Peer-reviewed version available at Buildings 2017, 7, 57; doi:10.3390/buildings7030057

Article

Exploratory Factors Influencing Building Development Costs in New Zealand Using SEM

Linlin Zhao , Jasper Mbachu and Niluka Domingo

School of Engineering and Advanced Technology, Massey University, 0632 Auckland, New Zealand; L.L.Zhao@massey.ac.nz; J.I.Mbachu@massey.ac.nz; N.D.Domingo@massey.ac.nz

Abstract: Identification of costs drivers and their influence level on building development costs play a key role in the development of construction models and improve the efficiency and effectiveness of any project. Forty-five indicators influencing building development costs in New Zealand are explored by literature review and pilot interviews. These indicators are grouped into seven categories. The determination and ranking of the cost drivers are carried out by a questionnaire survey distributed to key professionals working in New Zealand's construction industry. Structural equation modeling (SEM) software was employed for analysis of the collected data. One of the key advantages of this powerful software is to provide the p-value according to the structure of the research model. Findings of this study indicate that the property market and construction industry factor, statutory and regulatory factor, and socio-economic factors are major factor affecting building development costs in New Zealand.

Keywords: influencing factors; building development costs; New Zealand; structural equation modeling

1. Introduction

The construction industry is the fifth large sector in New Zealand, employing 8 percent of the total labor force, accounting for 10 percent of total businesses, and contributing 4 percent to GDP according to New Zealand Statistics [1]. Moreover, it is by far the largest investor of Gross Fixed Capital Formation (GFCF) which is the foundation of economic growth, contributing 45 percent of all investment in New Zealand [2]. Also, the construction industry plays a more important role in New Zealand's economy than any other industry - apart from gas, electricity, and the waste and water sector - through its workers' income spending and its spending on the supply chain. However, the construction industry is usually characterized by the domination of small firms and low labor productivity. The small firms are invariably lacking a breadth and depth of finance of a type that invests in capital to improve productivity. Lack of economic scale in the construction industry, especially in the residential construction group, significantly increases building development costs.

Many studies have been conducted to explore the factors influencing building development costs from various perspectives. However, the influencing factors for these specific costs are varied for different countries; therefore, an appreciation of a country's examination of the influencing factors for building development costs is required. Building development costs have increased dramatically during the last decade [3]. In the New Zealand context, building development costs increased more than the annual average earnings in Auckland for the period 2009 – 2014 [4]. Building costs rose by 9.48 percent in the country's eight major cities in 2013, up from the minimal year on year increase of 2.61 percent in 2012 [5].

The dramatic increases in building development costs are usually explained by the increase in the prices of building materials and labor [6]. 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 nature of the building materials, and other building materials have experienced a rather modest increase [7]. As the above has given rise

to different opinions, the main drivers behind the marked increase in building development costs remain unclear.

Exploring the relationship between building development costs and the significant influencing factors in the construction sector is vital to reliable cost estimation and cost management practices; fluctuations in building development costs could impact the decisions of investors, developers, clients, and financial institutions [8].A more reliable and validated relationship between building development costs and influencing factors can assist the investors, developers, and contractors in making appropriate decisions and ensuring well-planned cost management.

The clients that decide to invest in the construction sector consider the building development costs as the most important factor [9]. A lack of extensive studies on the leading indicators that significantly influence building development cost is one issue that impacts clients' investment [8]. A study of the factors significantly influencing building development costs in New Zealand would not only contribute to narrowing the gap in existing knowledge but also provide an evidence-base to support clients' investment decisions.

The study also contributes to methodological constructs by way of the detail description of structural equation modeling (SEM) and puts forward the framework for understanding the comprehensive and complex relationship between the latent factors and the building development costs.

2. A Brief Literature Review

Various factors significantly influence building development costs. 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, the 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 costs.

Bubshait and Al-Juwairah [10] addressed the theory that component costs factors and stakeholders' influences are the key determinants for building development costs in Saudi Arabia by measuring 42 factors known to affect building development costs. Chan and Park [11] conducted a random sample survey in Singapore to evaluate the factors that significantly influence building development costs, and then generated a result showing that project characters and stakeholders' influences are the major contributors to those costs.

Elhag et al. [12] stated that market and industry factors impose a strong influence on building development costs in the UK after the analysis of their questionnaire results. Bari et al. [13] identified the factors, such as the statutory and regulation factors and socio-economic conditions which significantly influence the building development costs, by conducting a questionnaire survey. The previous study also revealed that the national and global dynamics could directly and indirectly influence the building development costs as the demands for construction products are materially decided by exogenous determinants [14].

Many studies have examined the factors influencing building development costs [15]; however, the influence levels of the identified factors vary due to differences in the regulatory regimes of the construction industries. Furthermore, these studies only focused on preliminary influential factors such as building cost components, project character, stakeholders' influence, and new technology innovations. They did not examine wider factors, which also have effects on building development costs. 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 costs. Although many studies have examined the relationships between building development costs and influencing factors, only a few of them considered the effects of the macro-economy and policies that have underpinning effects on the aggregate economy [16].

It is necessary to explore the influencing factors for building development costs in New Zealand - it seems, according to literature reviewed - that so far no such investigation has been conducted

in this area. This study evaluates and ranks the cost drivers involved in the various stages of the development of building projects by employing a questionnaire survey to obtain the opinions and perspectives of the randomly selected samples of key professionals in New Zealand.

3. Methodology of Study

Study into the cost-influencing factors for building development costs in New Zealand is a qualitative and quantitative endeavor. The selected methodologies depend on their applicability for collecting and processing the available data and generating the results that limit the threats to external and internal validity. The literature survey and pilot interview were used to identify the factors influencing building development costs, and then the questionnaire survey was employed to quantify and validate the cost drivers.This study is carried out in three stages. First, the literature survey was conducted to find the factors influencing building development costs nationally and internationally. Then the influencing factors were grouped into seven categories in accordance with a previous study by Akintoye [17].

Second, the pilot interview with the key professionals including developers, asset managers, consultants, and project managers was used to determine the indicators that impact the building development costs in New Zealand. The pilot interview plays a key role in modifying and improving the draft questionnaire survey before sending it out to the potential respondents. Forty-five indicators are identified and grouped as project component costs factors, project characteristics factors, stakeholders' influences factors, property market and construction industry factors, statutory and regulatory factors, national and global dynamics, and socio-economy factors. These categories comprehensively involve all the criteria that should be considered in the development of a building construction project in New Zealand. Moreover, the semi-structured interview with the experts from construction and related industries also adds validity to the results and conclusion of the study.

Finally, a questionnaire survey is used to decide and rank these cost drivers based on their influence level on building development costs. The survey questionnaires were distributed by sending a web-link to the potential respondents, all of whom are registered members of New Zealand associations and institutions, such as New Zealand Institute of Architects (NZIA), New Zealand Institute of Quantity Surveyors (NZIQS), New Zealand Institute of Building (NZIOB), Association of Consulting Engineers of New Zealand (ACENZ), Property Institute New Zealand (PINZ), and Property Council New Zealand (PCNZ).

The response rate for the questionnaire survey was 18 percent. This is a normal response rate for a questionnaire survey carried out in the construction industry, according to [12]. The five-point Likert-scale (1=Very weak, 2=Weak, 3=Medium, 4=Strong, 5=Very Strong) was utilized to allow the respondents to determine the influence level of the indicators on building development costs in New Zealand.

4. Selection of Key Factors and Rationalization

Effective and efficient building cost planning is essential to ensuring that any building project is successful [18]. So accurate cost estimating is required from the earliest stages of the building project. However, inaccuracy in cost estimation is high in New Zealand. This is especially due to difficulty in identifying those indicators that can significantly influence building development costs. The heart of this study is to explore the factors that have significant effects on building development costs in New Zealand.

Previous studies have decided on numerous factors influencing building development costs, while there is a high degree of similarity in the influencing factors across many building projects. But these influencing factors do not necessarily follow suit. Several studies have been conducted in New Zealand to identify the cost-influencing factors, such as investor tendency, financing costs, relatively high material costs, shortage of skilled labor, increased population, and strict building code and health and safety regulations.However, these studies only focused on several indicators that influence

building development costs. This study identified 45 indicators that influence building development costs and sorts them into seven categories based on the literature survey and the interviews with the key professionals.

The seven categories are project component cost factor (PCC), project characteristics factor (PCF), project stakeholders' influence factor (PSI), property market and construction industry factor (PMCI), statutory and regulatory factor (SRF), national and global dynamics (NGD), and the socio-economic factor (SEF). The bulk of the 45 indicators grouped under these seven latent factors have been regarded as measured variables. Table 1 summarizes these seven latent factors and their respective measured variables as the hypothetical construct of the study.

5. Research Model Development and Conceptual Framework

Project component costs factor (PCC) is defined as a factor including three indicators, namely design costs (PCC1), construction costs (PCC2) and procurement costs (PCC3). Project characteristics factor (PCF) is attributable to five indicators, namely project location (PCF1), project complexity (PCF2), procedures methods (PCF3), contract types (PCF4) and technological innovations (PCF5). Project stakeholders' influence factor (PSI) is associated with five indicators: clients (PSI1), consultants (PSI2), contractors (PSI3), suppliers (PSI4) and building officials (PSI5). Property market and construction industry factor (PMCI) is defined as a factor involving eight indicators, namely material market (PMCI1), labour market (PMCI2), level of competition (PMCI3), market structure and size (PMCI4), boom and bust cycle (PMCI5), relationship of demand and supply (PMCI6), investment tendency (PMCI7), and housing sell and rental prices (PMCI8).

Statutory and regulatory factor (SRF) can be represented by five indicators, namely building code and compliance (SRF1), health and safety regulations (SRF2), political polices (SRF3), financial regulations (SRF4) and construction contract act (SRF5). National and global dynamics (NGD) is related to four indicators, namely global political dynamics (NGD1), natural forces (NGD2), the global economic trend (NGD3), and global business sentiments (NGD4). Socio-economic factor (SEF) is attributable to 15 indicators, namely gross domestic production (SEF1), capital goods prices (SEF2), producers price (SEF3), consumer price index (SEF4), productivity in construction industry (SEF5), labour costs (SEF6), net migration (SEF7), employment rate (SEF8), housing prices (SEF9), building consents (SEF10), energy prices (SEF11), exchange rate (SEF12), monetary policies (SEF13), investor confidence (SEF14), and fiscal policies (SEF15).

Using this framework of factors and dimensions of building development costs, a hypothetical diagram of the structural model incorporating these seven latent factors with their corresponding measured indicators, is presented in Figure 1. The structural model reveals the relationship between the building development costs and associated influencing factors. The direction of the arrows and the path loadings represent hypothetical, direct and indirect influences in the structural model. The corresponding hypotheses are list below:

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

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

H3: Project stakeholders' influence factor (PSI) has significant effects on the building development costs in New Zealand.

H4: Property market and construction industry factor (PMCI) has significant effects on the building development costs in New Zealand.

Peer-reviewed version available at Buildings 2017, 7, 57; doi:10.3390/buildings7030057

H5: Statutory and regulation factor (SRF) has significant effects on the building development costs in New Zealand.

H6: National and global dynamic factor (NGD) has significant effects on the building development costs in New Zealand.

H7: Socio-economic factor (SEF) has significant effects on the building development costs in New Zealand.

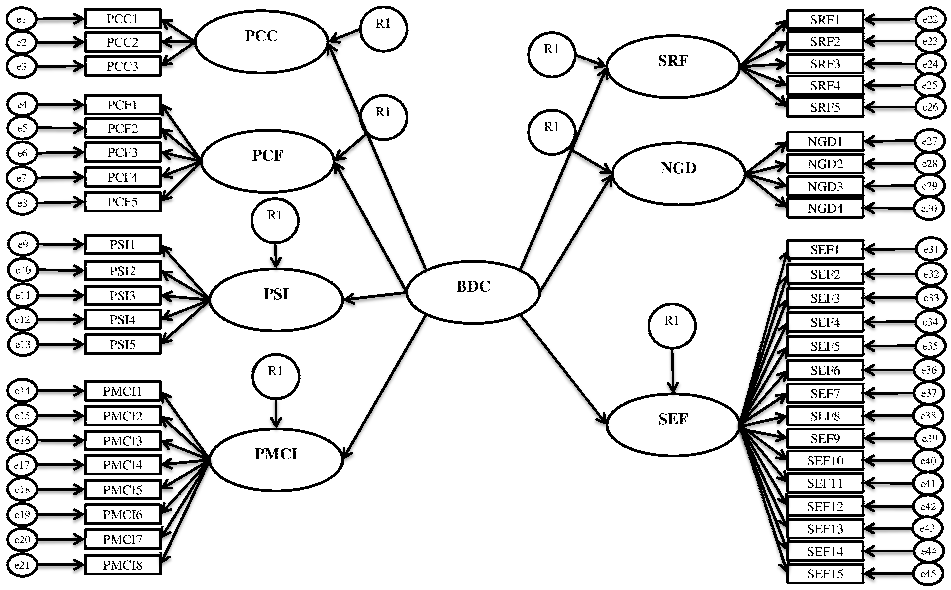

Figure 1. Structural Equation Model

6. Analytical Approach: the Application of SEM

Structural equation modeling is a multivariate method, which examines the relationship among exogenous latent variables and endogenous latent variables [19]. Structural equation modeling (SEM) uses various types of theoretical models to describe the relationship among observed and latent variables, which provides the quantitative test for a researcher's hypothesis [20].

Structural equation modeling was widely used in psychology and sociology [21]. Although SEM has been commonly used in other disciplines, its application in construction management research is not widespread. As the construction management studies usually involved data difficult to quantify, SEM is capable of identifying the influence of latent factors on the measured phenomenon [22].

In Figure 1, the path arrows show the hypothetical relationship among the dependent variables and independent variables and measured indicators. The rectangular shapes indicate the observed variables that are the individual items on the questionnaire survey (Table 1). There are several reasons for using SEM in this study. First, the latent variables are included in the model. Second, the study aims to examine the relationship between the latent variables. Third, structural equation modeling does not require data normally distributed as data from a perspective rating which is of unknown distribution. Finally, the SEM is capable of combining theoretical and empirical knowledge to advance understanding.

7. Reliability of Constructs

The reliability and validity of the constructs are essential for further analysis and arriving at reasonable research conclusions and results. The most widely used method for reliability testing is

Peer-reviewed version available at Buildings 2017, 7, 57; doi:10.3390/buildings7030057

Cronbach's alpha. This study employed the SPSS 23 to do the Cronbach's alpha test for all the eight constructs in the study.

The alpha values for the eight constructs are acceptable as they range between 0.8 and 0.9. Specifically, the reliability value of the component costs factor is 0.957, and the property market and industry factor has a responsibility alpha value of 0.921, while other constructs also report high reliability alpha values, as shown in Table 1. Therefore, the reliability of the constructs is acceptable as the satisfied reliability value is higher than 0.7 as recommended by [23].

Table 1. Measurement scale of constructs.

Latent Constructs	Indicators	Factor Loading	Cronbach's Alpha
Project Component Costs Factor (PCC)	Design Costs(PCC1)	0.582	0.957
	Construction Costs (PCC2)	0.642	
	Procurement Costs (PCC3)	0.577	
Project Characteristics Factor (PCF)	Project Location (PCF1)	0.748	0.871
	Complexity (PCF2)	0.62	
	Procedures Methods (PCF3)	0.71	
	Contract Types (PCF4)	0.869	
	Tech Innovations (PCF5)	0.786	
Project Stakeholders Influences Factor (PSI)	Clients (PSI1)	0776	0.902
	Consultants (PSI2)	0.813	
	Contractors (PSI3)	0.899	
	Suppliers (PSI4)	0.655	
	Building Officials (PSI5)	0.492	
Property Market and Construction Industry Factor (PMCI)	Material Market (PMCI1)	0.516	0.921
	Labor Market (PMCI2)	0.556	
	Level of Competition (PMCI3)	0.69	
	Market Structure and size (PMCI4)	0.469	
	Boom and Bust Cycle (PMCI5)	0.498	
	Supply and Demand (PMCI6)	0.691	
	Investment Tendency (PMCI7)	0.684	
	House R/S Prices (PMCI8)	0.641	
Statutory Regulatory Factor (SRF)	Building Code and Compliance (SRF1)	0.708	0.919
	Health and Safety Regulations (SRF2)	0.816	
	Political Policies (SRF3)	0.661	
	Financial Regulations (SRF4)	0.695	
	Construction Contract Act (SRF5)	0.529	
National and Global Dynamics (NGD)	Global Political Dynamics (NGD1)	0.567	0.895
	Natural Forces (NGD2)	0.822	
	Global Economic Trend (NGD3)	0.696	
	Global Business Sentiments (NGD4)	0.451	
Socio Economic Factor (SEF)	Gross Domestic Production (SEF1)	0.472	0.88
	Capital Goods Prices (SEF2)	0.67	
	Customer Price Index (SEF3)	0.721	
	Producer Price (SEF4)	0.637	
	Construction Productivity (SEF5)	0.651	
	Labor Cost (SEF6)	0.536	
	Net Migration (SEF7)	0.617	
	Employment Rate (SEF8)	0.452	
	House Prices (SEF9)	0.656	
	Building Consents (SEF10)	0.744	
	Energy Prices (SEF11)	0.574	
	Exchange Rate (SEF12)	0.732	
	Monetary Policies (SEF13)	0.528	
	Investor Confidence (SEF14)	0.807	
	Fiscal Policies (SEF15)	0.684	

8. Analysis of the Structural Equation Model

Confirmatory factor analysis was conducted to test the validity of the constructs in this study as the established relationship between the constructs and indicators, and the constructs are from the previous study. One important facet of confirmatory factor analysis is to test whether the constructs can be well explained by the related indicators [24]. The construct validity is acceptable when the factor loadings of the related indicators exceed 0.4 as suggested by Hair et al. [24]. The analysis results explore all the factor loadings of the indicators' range from 0.451 to 0.899, which means all the values are satisfied; thereby the validity of the constructs is achieved.

After the reliability and validity test of the constructs, the Amos software was employed to draw the structural model including all the constructs and relative indicators. The goodness of fit indices generated from Amos output should reveal the good fit of the structural model in order to test the hypothesis. In this study, the structural model has achieved adequate fit identified by Chi-square, df, GFI, IFI, CFI, NFI, PGFI, TLI and RMSEA, shown in Table 2.

Table 2. Goodness of fit indices for the structural model

Goodness of Fit Indices	Recommended Level	Structural Model
Chi-square/df	<2 Tabachnick and Fidell [25]	1.009
Goodness of Fit Index (GFI)	>0.95 Fan et al.[26]	0.961
Incremental Fit Index (IFI)	>0.9 Bollen[27]	0.947
Comparative Fit Index (CFI)	>0.93 Byrne [28]	0.983
Normed Fit Index (NFI)	>0.9 Bentler and Bonett [29]	0.922
Parsimony Goodness of fit (PGFI)	>0.6 Williams and Holahan [30]	0.875
Tucker-Lewis Index (TLI)	>0.9 Hoyle [31]	0.979
Root Mean Square Error of Approximation (RMSEA)	<0.05 MacCallum and Austin [32]	0.001

9. Hypothesis Testing

The regression result in Amos output explored the property market and construction industry factor has significant positive effects on building development costs as the critical value is greater than the cut off value of 1.96, so the hypothesis is accepted. Moreover, the analysis result also revealed that statutory and regulatory factors can have a significant negative influence on building development costs; hence, the hypothesis is accepted.

In addition, the generated output also indicated that the socio-economic factors have significant positive effects on building development costs, thereby, the hypothesis is accepted. In sum, the analysis output explored that the property market and construction industry factors, statutory and regulatory factors and socio-economic factors can explain 48 percent of the total variance in building development costs. The hypothesis testing results are shown in Table 3.

Table 3. Hypothesis testing results

Hypothesis	Std Estimate	S.E.	C.R.	p	Hypothesis Accepted
H1	0.145	0.076	1.892	0.058	No
H2	0.119	0.071	1.66	0.097	No
H3	0.137	0.076	1.806	0.071	No
H4	0.226	0.09	2.51	0.023	Yes
H5	0.121	0.065	1.867	0.062	No
H6	0.214	0.096	2.23	0.029	Yes
H7	0.175	0.085	2.07	0.035	Yes

10. Discussion of Results

This research aims to explore the effects of influencing factors on building development costs in New Zealand, such as project component costs factors, project characteristics factors, project

stakeholders' influences factors, property market and construction industry factors, statutory and regulatory factors, national and global dynamics factors, and socio-economic factors. The analysis results revealed that the property market and construction industry factors have significant positive effects on building development costs in New Zealand. This conclusion is supported by some previous studies[33–37].

Since the result identified the strong relationship between property market and construction industry factors and building development costs, it is suggested that the construction activities purchase all the resources from the construction industry and sell their products to the market. The building development costs are influenced by the resource supply (labour, material and plant) in the construction industry, and the relationship between supply and demand in the property market. Moreover, the other related indicators also have indirect effects on building development costs, such as competition level, market structure and size, and boom and bust cycle. Therefore, all the indicators combine as property market and construction industry factors can significantly influence building development costs in New Zealand.

Moreover, the result also identified that the statutory and regulatory factors have significant effects on building development costs in New Zealand; this corroborates well with several previous studies [38]. Base on the study of Roberti [39], the imposed regulatory effects on projects required by building codes can influence the building development costs of the project, including zone development fees, tip fees, and strict requirements raised for earthquake-prone zones. Further support from Page [40] found that the health and safety regulations also can influence building development costs as the stricter and complicated requirements for construction site and staff working on the site might have more money spent on the site management and staff safety training, thereby increasing the building development cost. In addition, some previous studies also identified that financial regulations can influence building development costs by directly influencing the cost of borrowing in the construction industry. Hence, the statutory and regulatory factors have significant effects on building development costs in New Zealand.

Finally, the result also revealed that socio-economic factors have significant effects on building development costs in New Zealand. Some previous studies have identified that socio-economic conditions can significantly influence building development costs as all economic activities – including construction activities and their associated costs - are influenced by socio-economic situations [41–44]. Furthermore, it had been stated previously that increases in population, employment and income have positive effects on building development costs as the increased population raises the need for housing, while the increase in employment requires more workplaces resulting in an increase in the demand for commercial buildings. In addition, the increased income boosts the demand for housing. Finally, monetary policy affects all economic activities and influences the supply of construction products in the construction industry and the demand for housing, which is also in line with previous studies [45].

This result suggests that building development costs in New Zealand are more influenced by the market and industry situation, regulatory regimes and the macro-economic environment rather than the primary and immediate direct factors, such as component costs factors, project characteristics factors and stakeholders' influence factors. However, the national and global dynamics also have minus effects on building development costs in New Zealand, which is not as the study previously assumed. This might be because the data involved in this study is mainly from professionals who worked in the construction industry and cannot provide information of national and global economic situations. The other reason might be that New Zealand is a relatively small and isolated economic zone that is not significantly influenced by global situations. However, one indicator–natural disasters– strongly influenced the construction industry in New Zealand; the Christchurch earthquake suddenly and dramatically increased the demand for housing and also was one of the key drivers for the increase in building development costs in New Zealand.

Project component costs factors did not show significant effects on building development cost movements. Although the design costs, procurement costs and construction costs comprise building development costs, they are more influenced by the market and industry, the regulatory regimes, and the macro-economy environment [46–48]. Project characteristics factors also cannot significantly influence building development costs as the project location indicators are more influenced by the local market and industry factors, while procedure methods and contract types are more influenced by the statutory and regulatory factor. Project complexity and technology innovation applications are more influenced by the combination of market and industry factors, statutory and regulatory factors, and macro-economy factors. So the project characteristics factors are more influenced by the combination of market and industry factors, regulatory factors and macro-economy factors. In addition, stakeholders' influence should significantly impact the building development costs but the analysis result did not identify that. This might be due to the people involved in the building projects being involved in many disciplines, with different interests, so that their effects on building development costs are varied and conflicting. Hence, their effects on building development costs are not significant as their influences might cancel out each other. It is not uncommon for conflicting interests to exist among project stakeholders, as identified by Olander and Landin [49].

11. Conclusion

There are a total 45 indicators that impact building development costs in New Zealand, as identified from the literature review and pilot interviews with key professionals working in the construction industry and related industries within New Zealand. Consequently, these indicators are grouped into seven categories following the classification from a previous study. Only three categories out of seven are considered by the respondents as factors that significantly influence building development costs in New Zealand.

The study explores three significant factors that could influence building development costs in New Zealand. It provides a model for explaining the multi-level or multi-dimensional effects on those costs. It also provides a better understanding of those costs in New Zealand by identifying the most significant and influential factors.

Further research should be conducted to investigate whether the respondents from different disciplines possess different or discrepant views on the cost drivers and their influence levels. The cost drivers from this study can be used as parameters for any project cost estimating model that should be developed in New Zealand's construction industry.

Acknowledgments: This research is financially supported by Chinese Scholarship Council and Building Research Association New Zealand (BRANZ). The appreciation should give the key professionals from the construction industry in New Zealand for providing their opinions, support and assistance

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

MDPI: Multidisciplinary Digital Publishing Institute
SEM: Structural Equation Modeling
NZ: New Zealand
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
PINZ: Property Institute New Zealand
PCNZ: Property Council New Zealand
PCC: Project Component Costs

PCF: Project Characteristics Factor
PSI: Project Stakeholders Influences Factor
PMCI: Property Market and Construction Industry Factor
SRF: Statutory and Regulatory Factor
NGD: National and Global Dynamics
SEF: Social Economic Indicators
GFI: Goodness of Fit Indices
df: Degree of Freedom
IFI: Incremental Fit Index
CFI: Comparative Fit Index
NFI: Normed Fit Index
PGFI: Parsimony Goodness of Fit
TLI: Tucker-Lewis Index
RMSEA: Root Mean Square Error of Approximation

References

1. New Zealand Statistics (NZS). *Global New Zealand International trade, investment, and travel profile*; New Zealand Foreign Affairs and Trade: Wellington, New Zealand, 2013.
2. PWC. *Valuing the role of construction in the New Zealand economy*; An Economic Analysis of Construction Sector, Construction Strategy Group; Construction Strategy Group (CSG); Auckland, New Zealand, 2011.
3. Boymal, J.; Silva, A.; Pomeroy, J. Quantity and quality estimates of changes in dwelling affordability in metropolitan Melbourne. *Aust.J.Reg.Stud*. **2013**, *19*, 64-84.
4. Helm, A. *Auckland house prices continue their relentless rise*; The National Business Review: Auckland, New Zealand, 2014.
5. Delmendo, C. *House price rises accelerating in Australia*; Global Property Guide (GPG): Bristol, UK, 2014.
6. Government Procurement Branch. *Total Cost of Ownership*; Ministry of Business, Innovation and Employment (MBIE): Wellington, New Zealand, 2013.
7. Cement and Concrete Association of New Zealand (CCANZ). *Material cost report*; CCANZ: Wellington, New Zealand, 2013.
8. Johnson, C.; Adelekan, I.; Bosher, L.; Jabeen, H.; Kataria, S.; Marome, A. W.; Zerjav, B.; Arefian, F. Private sector investment decisions in building and construction: increasing,managing and transferring risks. *The UNISDR 2013 Global Assessment Report.* **2013**.
9. Grimsey, D.; Lewis, M. Are Public Private Partnerships Value for Money? Evaluating Alternative Approaches and Comparing Academic and Practitioner Views. *Account Forum.* **2005**, *4*, 345-378.
10. Bubshait, A.A.; Al-Juwairah, Y.A. Factors Contributing to Construction Costs in Saudi Arabia. *Cost.Eng.* **2002**,*44(5)*, 30-34.
11. Chan, S.L.; Park, M. Project Cost Estimation Using Principal Component Regression. *Constr.M. Econ.* **2005**, *23(3)*, 295-304.
12. Elhag, T.M.S.; Boussabaine, A.H.; Ballal, T.M.A. Critical Determinants of construction tendering costs: Quantity Surveyor's standpoint. *Int.J.Pro.Manag.* **2005**, *23*, 535-545.
13. Bari, N.A.A.; Yusuff, R.; Ismail, N.; Jaapar, A.; Ahmad, N.Factors influencing the Construction Cost of Industrialised Building System projects. *Procd.Soc.Behv.* **2012**, *35*, 689-696.
14. Ive, G.J.; Gruneberg, S.L. *The Economics of the Modern Construction Sector*. Basingstoke: Macmillan, 2000.
15. Hwang, S. Dynamic Regression Models for Prediction of Construction Costs. *J.Constr.Eng.M.ASCE.* **2009**.
16. American Institute of Steel Construction (AISC). *Understanding the supply chain*; AISC: Chicago, USA, 2014.
17. Akintoye, A. Analysis of factors influencing project cost estimating practice.*Constr. Manag. Econ.* **2000**, *18 (1)*, 77-89.
18. Son, H.; Kim, C.; Kim, C. Hybrid principal component analysis and support vector machine model for predicting the cost performance of commercial building projects using pre-project planning variables. *Automat.Constr.* **2012**, *27*, 60-66.

19. Hox, J.J; Bechger, T.M. An introduction to structural equation modeling. *Fam.Sci.Rev.* **1998**, *11*, 354-373.
20. Byrne, B. M. *Structural equation modeling With AMOS basic concepts, applications, and programming*, 3rd ed.; Routledge, Taylor and Francis: New York, 2016.
21. Yang, J.B.; Ou, S.F., Using structural equation modeling to analyze relationships among key causes of delay in construction.*Can.J.Civil.Eng.* **2008**, *35*, 321-32.
22. Islam, M.D.M.; Faniran, O.O., Structural equation model of project planning effectiveness. *Constr.Manag.Econ.* **2005**, *23*, 215-23.
23. Pallant, J. *SPSS survival manual : a step by step guide to data analysis using IBM SPSS*. Crows Nest, N.S.W.: Allen and Unwin.
24. Hair, J.; Black, W.C.; Babin, B.J.; Anderson, R.E. *Multivariate data analysis*. Pearson Education International: Upper saddle River, New Jersey, 2010.
25. Tabachnick, B.G.; Fidell, L.S. *Using Multivariate Statistics.* Allyn and Bacon: Needham Heights, MA, 2001.
26. Fan, X.; Thompson, B.; Wang, L., Effects of sample size, estimation methods, and model specification on structural equation modeling fit indexes. *Struct.Equation.Model.* **1999**, *9*, 56-83.
27. Bollen, K.A. *Structural Equations with Latent Variables*. Wiley: New York, 1989.
28. Byrne,B.M. *Structural Equation Modeling With Eqs and Eqs/Windows* Sage Publications:Thousand Oaks, CA, 1994.
29. Bentler, P.M.; Bonett, D.G. Significant tests and goodness of fit in the analysis of covariance structures.*Psychol.Bull.* **1980**, *88*, 588-606.
30. Williams, L.J.; Holahan, P.J. Parsimony-based fit indices for multiple-indicator models: Do they work? *Struct.Equation.Model.* **1994**, *1*,161-189.
31. Hoyle, R.H. *Structural Equation Modeling: Concepts, Issues, and Applications*.Sage: Thousand Oaks, CA, 1995.
32. MacCallum, R.C.; Austin, J.T. Applications of structural equation modeling in psychological research. *Annu.Rev.Psychol.* **2000**, *51*, 201-226.
33. Ball, M. *Markets and Institutions in Real Estate and Construction*. Blackwell Publishing Ltd: Oxford, 2006.
34. Chiang, Y.H.; Tang, B.S.; Leung, W.Y., Market Structure of the Construction Industry in Hong Kong.*Constr.Manag.Econ.* **2001**, *19*, 675-687.
35. Parke, W.; Warren, A. *The effects of boom bust on national construction industry performance*. Ministry for Business, Innovation and Employment (MBIE): Wellington, New Zealand, 2014.
36. Toh, T.C.; Ting, C.; Ali, K.N.; Aliagha, G.U.; Munir, O. Critical Cost Factors of Building Construction Projects in Malaysia. In Proceedings of International Conference on Asia Pacific Business Innovation and Technology Management,Pattaya, Thailand, 13-15 January 2012.
37. Watson, E. *A closer look at some of the supply and demand factors influencing residential property markets*; Reserve Bank of New Zealand (RBNZ): Wellington, New Zealand, 2013.
38. Schill, M. H. Regulations and Housing Development: What We Know. *J.Policy.Dev.Res.* **2005**, *8(1)*, 5-19.
39. Roberti, J.R. *Trends in New Residential Construction in Auckland*; Building Research Association New Zealand (BRANZ): Porirua, New Zealand, 2014.
40. Page, I.C. *New House Price Modeling Study Report*; Building Research Association New Zealand (BRANZ): Porirua, New Zealand, 2008.
41. Adams, Z.; Füss, R. Macroeconomic determinants of international housing markets. *J.Hous.Econ.* **2009**, *19*, 38-50.
42. Iyer, K.C.; Jha, K.N. Factors Affecting Cost Performance: Evidence from Indian Construction Projects.*Int.J.Proj.Manag.* **2004**, *23*, 283-295.
43. Ng, S.T.; Cheung, S.O.; Skitmore, R.M.; Lam, K.C.; Wong, L.Y. Prediction of tender price index directional changes. *Constr.Manag.Econ.* **2000**, *18*, 843-852.
44. Wong, J.M.W.; Ng, S.T. Forecasting construction tender price index in Hong Kong using vector error correction model. *Constr.Manag.Econ.* **2010**, *28*, 1255-1268.
45. Forni, M.; Gambetti, L. The dynamic effects of monetary policy: A structural factor model approach. *J.Monetary.Econ.* **2009**, *57*, 203-216.
46. Bygballe, L.E.; Hakansson, H.; Jahre, M. A critical discussion of models for conceptualizing the economic logic of construction. *Constr. Manag.Econ.* **2013**, *31(2)*, 104-118.
47. Dlamini, S. Relationship of construction sector to economic growth. In Proceedings International Congress on Construction Management, Canada, 2012.

48. Squicciarini, M.; Asikainen, A.L. A value chain statistical definition of construction and the performance of the sector. *Constr.Manag.Econ.* **2011**, *29*, 671-693.
49. Olander, S.; Landin, A. Evaluation of stakeholder influence in the implementation of construction projects. *Int.J.Proj.Manag.* **2005**, *23*, 321-328.