EXPLORING COST AND RISK ISSUES IN THE VARIABILITY BETWEEN DESIGN STAGE ELEMENTAL COST PLAN AND FINAL TENDER SUM

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SYNOPSIS

Problem / Motivation: The reliability of final tender sums in traditional contracting depends on the accurate projections of baseline cost plans developed at the design development stage. However, no matter how much care and effort is put into the preparation of design stage elemental cost plans, deviations are usually observed. Accurate predictions are challenging and are attributable to the risk elements inherent in construction project developments.

Knowledge gap: Knowledge on how risk factors combine to influence the variability between design stage elemental cost plan and final tender sum is required. Previous researches have not investigated the nature of this variability in a manner that a model can be developed to improve accuracy in tender sum predictions in New Zealand.

Aim and objective: The aim of this study is to investigate the influence of risks on the variability between design stage elemental cost plan and final tender sum in building procurement, with a view to developing a model that could permit the prediction of final tender sum.

Research methods: Preliminary data were collated from some case study projects (8) and followed by interviews with 5 key project participants. The analyses comprise descriptive statistics, thematic analysis and analysis of documents obtained from the archives of the interviewed practitioners to arrive at the research conclusion.

Preliminary findings: The preliminary findings confirm the variability between elemental cost plans and final tender sums in the region of -14% and +13%. Client’s change, incomplete design information and site investigation information are the risk elements that have the major influence on the variability observed in the study.

Research Significance: These preliminary results confirm a significant variability between elemental cost plans and final tender sums while the risk factors identified are responsible for the deviations observed. The primary contribution of this study to the construction industry is the emergence of a risk profile which represents an outcome corroborated by previous related researches to facilitate risk management and cost planning practice.

KEYWORDS: Cost, Elemental cost plan, Final tender sum, Risk, Variability

INTRODUCTION
The construction industry, perhaps more than most, is plagued by risk. Project risk in construction environments is often dealt with inadequately, being a contributory factor to the instances of poor performance of construction projects (Bryde & Volm, 2009; Jin et al., 2007). Hence, whenever a construction project is embarked upon, there are some risk elements inherent in it such as design risk, price risk, physical risk, environmental risk, logistics risk, financial risk, legal risk, political risk, contractual risk, construction risk, operational risk among others (Onukwube et al., 2009). These risks must be assessed and accounted for in tenders. Otherwise, a construction enterprise may suffer a tremendous loss and eventually fail (Laryea & Hughes, 2006; Odeyinka et al., 2006; Onukwube et al., 2009).

In a similar study, it was opined that reliable prediction of final tender sums of building projects from the cost plans has posed challenges for clients and practitioners in New Zealand. No matter how much care and effort is put into the preparation of design stage elemental cost plans, deviations are usually observed between these cost plans and the final tender sum (Adafin et al., 2014). Such deviations in the region of +1% to 12% are also evidenced in a number of related previous studies by Skitmore and Picken (2000), Odeyinka and Yusif (2003), Aibinu and Pasco (2008) and Oladokun et al. (2011). According to Odeyinka (2007) the major attributable factors for these deviations are the risk elements that are inherent in construction project developments. Other researchers who have analysed the factors that affect the accuracy of pre-tender cost estimates include Akintoye (2000), Enshassi et al. (2007), Zou et al. (2007), Odusami and Onukwube (2008) and Enshassi et al. (2013). Whilst it is recognized that risk factors exist, the traditional way of dealing with them is to make a percentage or lump sum allowance in the form of contingency sum in cost plans and tender sums Odeyinka (2010). Bello and Odusami (2008) further explained that this conventional approach has been criticised and is a reason why so many projects are completed over budget. Thus, according to Baloi and Price (2003), Bello and Odusami (2008), Hlaing et al. (2008) and Tsai and Yang (2010) more analytical and scientific methods have evolved in construction risk assessment.

From the review of past contributions of researchers in this area of study, there is a dearth of literature on cost and risk issues in the variability between the design stage elemental cost plan and final tender sum. In other words, the deviation of cost plans from final tender sums in New Zealand is yet to be studied. This study therefore intends to close the gap, hence the need for the study.

**RESEARCH AIM AND OBJECTIVE**

The aim of this study is to investigate the influence of risks on the variability between design stage elemental cost plan and final tender sum in building procurement, with a view to developing a model that could permit the prediction of final tender sum from cost plan.

**RESEARCH METHODS**

The main research methods used in this study are interviews within case studies, descriptive statistics, thematic and documentary analyses. These helped to acquire an in-depth knowledge about the case study projects. Following Zuo (2010), Kalof et al. (2008) viewed case study as an in-depth study of a single person, event, community, group or project. The case study method was adopted in this research to achieve the research aim and objective through analysis of documents obtained from the archives of the interviewed practitioners. This was
done on a project-by-project basis which involved the collection of elemental cost plan sum and final tender sum data as well as the project type, year, location, procurement system adopted and risks identified from 8 case study projects. Hence, the purpose of case study method for this study is justified in securing theoretical validity rather than the more common statistical validity required of surveys. This view was shared in Fellows and Liu (2008) and Cohen et al. (2011). Meanwhile, Gibson and Brown (2009) viewed documentary analysis as a method that refers to the process of using documents as a means of social investigation and involves exploring the records that individuals, professionals and organisations produce. Similarly, percentage difference was used in the study to express the influence of risks on the observed variability. According to Nworgu (2006) descriptive statistics quantitatively describes the main features of a population or sample, and this includes percentage.

Furthermore, in-depth interviews were conducted with projects’ consultant Quantity Surveyors on the selected case study projects in the study areas. The interview was chosen as a data collection tool in carrying out the case studies in this research because it is an effective tool for gaining an insight to people’s experiences in particular scenarios as opined in Taylor and Bogdan (1984). Thematic analysis, a method which emphasises pinpointing, examining and recording patterns within data (Gibson & Brown, 2009) was employed in analysing the interview conducted by the researcher. In this study, this method was useful in identifying themes within the data, identifying theme co-occurrence and comparing theme frequencies. Also, the interview conducted remains anonymous.

Moreover, the demographic information about the 5 interviewed practitioners (Consultant Quantity Surveyors) from the 3 Auckland-based quantity surveying firms constitutes the designation (senior partners), academic (HNC/HND/Bachelor’s degree in quantity surveying) and professional qualifications (MNZIQS/FNZIQS) as well as the work experience (20-35 years) of the participants. This background information regarding the interviewed participants indicates that they are competent, experienced and capable of exercising sound judgement in responding to the interview. Therefore, responses provided by them could be relied upon for this study.

**PRELIMINARY FINDINGS**

The preliminary findings confirm the variability between elemental cost plans and final tender sums ranging between -14% and +13%. Client’s change, incomplete design information and site investigation information are the risks elements that have the major influence on the variability observed in the study.

These results are in agreement with related previous studies asserting that the accuracy of a cost plan estimate is highly dependent on the level of detail and adequate project scope (Akintoye, 2000; Odusami & Onukwube, 2008). It is actually not a surprise that client’s change or design variations / enhancements have significant impact on the budgetary
performance of CS01, CS02, CS04, CS06, CS07 and CS08 at pre-contract phase. As claimed by Odeyinka et al. (2010) this risk factor is design and scope related and at the pre-construction phase. However, within the cost planning and tender action stages (pre-contract phase) as more information are available, Architects may see the need for changes to the original design or scope (owner’s requirements). Also, clients who are equally getting the grasp of design and construction realities may wish to suggest changes or enhancements so as to ensure that their objectives are met. In some cases, they may also suggest changes to the scope of works.

The project information in this study fundamentally refers to the availability of design information as well as quality of information and flow requirements in the face of cost planning accuracy and reliability. The result agreed with a study conducted in Singapore by Ling and Boo (2001) that proper information management was the third most effective method of improving estimating accuracy, while availability of sufficient design information was indicated as the most important method of ensuring estimating accuracy. This accounts for the reason why incomplete or inadequate design information has significantly influenced the variance recorded on the budgetary performance of CS01, CS04 and CS06 at the pre-contract phase of the projects. Hence, the more detailed information / cost data at disposal, the more accurate the cost plan.

Site investigation information which reveals the site conditions, nature of the soil, sub-ground or geological conditions as it affects design and construction is a phenomenon which also represents a notable variance regarding CS01, CS03, CS06, CS07 and CS08. This agreed with the work of Zou et al. (2007) that site investigation information is one of the key risks in construction projects in China. They stressed that inadequate site information (soil test and survey report) leads to uninformative designs and further affects the progress of excavation, foundation and footing construction. For example, under the regulation of site investigations stipulated by the China’s Ministry of Construction, it was stated that prior to any design scheme, borehole, soil test and survey with the government agencies and nearby buildings should be conducted to ascertain the site conditions and reduce unexpected risks. This view was shared by Odeyinka et al. (2009) through a study conducted in the UK that lack of site investigation information could lead to defective design and consequently to problems with the foundation. Hence, when failure or deficiency is experienced in respect of site investigation it impacts significantly on a project’s budgetary performance and consequently the client’s cash flow position.

**RESEARCH SIGNIFICANCE**

The primary contribution of this study to the construction industry is the emergence of a checklist of risk factors which represents an outcome corroborated by previous related researches to facilitate risk management and cost planning practice. This risk profile enables a reliable and objective elemental cost plan to be produced at the early design development stage of a building project when limited information is available on a project. Project owners and practitioners should focus their attention on the risk factors identified in this study with a view to developing a model that could enable an accurate project cost planning. Moreover, the findings would provide the scarcity of mature research on cost and risk issues in New Zealand construction industry with in-depth research that could assist professional practice.
The main features of each of the completed case study projects have been examined and analyzed in Table 1 below.

Exchange rate: NZ$1.00 = US$0.85 = AU$0.91 = £0.51 sterling (2014)
Table 1: Case studies of commercial and educational buildings in Auckland, Christchurch and Wellington, New Zealand.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Project Type</th>
<th>Elemental Cost Plan Sum (NZ$)</th>
<th>Final Tender Sum (NZ$)</th>
<th>Cost Difference (NZ$)</th>
<th>Percentage Difference</th>
<th>Year</th>
<th>Project Location</th>
<th>Procurement System Adopted</th>
<th>Risks Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS01</td>
<td>Commercial building</td>
<td>2,850,000.00</td>
<td>3,058,252.85</td>
<td>+208,252.85</td>
<td>+7%</td>
<td>2012-13</td>
<td>Auckland</td>
<td>Traditional</td>
<td>Client change, inadequate tender documentation, incomplete design information and site investigation information</td>
</tr>
<tr>
<td>CS02</td>
<td>Commercial building</td>
<td>20,263,080.00</td>
<td>18,193,180.00</td>
<td>-2,069,900.00</td>
<td>-14%</td>
<td>2013</td>
<td>Wellington</td>
<td>Traditional</td>
<td>Improvement in market conditions and improvement in design cost planning functions</td>
</tr>
<tr>
<td>CS03</td>
<td>Commercial building</td>
<td>998,650.00</td>
<td>1,094,000.00</td>
<td>+95,350.00</td>
<td>+10%</td>
<td>2013</td>
<td>Auckland</td>
<td>Traditional</td>
<td>Market movement, documentation errors/omissions, client change, site investigation information and inadequate tender documentation</td>
</tr>
<tr>
<td>CS04</td>
<td>Educational building</td>
<td>3,740,518.00</td>
<td>3,989,698.00</td>
<td>+249,180.00</td>
<td>+7%</td>
<td>2013</td>
<td>Auckland</td>
<td>Traditional</td>
<td>Late client changes, incomplete documentation for cost plan and coordination errors at tender stage, incomplete design information</td>
</tr>
<tr>
<td>CS05</td>
<td>Educational building</td>
<td>3,986,000.00</td>
<td>3,904,300.00</td>
<td>-81,700.00</td>
<td>-2%</td>
<td>2013</td>
<td>Wellington</td>
<td>Traditional</td>
<td>Improvement in market conditions and improvement in design cost planning functions</td>
</tr>
<tr>
<td>CS06</td>
<td>Educational building</td>
<td>48,833,750.00</td>
<td>52,468,250.65</td>
<td>+3,634,500.65</td>
<td>+7%</td>
<td>2012</td>
<td>Christchurch</td>
<td>Traditional</td>
<td>Incomplete design information, market conditions, client change and site investigation information</td>
</tr>
<tr>
<td>CS07</td>
<td>Commercial building</td>
<td>31,790,000.00</td>
<td>35,790,100.00</td>
<td>+4,000,100.00</td>
<td>+13%</td>
<td>2010-11</td>
<td>Christchurch</td>
<td>Traditional</td>
<td>Market conditions, design variations, client change and site investigation information</td>
</tr>
<tr>
<td>CS08</td>
<td>Commercial building</td>
<td>28,245,000.00</td>
<td>30,285,225.00</td>
<td>+2,040,225.00</td>
<td>+7%</td>
<td>2010</td>
<td>Wellington</td>
<td>Traditional</td>
<td>Late client changes, design enhancements, market conditions and site investigation information</td>
</tr>
</tbody>
</table>
REFERENCES


