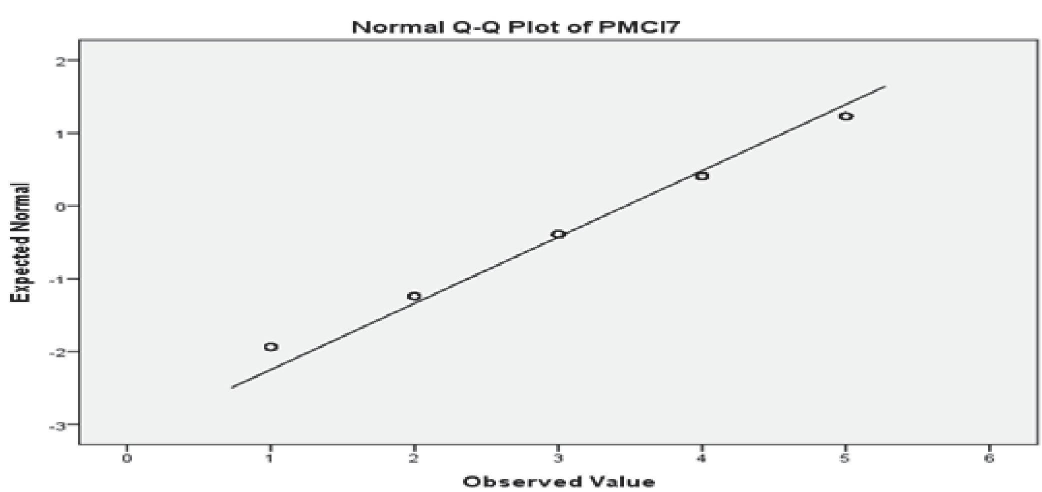

Normal Q-Q Plot of PMCI2
Expected Normal
Observed Value

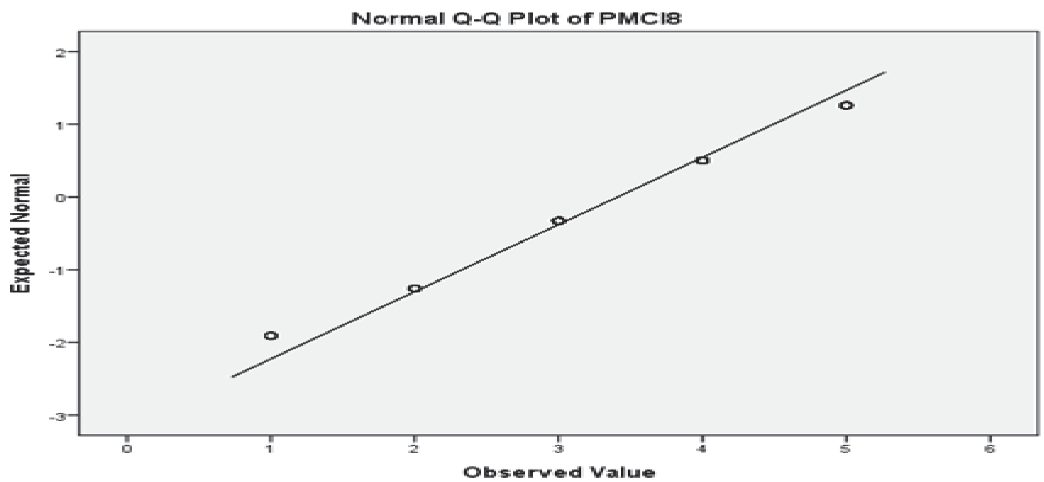

Normal Q-Q Plot of PMCI3
Expected Normal
Observed Value

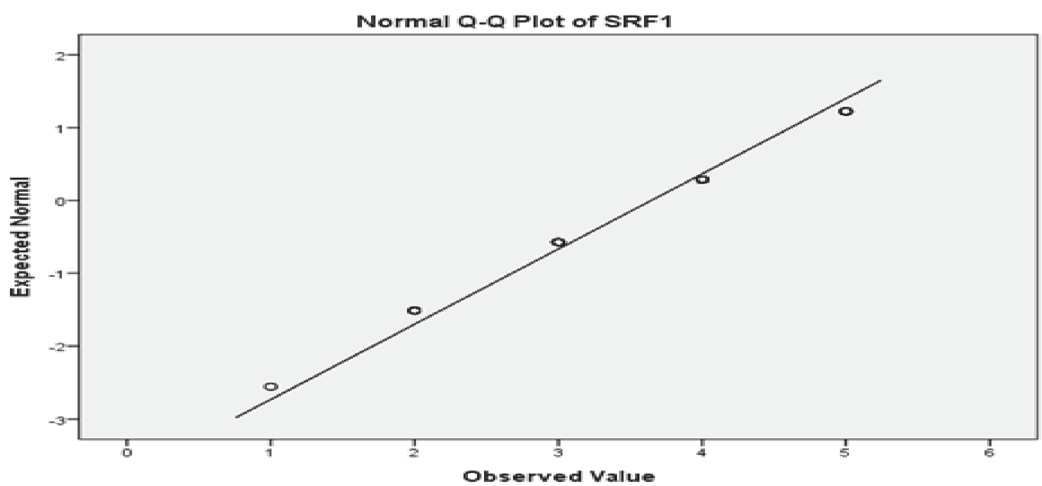

Normal Q-Q Plot of PMCI4
Expected Normal
Observed Value

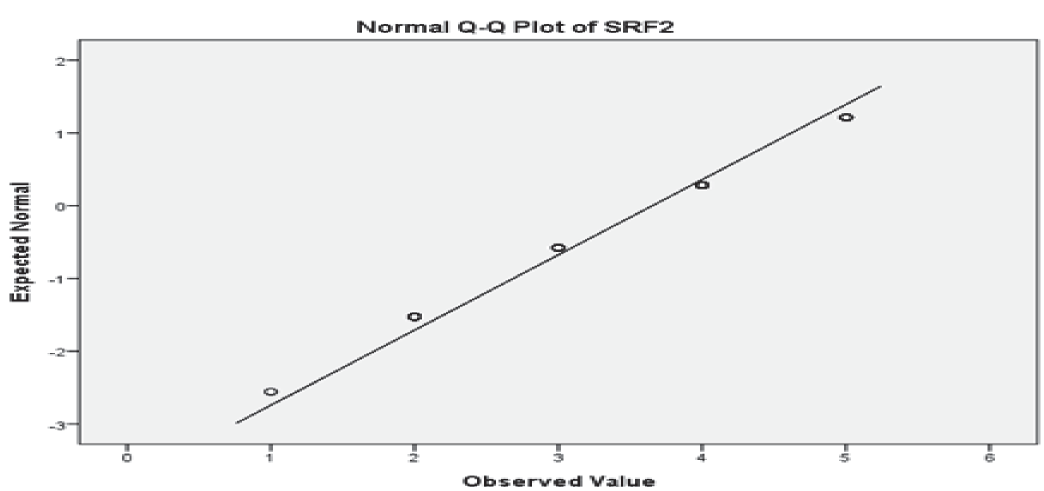

Normal Q-Q Plot of PMCI5
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

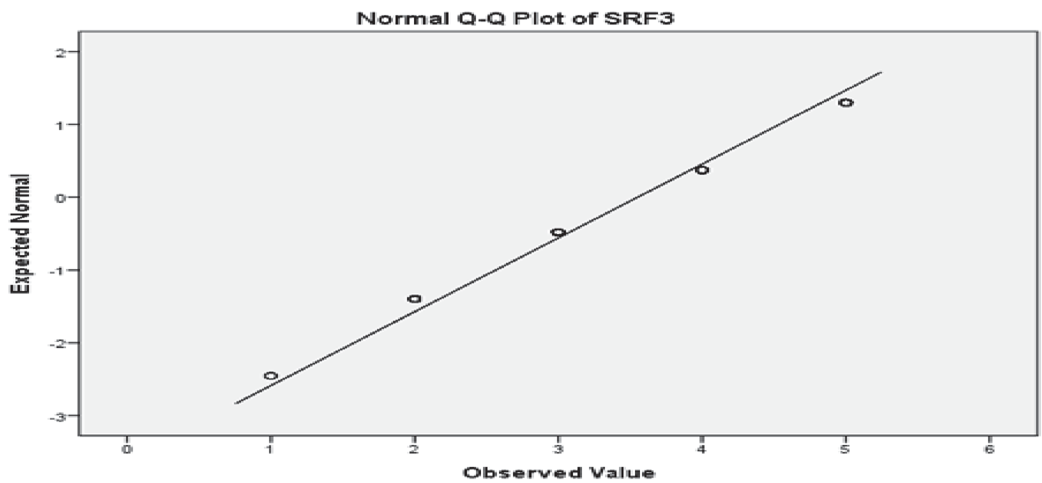

Normal Q-Q Plot of PMCI6
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

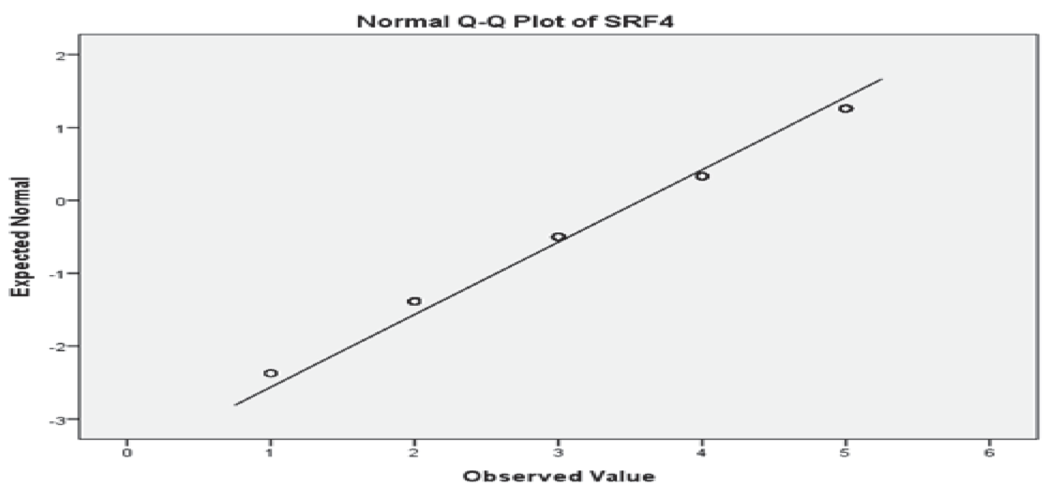

Normal Q-Q Plot of PMCI7
Expected Normal
Observed Value
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

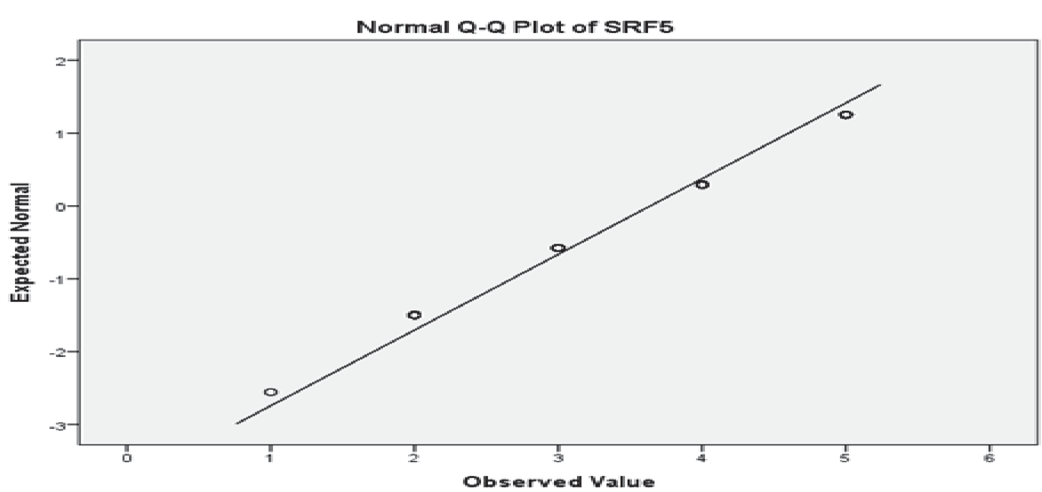

Normal Q-Q Plot of PMCI8
Expected Normal
Observed Value
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

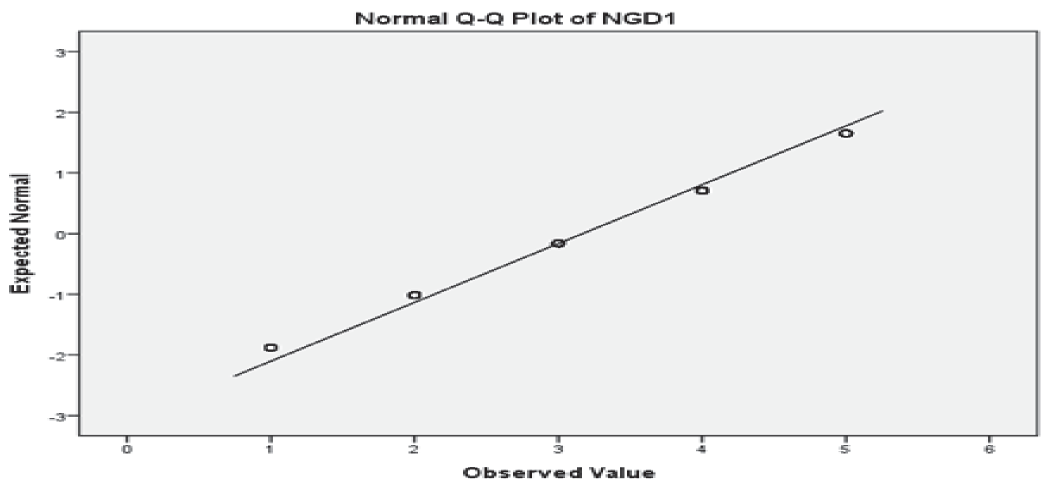

Normal Q-Q Plot of SRF1
Expected Normal
Observed Value
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

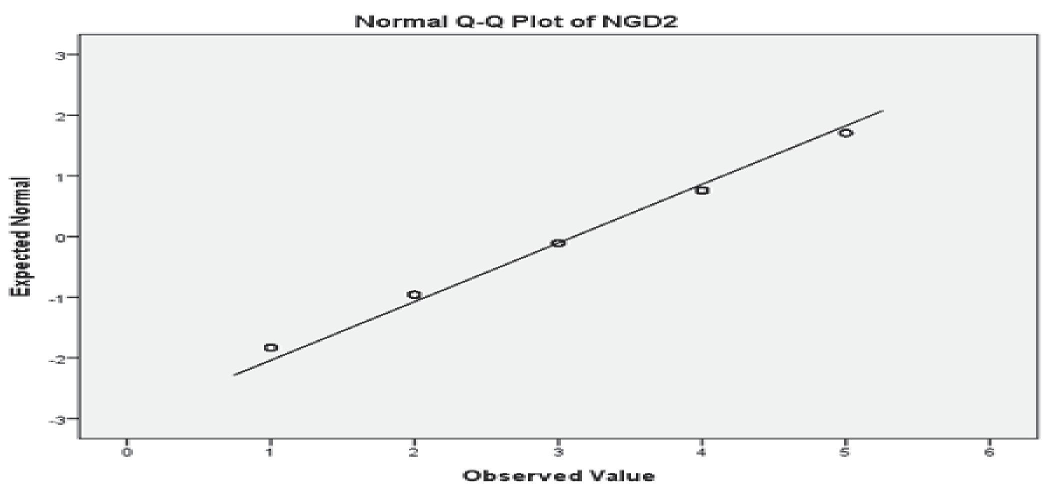

Normal Q-Q Plot of SRF2
Expected Normal
Observed Value
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

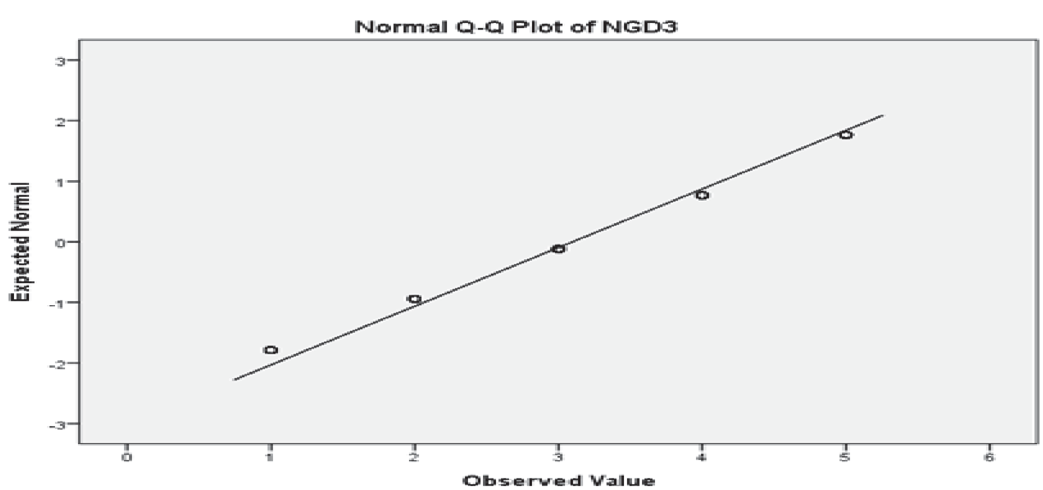

Normal Q-Q Plot of SRF3
Expected Normal
Observed Value
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

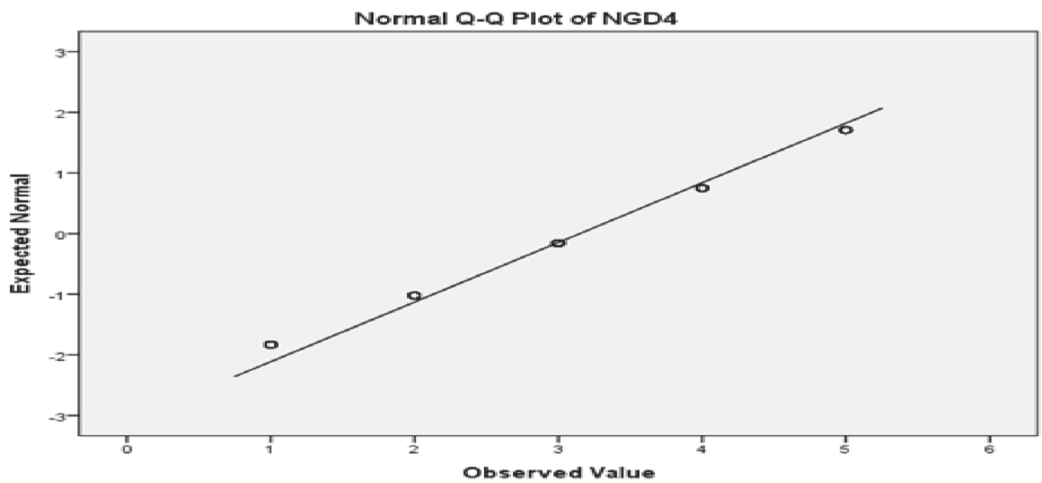

Normal Q-Q Plot of SRF4
Expected Normal
Observed Value
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

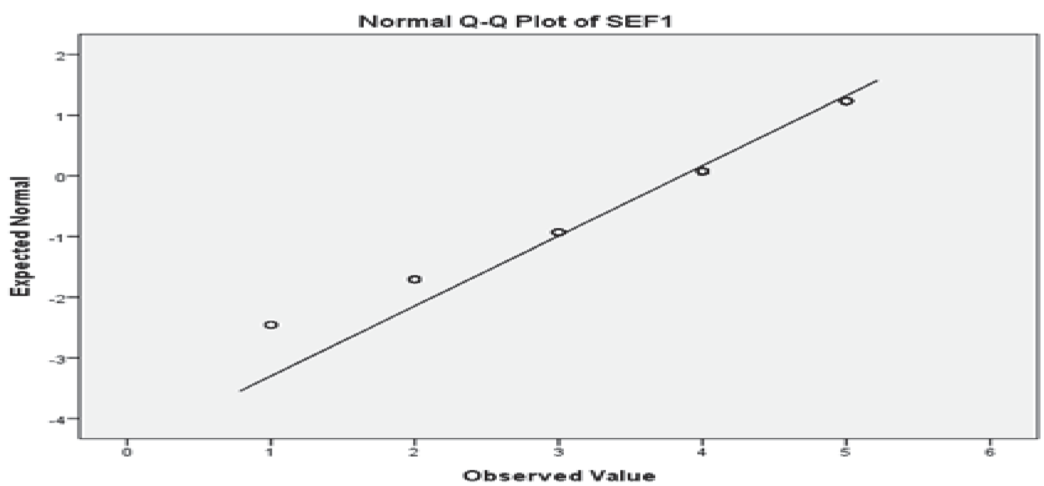

Normal Q-Q Plot of SRF5
Expected Normal
Observed Value
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

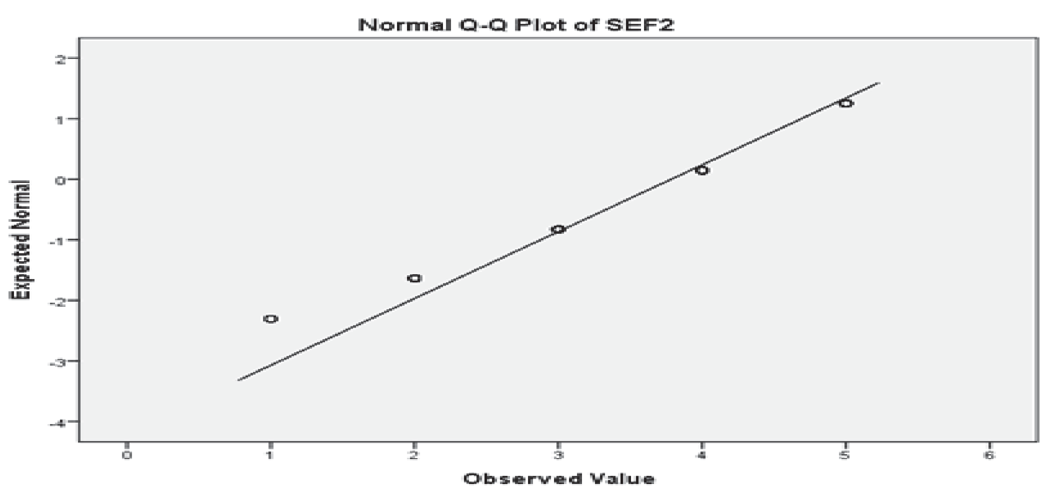

Normal Q-Q Plot of NGD1
Expected Normal
Observed Value
3
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

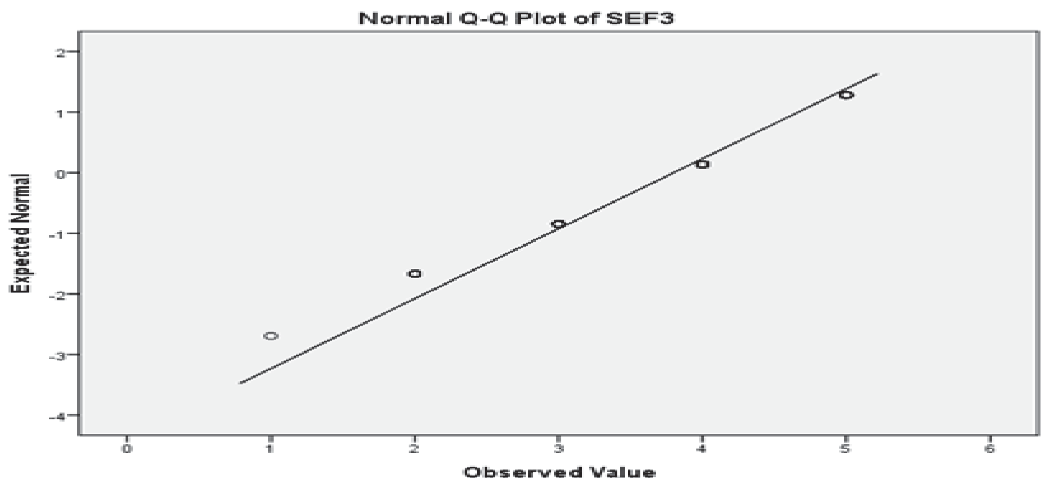

Normal Q-Q Plot of NGD2
Expected Normal
Observed Value
3
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

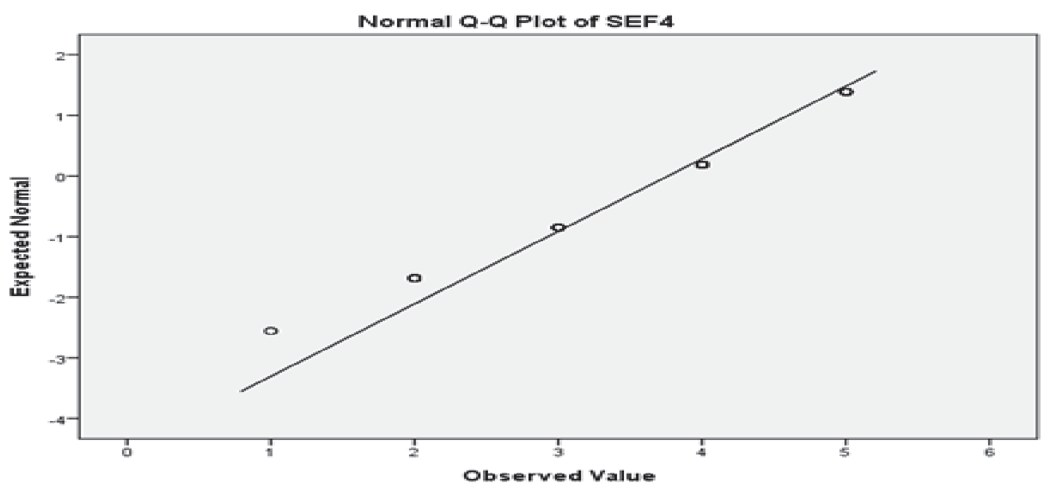

Normal Q-Q Plot of NGD3
Expected Normal
Observed Value
3
2
1
0
-1
-2
-3
0
1
2
3
4
5
6

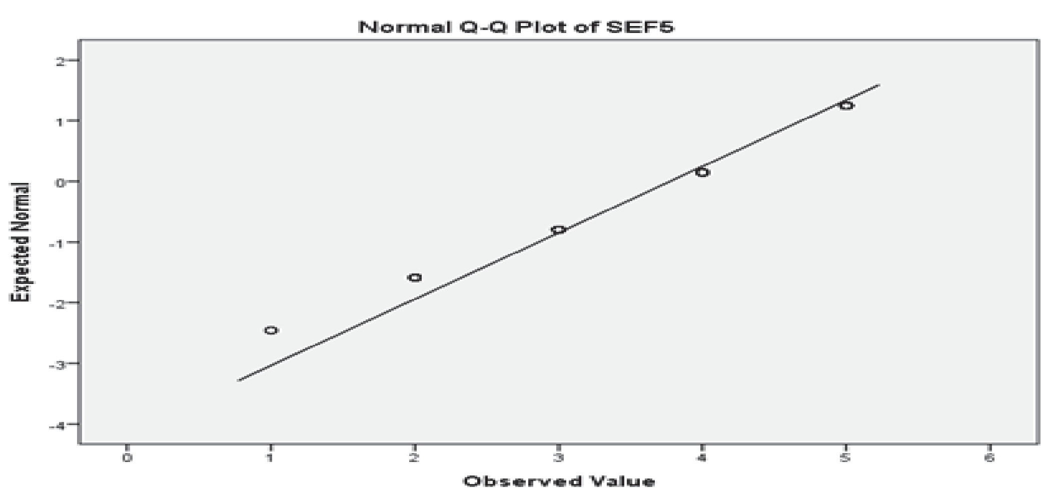

Normal Q-Q Plot of NGD4
Expected Normal
Observed Value

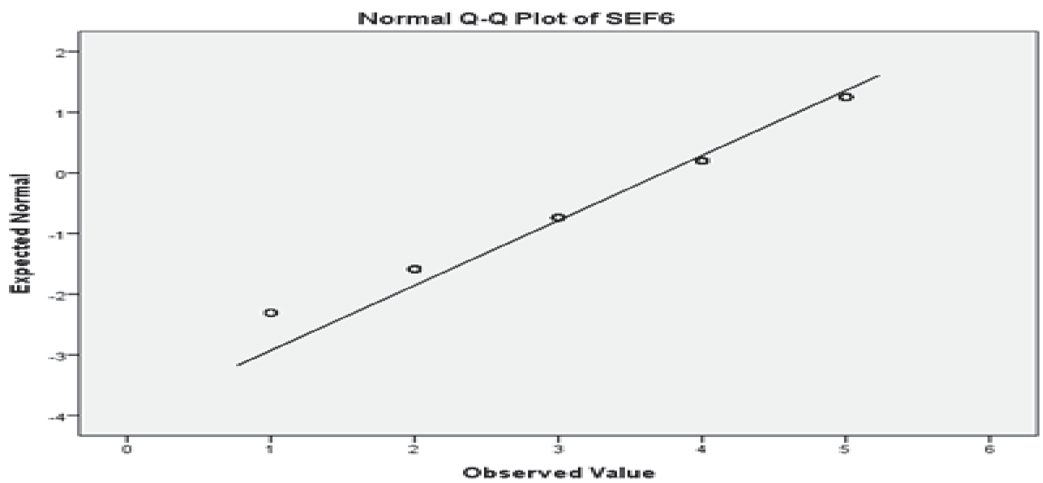

Normal Q-Q Plot of SEF1
Expected Normal
Observed Value

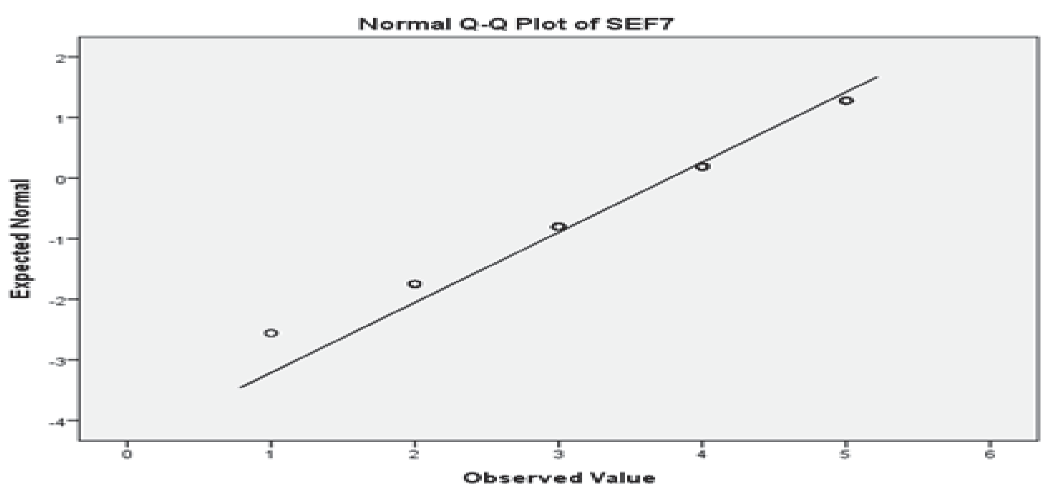

Normal Q-Q Plot of SEF2
Expected Normal
Observed Value

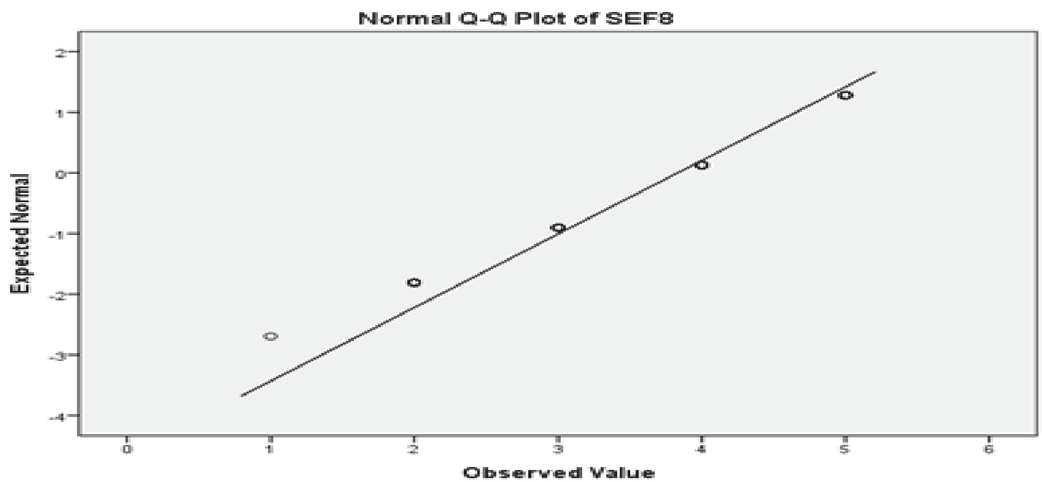

Normal Q-Q Plot of SEF3
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

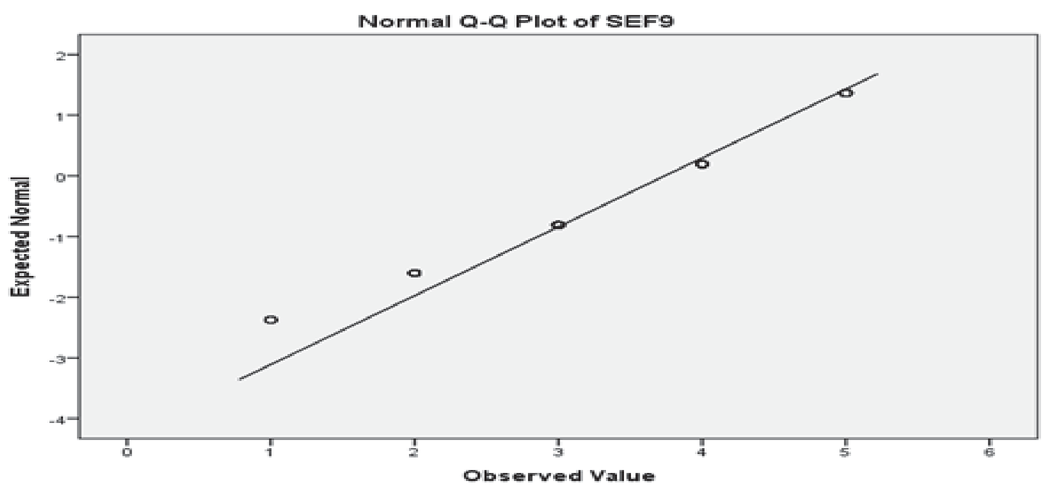

Normal Q-Q Plot of SEF4
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

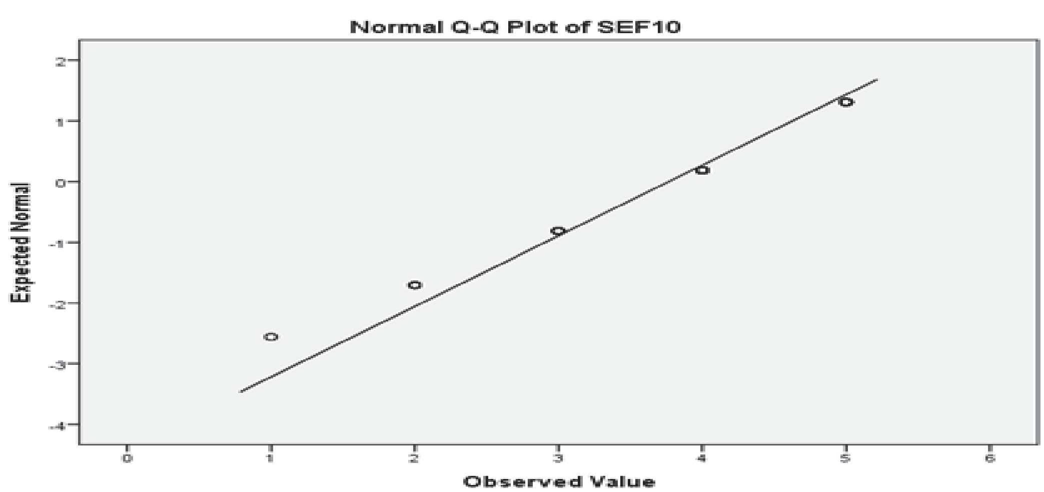

Normal Q-Q Plot of SEF5
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

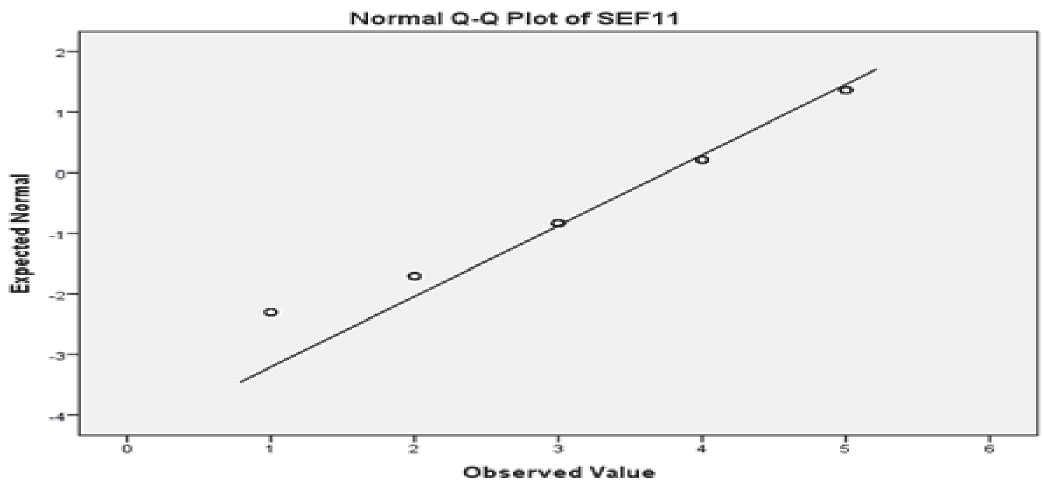

Normal Q-Q Plot of SEF6
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6


Normal Q-Q Plot of SEF7
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

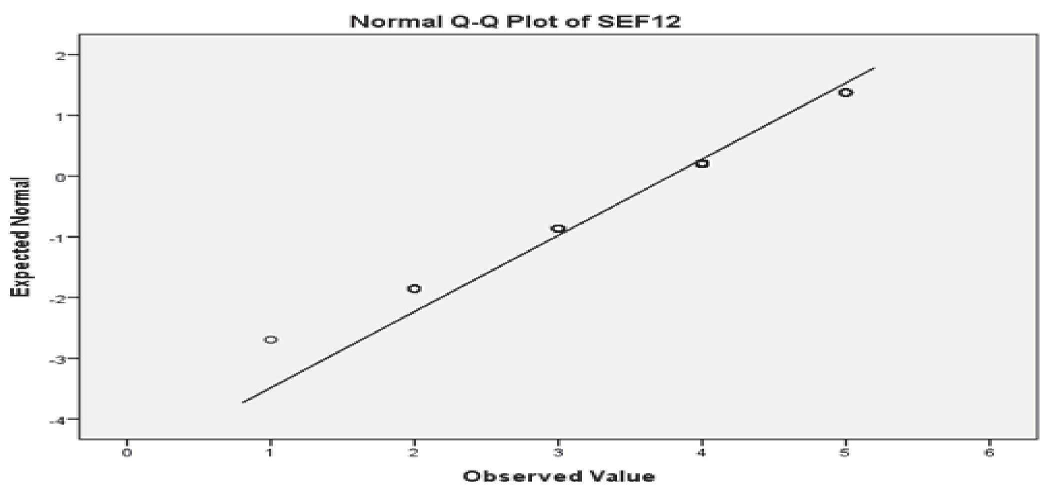

Normal Q-Q Plot of SEF8
Expected Normal
Observed Value


Normal Q-Q Plot of SEF9
Expected Normal
Observed Value

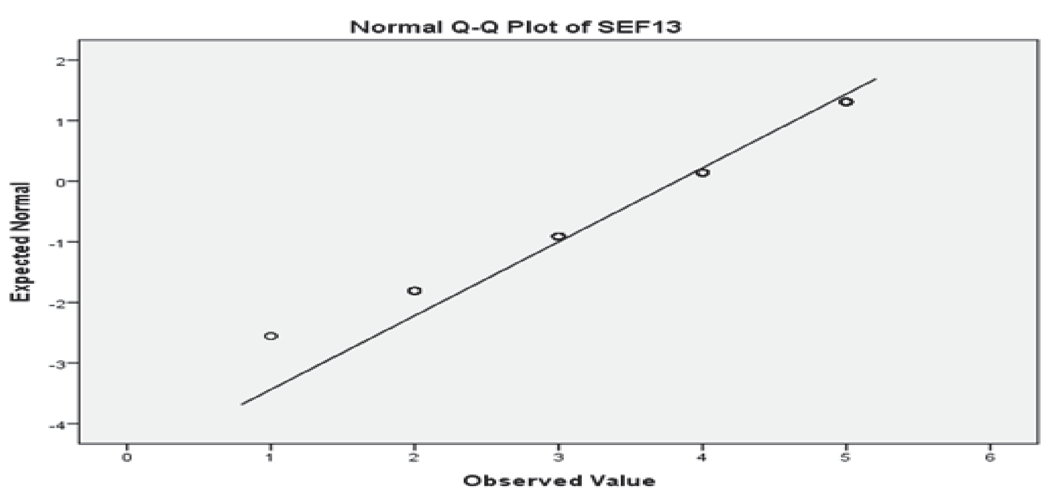

Normal Q-Q Plot of SEF10
Expected Normal
Observed Value



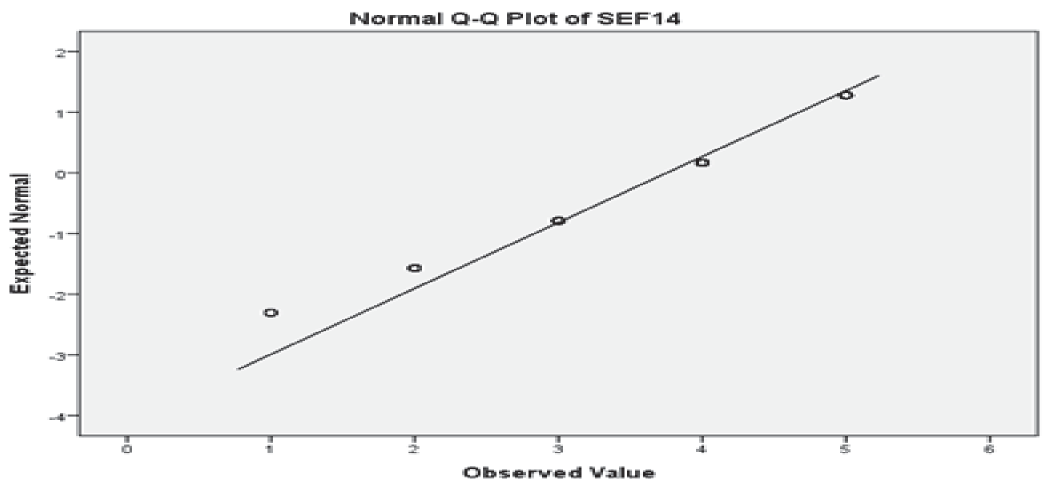
Normal Q-Q Plot of SEF11
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

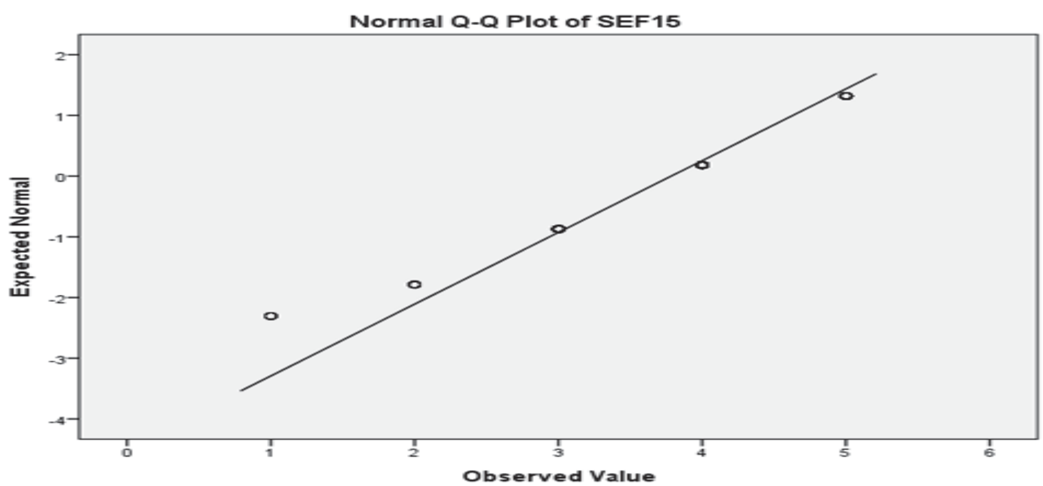


Normal Q-Q Plot of SEF12
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6



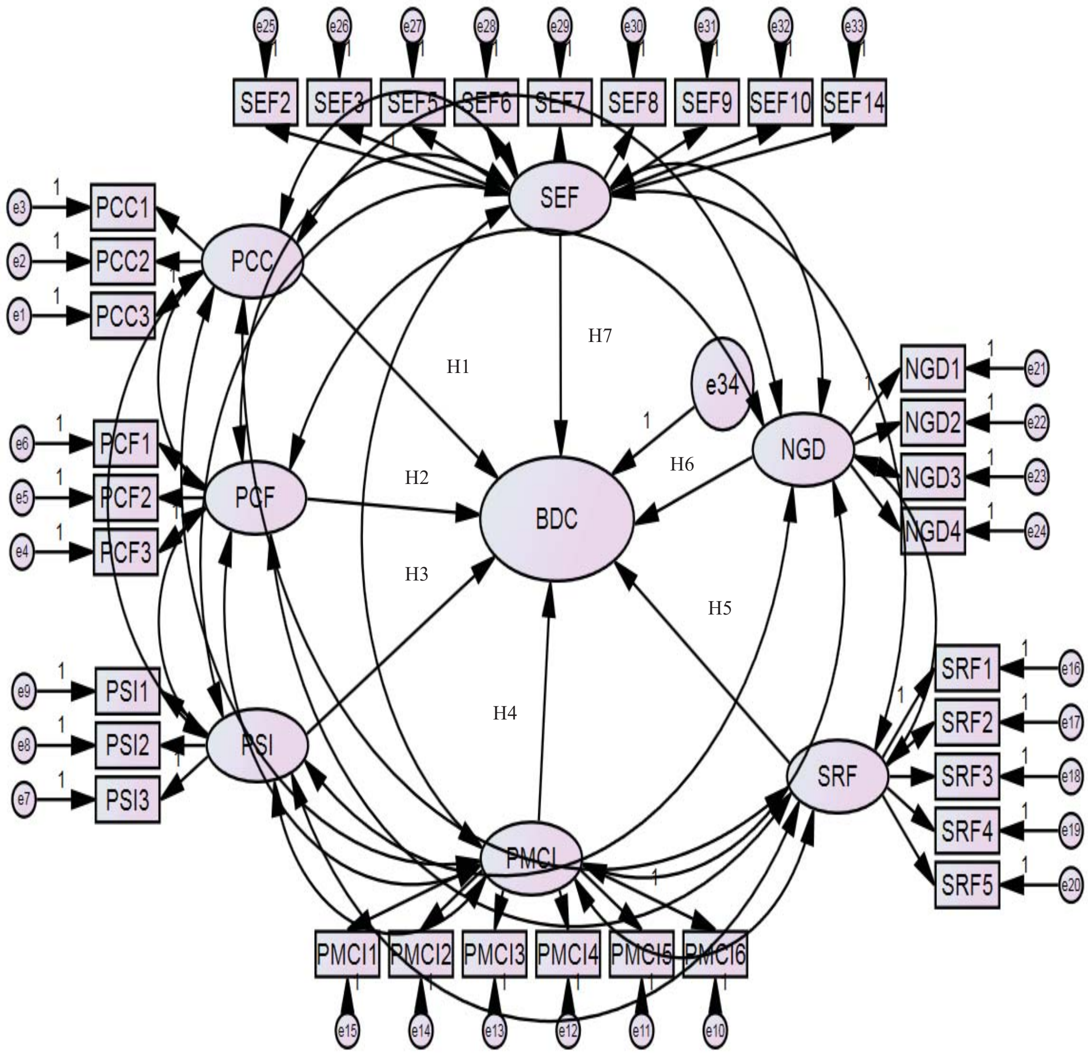
Normal Q-Q Plot of SEF13
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6


Normal Q-Q Plot of SEF14
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6


Normal Q-Q Plot of SEF15
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6

APPENDIX J: STRUCTURAL EQUATION MODELLING ANALYSIS

Appendix J1 (The Hypothetical Research Model)



Appendix J2 (Assessment of Normality)

Assessment of normality						
Variable	min	max	skew	c.r.	kurtosis	c.r.
InvesCon	1	5	-0.629	-4.45	0.245	0.866
BV	1	5	-0.469	-3.318	0.051	0.181
HP	1	5	-0.648	-4.583	0.326	1.154
Employment	1	5	-0.472	-3.338	-0.024	-0.087
Population	1	5	-0.387	-2.738	-0.089	-0.315
LCI	1	5	-0.493	-3.486	-0.027	-0.096
PI	1	5	-0.585	-4.14	0.005	0.017
PPI	1	5	-0.564	-3.99	0.013	0.048
CGPI	1	5	-0.612	-4.329	0.31	1.097
GBS	1	5	-0.185	-1.309	-0.343	-1.214
GET	1	5	-0.203	-1.437	-0.525	-1.855
NatFor	1	5	-0.084	-0.593	-0.502	-1.775
GPD	1	5	-0.149	-1.051	-0.445	-1.573
CCAct	1	5	-0.189	-1.336	-0.772	-2.729
FinReg	1	5	-0.194	-1.374	-0.714	-2.523
PoliPo	1	5	-0.158	-1.118	-0.692	-2.448
HSReg	1	5	-0.171	-1.212	-0.759	-2.682
BuilCC	1	5	-0.184	-1.301	-0.763	-2.699
MatMar	1	5	-0.915	-6.47	0.548	1.936
LabMar	1	5	-0.884	-6.251	0.634	2.243
ComLev	1	5	-0.839	-5.932	0.421	1.489
MarSS	1	5	-0.809	-5.718	0.304	1.075
BBCyc	1	5	-0.904	-6.393	0.609	2.153
SDRel	1	5	-0.897	-6.341	0.595	2.102
Client	1	5	-0.853	-6.032	0.775	2.739
Consultant	1	5	-0.778	-5.5	0.366	1.295
Contractor	1	5	-0.809	-5.717	0.543	1.92
ProL	1	5	-1.066	-7.541	1.262	4.461
ProCom	1	5	-1.012	-7.158	0.807	2.854
ProcMe	1	5	-1.128	-7.978	1.341	4.743
DesCost	1	5	-0.356	-2.52	-1.014	-3.584
ConstrCost	1	5	-0.42	-2.973	-0.868	-3.07
ProCost	1	5	-0.41	-2.899	-0.719	-2.541
Multivariate					713.471	128.558

Appendix J3 (Regression Weights)

Regression Weights: (Group number 1 - Default model)							
			Estimate	S.E.	C.R.	P	Label
SEF	<---	BDC	0.237	0.038	6.256	***	par_27
PCC	<---	BDC	0.241	0.05	4.811	***	par_28
PCF	<---	BDC	0.644	0.043	15.069	***	par_29
PSI	<---	BDC	0.7	0.044	15.834	***	par_30
PMCI	<---	BDC	0.771	0.046	16.602	***	par_31
SRF	<---	BDC	0.692	0.048	14.572	***	par_32
NGD	<---	BDC	0.56	0.053	10.639	***	par_33
ProCost	<---	PCC	1				
ConstrCost	<---	PCC	1.015	0.113	9.006	***	par_1
DesCost	<---	PCC	1.078	0.118	9.107	***	par_2
ProcMe	<---	PCF	1				
ProCom	<---	PCF	1.008	0.061	16.598	***	par_3
ProL	<---	PCF	0.998	0.065	15.357	***	par_4
Contractor	<---	PSI	1				
Consultant	<---	PSI	1.03	0.06	17.231	***	par_5
Client	<---	PSI	1.026	0.059	17.28	***	par_6
SDRel	<---	PMCI	1				
BBCyc	<---	PMCI	0.994	0.057	17.468	***	par_7
MarSS	<---	PMCI	0.997	0.057	17.607	***	par_8
ComLev	<---	PMCI	1.006	0.055	18.196	***	par_9
LabMar	<---	PMCI	0.994	0.059	16.861	***	par_10
MatMar	<---	PMCI	1.024	0.058	17.556	***	par_11
BuilCC	<---	SRF	1				
HSReg	<---	SRF	1.004	0.056	17.82	***	par_12
PoliPo	<---	SRF	0.984	0.058	16.963	***	par_13
FinReg	<---	SRF	0.999	0.061	16.34	***	par_14
CCAct	<---	SRF	0.994	0.058	17.213	***	par_15
GPD	<---	NGD	1				
NatFor	<---	NGD	1.043	0.093	11.244	***	par_16
GET	<---	NGD	1.048	0.095	11.04	***	par_17
GBS	<---	NGD	1.038	0.092	11.325	***	par_18
CGPI	<---	SEF	1				
PPI	<---	SEF	0.984	0.13	7.575	***	par_19
PI	<---	SEF	0.916	0.132	6.945	***	par_20
LCI	<---	SEF	0.962	0.136	7.097	***	par_21
Population	<---	SEF	1.056	0.13	8.091	***	par_22
Employment	<---	SEF	1.009	0.127	7.936	***	par_23
HP	<---	SEF	1.043	0.133	7.848	***	par_24
BV	<---	SEF	1.061	0.13	8.193	***	par_25
InvesCon	<---	SEF	0.994	0.133	7.461	***	par_26

Appendix J4 (Standardized Regression Weights)

Standardized Regression Weights			
			Estimate
SEF	<---	BDC	0.466
PCC	<---	BDC	0.336
PCF	<---	BDC	0.935
PSI	<---	BDC	0.956
PMCI	<---	BDC	0.983
SRF	<---	BDC	0.855
NGD	<---	BDC	0.774
ProCost	<---	PCC	0.681
ConstrCost	<---	PCC	0.718
DesCost	<---	PCC	0.738
ProcMe	<---	PCF	0.797
ProCom	<---	PCF	0.852
ProL	<---	PCF	0.806
Contractor	<---	PSI	0.812
Consultant	<---	PSI	0.852
Client	<---	PSI	0.851
SDRel	<---	PMCI	0.815
BBCyc	<---	PMCI	0.841
MarSS	<---	PMCI	0.844
ComLev	<---	PMCI	0.863
LabMar	<---	PMCI	0.819
MatMar	<---	PMCI	0.84
BuilCC	<---	SRF	0.836
HSReg	<---	SRF	0.842
PoliPo	<---	SRF	0.819
FinReg	<---	SRF	0.795
CCAct	<---	SRF	0.826
GPD	<---	NGD	0.71
NatFor	<---	NGD	0.737
GET	<---	NGD	0.721
GBS	<---	NGD	0.741
CGPI	<---	SEF	0.566
PPI	<---	SEF	0.573
PI	<---	SEF	0.506
LCI	<---	SEF	0.528
Population	<---	SEF	0.632
Employment	<---	SEF	0.621
HP	<---	SEF	0.604
BV	<---	SEF	0.64
InvesCon	<---	SEF	0.557

Appendix J5 (Squared Multiple Correlation)

Squared Multiple Correlations	
	Estimate
SEF	0.217
NGD	0.6
SRF	0.73
PMCI	0.966
PSI	0.915
PCF	0.874
PCC	0.113
InvesCon	0.31
BV	0.41
HP	0.365
Employment	0.385
Population	0.399
LCI	0.279
PI	0.256
PPI	0.328
CGPI	0.321
GBS	0.55
GET	0.52
NatFor	0.543
GPD	0.504
CCAct	0.683
FinReg	0.632
PoliPo	0.671
HSReg	0.708
BuilCC	0.698
MatMar	0.706
LabMar	0.67
ComLev	0.746
MarSS	0.713
BBCyc	0.707
SDRel	0.664
Client	0.725
Consultant	0.725
Contractor	0.66
ProL	0.65
ProCom	0.725
ProcMe	0.635
DesCost	0.545
ConstrCost	0.516
ProCost	0.464

Appendix J6 (Total Effects)

Total Effects								
	BDC	SEF	NGD	SRF	PMCI	PSI	PCF	PCC
SEF	0.237	0	0	0	0	0	0	0
NGD	0.56	0	0	0	0	0	0	0
SRF	0.692	0	0	0	0	0	0	0
PMCI	0.771	0	0	0	0	0	0	0
PSI	0.7	0	0	0	0	0	0	0
PCF	0.644	0	0	0	0	0	0	0
PCC	0.241	0	0	0	0	0	0	0
InvesCon	0.236	0.994	0	0	0	0	0	0
BV	0.252	1.061	0	0	0	0	0	0
HP	0.247	1.043	0	0	0	0	0	0
Employment	0.239	1.009	0	0	0	0	0	0
Population	0.25	1.056	0	0	0	0	0	0
LCI	0.228	0.962	0	0	0	0	0	0
PI	0.217	0.916	0	0	0	0	0	0
PPI	0.233	0.984	0	0	0	0	0	0
CGPI	0.237	1	0	0	0	0	0	0
GBS	0.582	0	1.038	0	0	0	0	0
GET	0.587	0	1.048	0	0	0	0	0
NatFor	0.584	0	1.043	0	0	0	0	0
GPD	0.56	0	1	0	0	0	0	0
CCAct	0.688	0	0	0.994	0	0	0	0
FinReg	0.691	0	0	0.999	0	0	0	0
PoliPo	0.681	0	0	0.984	0	0	0	0
HSReg	0.695	0	0	1.004	0	0	0	0
BuilCC	0.692	0	0	1	0	0	0	0
MatMar	0.789	0	0	0	1.024	0	0	0
LabMar	0.766	0	0	0	0.994	0	0	0
ComLev	0.776	0	0	0	1.006	0	0	0
MarSS	0.769	0	0	0	0.997	0	0	0
BBCyc	0.766	0	0	0	0.994	0	0	0
SDRel	0.771	0	0	0	1	0	0	0
Client	0.718	0	0	0	0	1.026	0	0
Consultant	0.721	0	0	0	0	1.03	0	0
Contractor	0.7	0	0	0	0	1	0	0
ProL	0.643	0	0	0	0	0	0.998	0
ProCom	0.649	0	0	0	0	0	1.008	0
ProcMe	0.644	0	0	0	0	0	1	0
DesCost	0.26	0	0	0	0	0	0	1.078
ConstrCost	0.245	0	0	0	0	0	0	1.015
ProCost	0.241	0	0	0	0	0	0	1

Appendix J7 (Standardized Total Effects)

Standardized Total Effects								
	BDC	SEF	NGD	SRF	PMCI	PSI	PCF	PCC
SEF	0.466	0	0	0	0	0	0	0
NGD	0.774	0	0	0	0	0	0	0
SRF	0.855	0	0	0	0	0	0	0
PMCI	0.983	0	0	0	0	0	0	0
PSI	0.956	0	0	0	0	0	0	0
PCF	0.935	0	0	0	0	0	0	0
PCC	0.336	0	0	0	0	0	0	0
InvesCon	0.259	0.557	0	0	0	0	0	0
BV	0.298	0.64	0	0	0	0	0	0
HP	0.281	0.604	0	0	0	0	0	0
Employment	0.289	0.621	0	0	0	0	0	0
Population	0.294	0.632	0	0	0	0	0	0
LCI	0.246	0.528	0	0	0	0	0	0
PI	0.235	0.506	0	0	0	0	0	0
PPI	0.267	0.573	0	0	0	0	0	0
CGPI	0.264	0.566	0	0	0	0	0	0
GBS	0.574	0	0.741	0	0	0	0	0
GET	0.559	0	0.721	0	0	0	0	0
NatFor	0.571	0	0.737	0	0	0	0	0
GPD	0.55	0	0.71	0	0	0	0	0
CCAct	0.706	0	0	0.826	0	0	0	0
FinReg	0.679	0	0	0.795	0	0	0	0
PoliPo	0.7	0	0	0.819	0	0	0	0
HSReg	0.719	0	0	0.842	0	0	0	0
BuilCC	0.714	0	0	0.836	0	0	0	0
MatMar	0.826	0	0	0	0.84	0	0	0
LabMar	0.805	0	0	0	0.819	0	0	0
ComLev	0.849	0	0	0	0.863	0	0	0
MarSS	0.83	0	0	0	0.844	0	0	0
BBCyc	0.826	0	0	0	0.841	0	0	0
SDRel	0.801	0	0	0	0.815	0	0	0
Client	0.814	0	0	0	0	0.851	0	0
Consultant	0.815	0	0	0	0	0.852	0	0
Contractor	0.777	0	0	0	0	0.812	0	0
ProL	0.754	0	0	0	0	0	0.806	0
ProCom	0.796	0	0	0	0	0	0.852	0
ProcMe	0.745	0	0	0	0	0	0.797	0
DesCost	0.248	0	0	0	0	0	0	0.738
ConstrCost	0.242	0	0	0	0	0	0	0.718
ProCost	0.229	0	0	0	0	0	0	0.681

Appendix J8 (Direct Effects)

Direct Effects								
	BDC	SEF	NGD	SRF	PMCI	PSI	PCF	PCC
SEF	0.237	0	0	0	0	0	0	0
NGD	0.56	0	0	0	0	0	0	0
SRF	0.692	0	0	0	0	0	0	0
PMCI	0.771	0	0	0	0	0	0	0
PSI	0.7	0	0	0	0	0	0	0
PCF	0.644	0	0	0	0	0	0	0
PCC	0.241	0	0	0	0	0	0	0
InvesCon	0	0.994	0	0	0	0	0	0
BV	0	1.061	0	0	0	0	0	0
HP	0	1.043	0	0	0	0	0	0
Employment	0	1.009	0	0	0	0	0	0
Population	0	1.056	0	0	0	0	0	0
LCI	0	0.962	0	0	0	0	0	0
PI	0	0.916	0	0	0	0	0	0
PPI	0	0.984	0	0	0	0	0	0
CGPI	0	1	0	0	0	0	0	0
GBS	0	0	1.038	0	0	0	0	0
GET	0	0	1.048	0	0	0	0	0
NatFor	0	0	1.043	0	0	0	0	0
GPD	0	0	1	0	0	0	0	0
CCAct	0	0	0	0.994	0	0	0	0
FinReg	0	0	0	0.999	0	0	0	0
PoliPo	0	0	0	0.984	0	0	0	0
HSReg	0	0	0	1.004	0	0	0	0
BuilCC	0	0	0	1	0	0	0	0
MatMar	0	0	0	0	1.024	0	0	0
LabMar	0	0	0	0	0.994	0	0	0
ComLev	0	0	0	0	1.006	0	0	0
MarSS	0	0	0	0	0.997	0	0	0
BBCyc	0	0	0	0	0.994	0	0	0
SDRel	0	0	0	0	1	0	0	0
Client	0	0	0	0	0	1.026	0	0
Consultant	0	0	0	0	0	1.03	0	0
Contractor	0	0	0	0	0	1	0	0
ProL	0	0	0	0	0	0	0.998	0
ProCom	0	0	0	0	0	0	1.008	0
ProcMe	0	0	0	0	0	0	1	0
DesCost	0	0	0	0	0	0	0	1.078
ConstrCost	0	0	0	0	0	0	0	1.015
ProCost	0	0	0	0	0	0	0	1

Appendix J9 (Standardized Direct Effects)

Standardized Direct Effects								
	BDC	SEF	NGD	SRF	PMCI	PSI	PCF	PCC
SEF	0.466	0	0	0	0	0	0	0
NGD	0.774	0	0	0	0	0	0	0
SRF	0.855	0	0	0	0	0	0	0
PMCI	0.983	0	0	0	0	0	0	0
PSI	0.956	0	0	0	0	0	0	0
PCF	0.935	0	0	0	0	0	0	0
PCC	0.336	0	0	0	0	0	0	0
InvesCon	0	0.557	0	0	0	0	0	0
BV	0	0.64	0	0	0	0	0	0
HP	0	0.604	0	0	0	0	0	0
Employment	0	0.621	0	0	0	0	0	0
Population	0	0.632	0	0	0	0	0	0
LCI	0	0.528	0	0	0	0	0	0
PI	0	0.506	0	0	0	0	0	0
PPI	0	0.573	0	0	0	0	0	0
CGPI	0	0.566	0	0	0	0	0	0
GBS	0	0	0.741	0	0	0	0	0
GET	0	0	0.721	0	0	0	0	0
NatFor	0	0	0.737	0	0	0	0	0
GPD	0	0	0.71	0	0	0	0	0
CCAct	0	0	0	0.826	0	0	0	0
FinReg	0	0	0	0.795	0	0	0	0
PoliPo	0	0	0	0.819	0	0	0	0
HSReg	0	0	0	0.842	0	0	0	0
BuilCC	0	0	0	0.836	0	0	0	0
MatMar	0	0	0	0	0.84	0	0	0
LabMar	0	0	0	0	0.819	0	0	0
ComLev	0	0	0	0	0.863	0	0	0
MarSS	0	0	0	0	0.844	0	0	0
BBCyc	0	0	0	0	0.841	0	0	0
SDRel	0	0	0	0	0.815	0	0	0
Client	0	0	0	0	0	0.851	0	0
Consultant	0	0	0	0	0	0.852	0	0
Contractor	0	0	0	0	0	0.812	0	0
ProL	0	0	0	0	0	0	0.806	0
ProCom	0	0	0	0	0	0	0.852	0
ProcMe	0	0	0	0	0	0	0.797	0
DesCost	0	0	0	0	0	0	0	0.738
ConstrCost	0	0	0	0	0	0	0	0.718
ProCost	0	0	0	0	0	0	0	0.681

Appendix J10 (Indirect Effects)

Indirect Effects								
	BDC	SEF	NGD	SRF	PMCI	PSI	PCF	PCC
SEF	0	0	0	0	0	0	0	0
NGD	0	0	0	0	0	0	0	0
SRF	0	0	0	0	0	0	0	0
PMCI	0	0	0	0	0	0	0	0
PSI	0	0	0	0	0	0	0	0
PCF	0	0	0	0	0	0	0	0
PCC	0	0	0	0	0	0	0	0
InvesCon	0.236	0	0	0	0	0	0	0
BV	0.252	0	0	0	0	0	0	0
HP	0.247	0	0	0	0	0	0	0
Employment	0.239	0	0	0	0	0	0	0
Population	0.25	0	0	0	0	0	0	0
LCI	0.228	0	0	0	0	0	0	0
PI	0.217	0	0	0	0	0	0	0
PPI	0.233	0	0	0	0	0	0	0
CGPI	0.237	0	0	0	0	0	0	0
GBS	0.582	0	0	0	0	0	0	0
GET	0.587	0	0	0	0	0	0	0
NatFor	0.584	0	0	0	0	0	0	0
GPD	0.56	0	0	0	0	0	0	0
CCAct	0.688	0	0	0	0	0	0	0
FinReg	0.691	0	0	0	0	0	0	0
PoliPo	0.681	0	0	0	0	0	0	0
HSReg	0.695	0	0	0	0	0	0	0
BuilCC	0.692	0	0	0	0	0	0	0
MatMar	0.789	0	0	0	0	0	0	0
LabMar	0.766	0	0	0	0	0	0	0
ComLev	0.776	0	0	0	0	0	0	0
MarSS	0.769	0	0	0	0	0	0	0
BBCyc	0.766	0	0	0	0	0	0	0
SDRel	0.771	0	0	0	0	0	0	0
Client	0.718	0	0	0	0	0	0	0
Consultant	0.721	0	0	0	0	0	0	0
Contractor	0.7	0	0	0	0	0	0	0
ProL	0.643	0	0	0	0	0	0	0
ProCom	0.649	0	0	0	0	0	0	0
ProcMe	0.644	0	0	0	0	0	0	0
DesCost	0.26	0	0	0	0	0	0	0
ConstrCost	0.245	0	0	0	0	0	0	0
ProCost	0.241	0	0	0	0	0	0	0

Appendix J11 (Standardized Indirect Effects)

Standardized Indirect Effects								
	BDC	SEF	NGD	SRF	PMCI	PSI	PCF	PCC
SEF	0	0	0	0	0	0	0	0
NGD	0	0	0	0	0	0	0	0
SRF	0	0	0	0	0	0	0	0
PMCI	0	0	0	0	0	0	0	0
PSI	0	0	0	0	0	0	0	0
PCF	0	0	0	0	0	0	0	0
PCC	0	0	0	0	0	0	0	0
InvesCon	0.259	0	0	0	0	0	0	0
BV	0.298	0	0	0	0	0	0	0
HP	0.281	0	0	0	0	0	0	0
Employment	0.289	0	0	0	0	0	0	0
Population	0.294	0	0	0	0	0	0	0
LCI	0.246	0	0	0	0	0	0	0
PI	0.235	0	0	0	0	0	0	0
PPI	0.267	0	0	0	0	0	0	0
CGPI	0.264	0	0	0	0	0	0	0
GBS	0.574	0	0	0	0	0	0	0
GET	0.559	0	0	0	0	0	0	0
NatFor	0.571	0	0	0	0	0	0	0
GPD	0.55	0	0	0	0	0	0	0
CCAct	0.706	0	0	0	0	0	0	0
FinReg	0.679	0	0	0	0	0	0	0
PoliPo	0.7	0	0	0	0	0	0	0
HSReg	0.719	0	0	0	0	0	0	0
BuilCC	0.714	0	0	0	0	0	0	0
MatMar	0.826	0	0	0	0	0	0	0
LabMar	0.805	0	0	0	0	0	0	0
ComLev	0.849	0	0	0	0	0	0	0
MarSS	0.83	0	0	0	0	0	0	0
BBCyc	0.826	0	0	0	0	0	0	0
SDRel	0.801	0	0	0	0	0	0	0
Client	0.814	0	0	0	0	0	0	0
Consultant	0.815	0	0	0	0	0	0	0
Contractor	0.777	0	0	0	0	0	0	0
ProL	0.754	0	0	0	0	0	0	0
ProCom	0.796	0	0	0	0	0	0	0
ProcMe	0.745	0	0	0	0	0	0	0
DesCost	0.248	0	0	0	0	0	0	0
ConstrCost	0.242	0	0	0	0	0	0	0
ProCost	0.229	0	0	0	0	0	0	0

Appendix J12 (Model Fit Parameters)

CMIN					
Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	73	865.703	488	0	1.774
Saturated model	561	0	0		
Independence model	33	6586.919	528	0	12.475

RMR, GFI				
Model	RMR	GFI	AGFI	PGFI
Default model	0.04	0.86	0.84	0.749
Saturated model	0	1		
Independence model	0.335	0.167	0.115	0.157

Baseline Comparisons					
Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	0.869	0.858	0.938	0.933	0.938
Saturated model	1		1		1
Independence model	0	0	0	0	0

Parsimony-Adjusted Measures			
Model	PRATIO	PNFI	PCFI
Default model	0.924	0.803	0.867
Saturated model	0	0	0
Independence model	1	0	0

NCP			
Model	NCP	LO 90	HI 90
Default model	377.703	299.569	463.681
Saturated model	0	0	0
Independence model	6058.919	5800.571	6323.723

FMIN				
Model	FMIN	F0	LO 90	HI 90
Default model	2.895	1.263	1.002	1.551
Saturated model	0	0	0	0
Independence model	22.03	20.264	19.4	21.15

RMSEA				
Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	0.051	0.045	0.056	0.39
Independence model	0.196	0.192	0.2	0

AIC				
Model	AIC	BCC	BIC	CAIC
Default model	1011.703	1030.436	1282.08	1355.08
Saturated model	1122	1265.955	3199.822	3760.822
Independence model	6652.919	6661.387	6775.144	6808.144

ECVI				
Model	ECVI	LO 90	HI 90	MECVI
Default model	3.384	3.122	3.671	3.446
Saturated model	3.753	3.753	3.753	4.234
Independence model	22.251	21.387	23.136	22.279

HOELTER		
Model	HOELTER	HOELTER
	0.05	0.01
Default model	187	195
Independence model	27	28

APPENDIX K: ANALYSIS OF INTERVIEW RESPONSE

Q	Responses					TR	Ave	Conclusion
	5 (strongly agree)	4 (agree)	3 (neutral)	2 (Disagree)	1 (strongly disagree)			
1	5	10	3	1	1	20	3.85	Agree
2	4	9	5	1	2	21	3.57	Neutral
3	3	11	4	2	0	20	3.75	Agree
4	4	12	4	0	1	21	3.86	Agree
5	2	14	1	1	3	21	3.52	Neutral
6	5	12	2	0	0	19	4.15	Agree
7	6	6	7	1	0	20	3.85	Agree
8	6	8	7	0	0	21	3.96	Agree
9	5	12	3	1	0	21	4.00	Agree
10	1	13	7	0	0	21	3.72	Agree
11	0	6	9	4	1	20	3.00	Neutral
12	2	7	8	2	1	20	3.35	Neutral

Note: Q= Question number; TR=Total Responses; Ave=Average Score

APPENDIX L: PUBLICATIONS

J1: *Socio-Economic Indicators and Building development cost: A New Zealand Trend and Correlation Analysis 2001-2013*. Paper presented at *Building A Better New Zealand 2014 Conference*, Auckland, New Zealand.

J2: *Influence of Socio-Economic Conditions on Building Costs in New Zealand.* Paper published in the proceedings of 4th Annual New Zealand Building Environment Research Symposium (NZBERS), November 2014.

J3: Exploratory Factors Influencing Building development cost in New Zealand. Paper published in the *Journal of Buildings* [7(3), 2017, pp. 57-73: DOI: 10.3390/buildings7030057]

J4: *Predictors of Building Development Cost Trend: A New Zealand Multilevel Analysis*. Paper will be published in the proceedings of 5th Annual New Zealand Building Environment Research Symposium (NZBERS), [October 2017].

J5: A Better Modelling and Assessment of Key Factors Affecting Cost Performance of Building Projects: The Case of New Zealand. Paper published in *International Journal of Construction Engineering and Management* [September, 2017].

J6: Structural Equation Model for Investigating the Casual Relationships Between Project Complexities and Project Cost: An Empirical Study from New Zealand. Paper will be published in the *International Journal of Project Management.*

J7: Bayesian Structural Equation Modelling for Examining the Relationship between Multidimensional Factors and Building Project Cost. Paper will be published in *Building and Environment*.