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

2018
BUILDING DEVELOPMENT COST DRIVERS IN THE NEW ZEALAND CONSTRUCTION INDUSTRY: A MULTILEVEL ANALYSIS OF THE CAUSAL RELATIONSHIPS

A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy (PhD)

in

Construction

School of Engineering & Advanced Technology

Massey University

Albany

New Zealand

Lin Lin Zhao

[SID 09166424]

February 2018
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.

__________________________
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.”
Acknowledgements

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I sincerely express my utmost appreciation to the professional associations/institutions in New Zealand and internationally operated, such as NZIA, NZIQS, NZIOB, ACENZ, PINZ, and PCNZ for their assistance in providing their in-depth insights based on their expertise and experience. Moreover, a big thank you to all those people who provided assistance and the facilities enabling contact and connection with the industry professionals.

I also wish to express thanks to Massey University Human Ethics Committee (MUHEC) for granting approval to undertake the stakeholder consultation process.

I am grateful to the organizations and individuals who participated in this research. Heartfelt thanks go to all the clients, consultants, contractors and project managers, quantity surveyors
and all those industry-related professionals who extended their support, dedicated their time and shared the data required for this research.

Finally, my sincere thanks go to my family for their blessings, unfailing faith, and enormous support, all of which has contributed to my progress to date towards successful completion of this research. I am very glad to have an opportunity to say “Thank You” to my great Mom — Li Feng Yun. You are so kind, so careful, and such a lovely Mother; I am so lucky to be your child. Moreover, I will always have sadness in my heart for my Father – his loss was such a blow.
Dedication

To my amazing Mother

Feng Yun Li
## List of Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ACENZ</td>
<td>Association of Consulting Engineers New Zealand</td>
</tr>
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<td>AMOS</td>
<td>Analysis of Moment Structures</td>
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<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
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<tr>
<td>BDC</td>
<td>Building Development Cost</td>
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<tr>
<td>BRANZ</td>
<td>Building Research Association of New Zealand</td>
</tr>
<tr>
<td>DBH</td>
<td>Department of Building and Housing</td>
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<tr>
<td>IPENZ</td>
<td>Institution of Professional Engineers New Zealand</td>
</tr>
<tr>
<td>MANOVA</td>
<td>Multivariate Analysis of Variance</td>
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<tr>
<td>MUHEC</td>
<td>Massey University Human Ethics Committee</td>
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<tr>
<td>NGD</td>
<td>National and Global Dynamics Factor</td>
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<td>NGD1</td>
<td>Global Political Dynamics</td>
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<td>NGD2</td>
<td>Natural Forces</td>
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<td>NGD3</td>
<td>Global Economic Trend</td>
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<td>NGD4</td>
<td>Global Business Sentiments</td>
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<td>NZIA</td>
<td>New Zealand Institute of Architects</td>
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<tr>
<td>NZIOB</td>
<td>New Zealand Institute of Building</td>
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<tr>
<td>NZIQS</td>
<td>New Zealand Institute of Quantity Surveyors</td>
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<tr>
<td>PCA</td>
<td>Principal Component Analysis</td>
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<td>PCC</td>
<td>Project Component Costs Factor</td>
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<tr>
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<td>PCC1</td>
<td>Design Cost</td>
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<td>PCC2</td>
<td>Construction Cost</td>
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<td>PCC3</td>
<td>Procurement Cost</td>
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<td>PCF</td>
<td>Project Characteristics Factor</td>
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<td>Project Location</td>
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<td>PCNZ</td>
<td>Property Council New Zealand</td>
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<td>PINZ</td>
<td>Property Institute of New Zealand</td>
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<tr>
<td>PMCI</td>
<td>Property Market and Construction Industry Factor</td>
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<td>PMCI1</td>
<td>Material Market</td>
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<td>PMCI2</td>
<td>Labour Market</td>
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<td>PMCI3</td>
<td>Competition Level</td>
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<td>PMCI4</td>
<td>Market Structure &amp; Size</td>
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<td>PMCI5</td>
<td>Boom and Bust Cycles</td>
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<td>PMCI6</td>
<td>Relationship of Supply and Demand</td>
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<tr>
<td>PMCI7</td>
<td>Investment Tendency</td>
</tr>
<tr>
<td>PMCI8</td>
<td>House Sell/Rent Prices</td>
</tr>
<tr>
<td>PSI</td>
<td>Project Stakeholders’ Influences Factor</td>
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LIST OF ABBREVIATIONS

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
<table>
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<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>SEF15</td>
<td>Government Fiscal Policies</td>
</tr>
<tr>
<td>SEM</td>
<td>Structural Equation Modelling</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences</td>
</tr>
<tr>
<td>SRF</td>
<td>Statutory and Regulatory Factor</td>
</tr>
<tr>
<td>SRF1</td>
<td>Building Code and Compliance</td>
</tr>
<tr>
<td>SRF2</td>
<td>Health and Safety Regulations</td>
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<tr>
<td>SRF3</td>
<td>Political Policies</td>
</tr>
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<td>SRF4</td>
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