Critical determinants of construction tendering costs in New Zealand: Quantity surveyors’ perceptions

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Abstract

Identifying critical determinants of tendering cost is key to reliable construction cost forecasting. Thirty-seven pre-tender construction cost-influencing factors were identified in a pilot study. The identified factors were segregated into six clusters for quantitative analysis. Online questionnaire survey was used to obtain quantity surveyors’ feedback on the relative importance of the identified factors. The empirical data were subjected to multi-attribute analysis. Results showed that poor tender document was perceived as the most important factor underlying reliable pre-tender cost estimation. Concordance analysis indicated high level of agreement amongst survey participants in the rank-ordering of the relative importance of the cost-influencing factors. The findings could assist quantity surveyors to prepare more reliable pre-tender construction estimates. It would also assist in effective cost control at the construction stage.

Key Words: Construction cost, construction cost forecasting, pre-tender estimating, tendering.

Introduction

Recently, speed of construction market development and level of competition in construction industry is higher than before in New Zealand. Gaining construction project from client is critical for contractors to survive in highly competitive construction industry. Even though lowest tendering price do not means highest competitive price, tendering price is critical for contractor selection over the years (Wong, Holt, Ji, C. and Domingo, N. (2014). Critical determinants of construction tendering costs in New Zealand: Quantity surveyors’ perspectives. Proceedings of the 4th New Zealand Built Environment Research Symposium (NZBERS). Auckland, New Zealand. 14 November. ISSN 2324-1829 (Online).
Cost estimating is forecasting for total construction cost in pre-tender stage, which is regarded as an experience-based process. Construction cost is influenced by factors of uncertainty, incompleteness and unknown circumstance, which can bring challenge for preparing accuracy and reliable cost estimating. It also brings challenge for clients’ quantity surveyors to achieve cost control at pre-tender stage.

Generally, tendering price includes actual cost of carrying out construction works and mark-up. Actual cost of construction contains materials cost, labour cost and plant cost. In addition, mark-up of construction contains overhead, profits and risk, which is same as most cost estimating techniques. They only take account of significant quantified affecting factors. Since nature of qualitative factors are difficult to measure, most of qualitative factors, such as client priority and procumbent methods, are ignored by common cost estimating method. A few relative researches have been conducted in New Zealand. Understanding these tendering cost-influencing factors can improve the competence of quantity surveyors, who can prepare more reliable and accurate tendering price. It is also critical for quantity surveyors, who are worked for developer, to achieve cost control at pre-tender stage.

**Literature review**

Nor Azmi Ahmad, Rosnah, Napsiah, Aini, and Rizan (2012) investigated construction cost influencing factors for Industrialized Building System (IBS) projects in Malaysia. They used method of Relative Importance Index (RII) to rank importance of factors. Total factors were divided into seven main groups including characteristics of general contract, methods of procurement, attributes of contractors and contractors, design parameters and external market factors. RII index of projects characteristics, contractor attributes and market factors were higher than other groups.

Memon, Rahman, Abdullah, and Azis (2010) investigated factors influencing construction cost in the project of Malaysian government agencies. The method of questionnaire survey was used for analysing
data to rank factors. There were seven main factors including cash flow and financial difficulties faced by contractors, poor site management and supervision (contractors), shortage of contractor experience, not enough site labour, inadequate construction planning and scheduling. Meanwhile, designing changes was regarded as the lowest influential factors on cost of construction.

Two basic factors have been defined as critical determinants of tendering price (Tebin, 2009). The one is that the tender document which is responsibility of client. The other one is that the scope is cover by tendering price, which is regarded as contractor responsibility. A working knowledge of whole construction process needs to be understood.

This similar research has been done in UK which was carried out by Elhag, Boussabaine, and Ballal (2005). Elhag et al. (2005) investigated tendering cost influencing factors through standpoint of quantity surveyors. 67 variables, which influence pre-tender cost, are identified through interview and literature review. Questionnaire method is used for ranking these 67 factors. The questionnaire was posted to 218 quantity surveyors for Royal Institute of Chartered Surveyors (RICS). The result of survey was analysed form 68 mails and the response rate is 31%. Severity index computation is used for raking all factors. After investigating all factors, severity index of 52 factors shows more than 65%, which means these factors regarded as important with highly agreement. What is more, the result indicates that top ranked factor is consultant & design parameters and bottom ranked factor is contractor attributes. This indicated that designers have more effects on construction projects than contractors through standpoint of quantity surveyors do.

S. L. Chan and Park (2005) measured and evaluated factors which influence construction cost in Singapore according to survey of national construction projects. The selected project cost more than five million US dollars and was finished after 1992. Three main groups were divided into characteristics of project, contracts and owner/consultant. The findings indicate that special requirements influence
construction cost including level of high-technology, special skill of contractor and public-administered contracts. What is more, technical expertise of contractors, financial factors and level of construction familiarity can affect construction cost as well.

Bubshait and Al-Juwairah (2002) evaluated 42 factors which affect construction cost in Saudi Arabia. According to index for contractors, consultants/engineers, owners and combination, 42 factors were divided into five main groups to rank the level of importance. It was indicated that material cost, incorrect planning, contractor experience, contract management and poor financial control are main factors influencing high costs of construction.

Factors influencing project cost estimating has done by Akintoye and Fitzgerald (2000) in UK. The target of the study is that gaining understanding of factors influencing cost estimating. 24 factors have been investigated in the research. Complex of the project, scale and scope of construction, marketing condition and method of construction are regarded as highly important factors.

Dissanayaka and Kumaraswamy (1999) investigated factors influencing cost performance based on a sample of construction projects in Hong Kong. According to method of multiple linear regressions, there are four main factors influencing construction overruns including level of client confidence in the construction team, payment method, risk of client’s quantity variation and complexity of construction. After analysing factors, artificial neural network models were developed to predicting cost indices of construction.

**Project characteristics**

There are ten main factors grouped into characteristics of projects. Project characteristics are regarded as the biggest tendering cost influencing factors. Size of floor is generally regarded as highly important factors (Sonmez, 2004; Stoy & Schalcher, 2007). Construction cost is based on size of floor which
influencing quantity of materials. What is more, construction location can influence tendering cost. Far from city or contractor’s company make higher delivery fees and less control of construction. Construction can be influenced by local government policy (Akintoye, 2000; E. Chan & Au, 2009; Dulaimi & Hong Guo, 2002; Elhag et al., 2005). Buildability of construction is investigated by Dulaimi and Hong Guo (2002) to approve that it is important.

What is more, complexity of design and structure of construction can influence construction cost. The design is more difficult to fulfil, cost of time and money will be higher. Different structure of construction has different cost. For example, steel structure is more expensive than timber framing structure. (Akintoye, 2000; E. Chan & Au, 2009; Dulaimi & Hong Guo, 2002; Elhag et al., 2005)

Construction duration is a critical factor as well (Akintoye, 2000; E. Chan & Au, 2009; Dulaimi & Hong Guo, 2002). Long duration of construction can increase on-site labour cost, plant cost and site overhead. Long duration improve risk level for construction as well. What is more, type of construction is another factor. Different type of construction, such as office, residential building and commercial building, has different requirement such as building service. Furthermore, access to site and storage limitation, scope of construction and technique are regarded as the factor influencing tender cost. (Akintoye, 2000; Elhag et al., 2005)

Client characteristics

Type of client was investigated in many past researches and it was approved importance of tendering cost (Akintoye, 2000; E. Chan & Au, 2009; Dulaimi & Hong Guo, 2002; Elhag et al., 2005). There are so difference between public clients and private clients. Generally, public project is bigger and pay more attention on quality of construction. However, private clients generally focus on both of cost and quality. It means that tendering cost for public clients is higher.

What is more, financial situation of clients is regarded as less important factors (Elhag et al., 2005). However, financial situation of clients might be important factors in New Zealand because of different economic environment and payment system for different countries. Quality of construction requirement is another factor (Akintoye, 2000; Elhag et al., 2005). High quality of project means high construction cost. High cost means high tendering price from contractors. Construction deadline indicated that how long construction cost. Not enough construction time can improve construction cost (Elhag et al., 2005). A clear and certainty of project brief is important for making tendering cost (Elhag et al., 2005).

**Contractor characteristics**

Management team is regarded as the most important factors in terms of contractor characteristics (Elhag et al., 2005). A perfect management team with experienced staff can is more expensive that others, which bring more benefits than shortages for most construction bidding. What is more, capability of construction plan is regarded as an influencing factor by Elhag et al. (2005). Meanwhile, contractors have experience on similar projects is important, which is same as factor of experience team (Dulaimi & Hong Guo, 2002; Elhag et al., 2005). Dulaimi and Hong Guo (2002) also agree that current work load is important for tendering. However Elhag et al. (2005) thought it is not highly important.

What is more, past relationship between clients and contractors can affect tendering price (E. Chan & Au, 2009). To keep long-term relationship with clients, contractors can submit a lower price through decreasing profits. Long-term relationship will help contractors to get more projects and gain more benefit in the future. What is more, need for work is thought an important factor for influencing tendering cost. Need for work is decided by many factors, including vacation of resource such as plant, finical statement. The contractor is more need for the project, the price will be lower. Lower price can improve the competition of the contractor in the similar situation. (E. Chan & Au, 2009; Dulaimi & Hong Guo, 2002).
**Tendering situation, consultant and design**

There are six main factors, which influence tendering cost, grouped in to tendering situation, consultant and design. Elhag et al. (2005) investigated all factors listed in this group. Absence of alterations and late change can increase tendering cost. Not enough information for project can influence tendering cost. Even though it can make tendering lower, it can make more variation at later stage of construction. Therefore, it is easy to make construction overrun. What is more, the more variation ordered by clients, the tendering cost would be high. These three factors are regarded main factors in terms of consultant and design.

At the same time, Dulaimi and Hong Guo (2002) agreed that tendering situation is important for tendering cost influencing. Tendering method, tendering procurement and type of contract are there main factors in terms of bidding situation.

There are many methods for selecting contractors. Open tendering method generally makes tendering cost lower than others do. More contractors can bid for projects because of limitation for bidding company. At the same time, elective tendering method is popular for contractors selecting as well. The contractors, who have been pre-qualified and list by client, have opportunities to bid the project. It causes tendering cost higher. (Smith, Merna, & Jobling, 2006)

What is more, traditional method and design-build method are two main procurement methods in bidding process. When using traditional method, contractors just bid for the stage of construction. Cost of tendering just focus on construction based on design from separate design team Greenhalgh and Squires (2011). However, cost of design-build method need cover fees of design and construction building. Tendering cost is made based on plan of clients and negotiation with clients. Lump-sum
External factors and market conditions

There are six main factors, which influence tendering cost, grouped into external factors and market conditions. All factors were investigated by Elhag et al. (2005) as well. They found competition of construction activity is an important factor. Contractors will make tendering cost lower to get the project in high competition. What is more, material cost of construction project is important for tendering sum. During estimating tender cost, quantities of materials and cost of materials become more than half of total tendering cost. Moreover, labour cost and inflation rate are important as well. Akintoye (2000) also investigated that stability of market conditions is an important factor. A stable construction market can make all price of construction stability. What is more, Dulaimi and Hong Guo (2002) also agreed that number of bidding contractors can influence tendering cost.

Inaccuracy of cost estimating

Making tendering price is based on estimating practice. Inaccuracy of cost estimating influence tendering cost directly. There are many factors influencing inaccuracy of cost estimating researched by Akintoye and Fitzgerald (2000). Based on research, the most important factor is regarded as insufficient time for estimating. No enough estimating time will cause estimators to finish job as soon as possible before deadline. Some details of site drawing and specifications are easy to be ignored, which can make errors in estimating. Poor tender document is regarded as main factors to make inaccuracy of cost estimating. Tender document contains drawings and specifications, which are critical for cost estimating. Poor cost document provide insufficient information about building for estimating.

Methodology

A two-stage research methodology was selected in the research. The first stage is reviewing topic relative literature. Before starting the following stage, thirty-seven pre-tender construction
cost-influencing factors are identified and divided into six groups.

NZIQS (New Zealand Institute of Quantity Surveyors) is an official institute of quantity surveyors in New Zealand. To gain data on the factors considered by quantity surveyor is New Zealand, all members of NZIQS were invited to take participant into this research in the following stage. The link of online questionnaire website was send to all of them through Email. Until end of the research, 152 completed online questionnaires have been collected.

Method of data analysis

Analysing and ranking for cost factors

There are 152 completed questionnaires being collected form online questionnaire. For rating importance of factors, a five-point scale is used as five means highly important factors and one means not important at all.

\[
SI = \left( \sum_{i=1}^{5} wi \times fi \right) \times \frac{100\%}{n}
\]

Equation 1

Where \( i \) mean rating 1-5, \( f_i \)means frequency; \( n \) means total numbers of response and \( w_i \)means each rating weight (Equation 2). SI more than 70% is regard as highly important factors.

Table 8 to 13 summaries the find of statistical analysis for the research. It indicates that 28 factors have severity index from 70% to 88%. Severity index of remaining 9 factors is from 61% to 70%. Therefore, 27 factors are thought by quantity surveyors in New Zealand as highly important factors for tendering cost in construction project. Top three factors have more than 75% of severity index.

**Measuring quantity surveyors concordance**

"Coefficient of variation (COV) indicate the standard deviation as a percentage of the mean, and it is useful in comparing relative variability of different responses" (Elhag et al., 2005).

$$COV = \frac{S}{X} \times 100\%$$

Equation 3

Where COV means coefficient of variation, S means the standard deviation and $\bar{X}$ means the weighted mean of sample.

The COV results will reflect the different opinion of all participants for the results. Lower number of COV means higher agreement between all participants. The range of COV for the research is from 12.71% to 25.91%, which means highly agreement between all participants for most factors.

**Discussion of results**

**Project characteristics**

<table>
<thead>
<tr>
<th>Project Characteristics</th>
<th>SI</th>
<th>Total Rank</th>
<th>Group Rank</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity of design and construction</td>
<td>85%</td>
<td>2</td>
<td>1</td>
<td>22.46%</td>
</tr>
</tbody>
</table>

### Table 1

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>Rank</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildability</td>
<td>83%</td>
<td>6</td>
<td>20.82%</td>
</tr>
<tr>
<td>Scale and scope of construction</td>
<td>81%</td>
<td>12</td>
<td>19.31%</td>
</tr>
<tr>
<td>Construction techniques</td>
<td>78%</td>
<td>19</td>
<td>18.41%</td>
</tr>
<tr>
<td>Construction location (regions / rural; urban)</td>
<td>75%</td>
<td>24</td>
<td>17.70%</td>
</tr>
<tr>
<td>Project duration</td>
<td>73%</td>
<td>28</td>
<td>15.31%</td>
</tr>
<tr>
<td>Complexity of design and construction</td>
<td>70%</td>
<td>30</td>
<td>12.71%</td>
</tr>
<tr>
<td>Type / function of construction (residential, commercial, industrial, office)</td>
<td>70%</td>
<td>31</td>
<td>13.95%</td>
</tr>
<tr>
<td>Access to site and storage limitation</td>
<td>70%</td>
<td>32</td>
<td>18.87%</td>
</tr>
<tr>
<td>Type of structures (steel, concrete, brick, timber, masonry)</td>
<td>70%</td>
<td>31</td>
<td>13.95%</td>
</tr>
<tr>
<td>Project size/ gross floor area</td>
<td>69%</td>
<td>34</td>
<td>14.83%</td>
</tr>
</tbody>
</table>

There are 10 factors in category of project characteristics. Top six factors achieve severity index more than 70%, which means these six factors are regard as highly important factors for influencing tendering cost in New Zealand. Two factors are ranked in top ten important factors of all. What is more, this category contains COV lower than 20% with the exception of two factors. It is good to show highly agreement by all participants.

Complexity of design and construction is regarded as most important factors in this group, which is ranked totally as second important factor. The complexity of project has already been investigated by Elhag et al. (2005). Complexity issues are ranked as second important factor in project characteristics in that research. What is more, Shash (1993) also addressed complexity of design and construction is a key issue to influence tendering cost. Buildability is ranked as second important factors, whose overall ranking is sixth. However, it was just ranked as eighty of twenty-four in research for analysing cost estimating practice influencing factors (Akintoye, 2000; Dulaimi & Hong Guo, 2002). Another important factor is scale and scope of project. Akintoye (2000) also approved this factor is important factor during studying cost estimating practice influencing factors. In that research, overall ranking for that research is the second. A remarkable factor is project size and gross floor area. Severity index of the factor is just 69% and overall ranking is 34, which is defined as least important factors in this group. However, Size

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of floor is generally regarded as highly important factors (Sonmez, 2004; Stoy & Schalcher, 2007). Elhag et al. (2005) indicates that site size is ranked as 30 of 67 factors, which is middle level of importance.

### Client characteristics

<table>
<thead>
<tr>
<th>Client Characteristics</th>
<th>SI</th>
<th>Total Rank</th>
<th>Group Rank</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial ability of client</td>
<td>83%</td>
<td>5</td>
<td>1</td>
<td>22.65%</td>
</tr>
<tr>
<td>Certainty of project brief</td>
<td>82%</td>
<td>7</td>
<td>2</td>
<td>19.60%</td>
</tr>
<tr>
<td>Deadline requirement</td>
<td>82%</td>
<td>9</td>
<td>3</td>
<td>21.36%</td>
</tr>
<tr>
<td>Client requirements on quality</td>
<td>79%</td>
<td>15</td>
<td>4</td>
<td>19.55%</td>
</tr>
<tr>
<td>Type of client (public/private)</td>
<td>69%</td>
<td>33</td>
<td>5</td>
<td>15.56%</td>
</tr>
</tbody>
</table>

Table 2

There are five factors in group of client characteristics, in Figure 19. There are three factors in top 10 factors of entire factors. Top three important factors in this group are ranked as most ten important factors for all factors. Severity index of top four important factors are between 79% and 83%. It indicates that client characteristics have high influence for tendering cost in New Zealand. This group indicates coefficient of variations ratio from 19.55% to 22.65%, which is relatively low. It means high agreement level for all participants.

Top important factor is “financial ability of client in this group” factor and it ranked as fifty for overall ranking. However, this factor in typical research done by Elhag et al. (2005) is defined least important factor in group of client characteristics, which is ranked as 53 of 67 totally. The reason for this significant difference is might be economical environmental of local industry market. Compared with UK, market of construction industry in New Zealand is smaller and has less stability. The second ranked factor of this group is certainty of project brief which ranked with seventh in total ranking. Certainty of project brief has been approved by Elhag et al. (2005) and it was ranked as 2ed out of 67 factors. Type
of client is regarded as least important factors, which is ranked as 33 of 37. However, (Elhag et al., 2005) find that factor is important factors which was ranked as 16 of 67. Low COV indicates a strong agreement between quantity surveyors in ranking of these factors.

**Contractor Characteristics**

<table>
<thead>
<tr>
<th>Contractor Characteristics</th>
<th>SI Total Rank</th>
<th>Group Rank</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience on similar projects</td>
<td>80% 13 1</td>
<td>23.98%</td>
<td></td>
</tr>
<tr>
<td>Management team (suitability, experience, performance)</td>
<td>80% 14 2</td>
<td>19.86%</td>
<td></td>
</tr>
<tr>
<td>Past relationship with clients</td>
<td>79% 16 3</td>
<td>18.82%</td>
<td></td>
</tr>
<tr>
<td>Current work load</td>
<td>78% 18 4</td>
<td>19.96%</td>
<td></td>
</tr>
<tr>
<td>Need for work</td>
<td>75% 22 5</td>
<td>19.96%</td>
<td></td>
</tr>
<tr>
<td>Planning capability</td>
<td>73% 29 6</td>
<td>20.93%</td>
<td></td>
</tr>
</tbody>
</table>

Table 3

There are six factors in group of contractor characteristics, Figure 20. Severity index of all factors in the group is from 73% to 80%, which means all of these factors are regarded as important factors affecting tendering cost. However, there are no top ten factors for total ranking, which means all these factors are not strongly important for influencing tendering cost in New Zealand. The highest COV of factor is top important factor in the group. It means all participants have more opinion on these factors than others. For least five factors, COV of them is less than 20%, which means all responders have high agreement on these factors.

Most important factor of this group is experience on similar projects, which is ranked as 13th out of 37 factors. Both of Elhag et al. (2005) and Dulaimi and Hong Guo (2002) have addressed this factors is key cost-influencing factor in their previous study. The second important factor is experience and performance of management, which is ranked as 14th out of 37 factors. Both of these two factors were found by Elhag et al. (2005) as top two important factor of group contractor attributes. The overall ranks

of them are 13th and 2ed of total factors, separately. Nor Azmi Ahmad et al. (2012) also investigated this factor as top ten important factors. Planning capability is regard as least important factors of this group. However, Elhag et al. (2005) found it is an top three important factor in the group. Different industry market might be the main reason for difference. Planning capability is defined as least important factor in this group.

**Tendering situation, consultant and design**

<table>
<thead>
<tr>
<th>Tendering Situation, Consultant and Design</th>
<th>SI</th>
<th>Total Rank</th>
<th>Group Rank</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completeness of project information</td>
<td>85%</td>
<td>3</td>
<td>1</td>
<td>21.98%</td>
</tr>
<tr>
<td>Absence of alterations and late change</td>
<td>76%</td>
<td>21</td>
<td>2</td>
<td>16.24%</td>
</tr>
<tr>
<td>Procurement method</td>
<td>75%</td>
<td>23</td>
<td>3</td>
<td>18.86%</td>
</tr>
<tr>
<td>Type of contract</td>
<td>74%</td>
<td>26</td>
<td>4</td>
<td>18.13%</td>
</tr>
<tr>
<td>Tendering method</td>
<td>73%</td>
<td>27</td>
<td>5</td>
<td>15.76%</td>
</tr>
<tr>
<td>Variation order</td>
<td>68%</td>
<td>36</td>
<td>6</td>
<td>14.68%</td>
</tr>
</tbody>
</table>

Table 4

There are six factors in group of tendering situation, consultant and design, Figure 21. Severity index of these factors over from 85% to 68%, which means that just one factor is defined as non-highly important factor for tendering cost. Most important factor is ranked as third important factor of the whole. 21.98% of coefficient of variation means that result has strongly agreed by all participants. Scope of coefficient of variation is range from 14.68% to 21.98%, which means that all results have high concordances for all responders. Severity index of least important factor in this group is 68%, which means it is not a highly important factor.

Completeness of project information is defined as most important cost-influencing factor in this group, which is ranked as third important factors of the total. Elhag et al. (2005) also approved it is a key
factors for tendering cost, which was ranked as fourth of total 67 factors. Therefore, completeness of project information is needed to be paying more attention by client. Other factors are ranked more than 20 of the whole. Therefore, it indicates that these factors not need to be paid too much attention influence for preparing tendering price. Variation order is regarded as least important factors in this group. However, Elhag et al. (2005) found it was an important factors, which was ranked same as completeness of project information (4th of total).

**External factors and market condition**

<table>
<thead>
<tr>
<th></th>
<th>SI</th>
<th>Total Rank</th>
<th>Group Rank</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of competition and Level of construction activity</td>
<td>82%</td>
<td>8</td>
<td>1</td>
<td>20.00%</td>
</tr>
<tr>
<td>Material cost</td>
<td>81%</td>
<td>11</td>
<td>2</td>
<td>18.76%</td>
</tr>
<tr>
<td>Labour cost /performance</td>
<td>79%</td>
<td>17</td>
<td>3</td>
<td>18.44%</td>
</tr>
<tr>
<td>Number of bidders on competitive projects</td>
<td>78%</td>
<td>20</td>
<td>4</td>
<td>17.33%</td>
</tr>
<tr>
<td>Stability of market conditions</td>
<td>68%</td>
<td>35</td>
<td>5</td>
<td>18.39%</td>
</tr>
<tr>
<td>Interest rate/inflation rate</td>
<td>61%</td>
<td>37</td>
<td>6</td>
<td>15.58%</td>
</tr>
</tbody>
</table>

Table 5

There are six factors in category of external factors and market conditions, Figure 22. There are two factors are defined as non-highly important factors. Severity index of both of them are 68% and 61%, separately. At the same time, they are defined as last three factors of overall ranking. There are two factors’ severity index higher than 80%, which were ranked as 8th and 11th of total factors. Only one factor is ranked as top ten important factors of the total. Coefficient of variation for all factors is less than 20.00%, which means results gaining high agreement of participants.

Level of competition and level of construction activity is defined as most important factor in this group, which is ranked as 8th of the whole. It is only one factor who is regarded as top ten important factors of the total. This result has addressed by Elhag et al. (2005) and it was ranked as the most important
factor in group of external factors and market conditions. It means that it have high influence in preparation of construction estimates. The result indicates that level of competition is a main factor for influencing tendering cost. Material cost and labour cost are two important factors in this group. However, they have not too much influence on preparing tendering cost based on not high overall ranking. This finding was still approved by Elhag et al. (2005).

**Inaccuracy of cost estimating**

<table>
<thead>
<tr>
<th>Cost Estimating Inaccuracy</th>
<th>SI</th>
<th>Total Rank</th>
<th>Group Rank</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor tender document</td>
<td>88%</td>
<td>1</td>
<td>1</td>
<td>25.91%</td>
</tr>
<tr>
<td>Insufficient estimating time</td>
<td>83%</td>
<td>4</td>
<td>2</td>
<td>19.60%</td>
</tr>
<tr>
<td>Insufficient analysing of tender document</td>
<td>82%</td>
<td>10</td>
<td>3</td>
<td>20.14%</td>
</tr>
<tr>
<td>Shortage of project requirement standing</td>
<td>74%</td>
<td>25</td>
<td>4</td>
<td>18.20%</td>
</tr>
</tbody>
</table>

Table 6

There are four factors in group of cost estimating inaccuracy, Figure 23. There are two factors are defined as top five important factors of entire factors. Severity index of these two methods are 88% and 83%, separately. Highest factor is also ranked as most important factors of overall ranking. Average of severity index of this group is highest in all six groups of all factors. Highest coefficient of variation comes from best important factors. But it is just 25.91% and still very low. All factors’ coefficient of variation is around 20%, which means highly agreement of all factors.

Compared with typical research done by Elhag et al. (2005), this group is added based other similar research. Average severity index of this group is higher than others, which means estimating inaccuracy need to be paid more attention when preparing tendering cost in New Zealand. Three of four factors are highly important as they were ranked as top ten important factors. The finding was also approved by Akintoye and Fitzgerald (2000) and all these three factors were regarded as key factors.

Poor tender document is ranked as most important factor of all factors for this research. Sometime,
quantity surveyors are different to prepare an accuracy bill of quantity because of poor tender document. It will caused huge influence of tendering cost as less of relative document.

Conclusions and Recommendations

For this research, two-stage research method has been selected. Literature review is the first stage to identify and group all possible critical determinants of tendering cost. The second stage is online questionnaire survey to rank importance of all these factors. After analysing more than 150 valid online questionnaires, poor tender document, complex of design & construction and completeness of project information are defined as top three critical determinants of tendering cost in New Zealand. There are only nine factors are regarded as less important factors based on result of this research.

After ranking and evaluating all these factors, it can help quantity surveyors to enrich their edge. It is critical for contractors’ quantity surveyors to prepare a more accurate and reliable tendering estimating for bidding based on understanding cost-affecting factor clearly. It is also critical for quantity surveyors, who are worked for contractor, to achieve cost control at pre-tender stage.

Since time limitation of the research, online questionnaire is the only method to achieve data collection. For further study, interview is recommended to add into the research. It is meaningful to gain deeper understanding of critical cost influencing factors. What is more, these critical factors evaluated in this research are ignored by most common cost estimating method. Actually, most qualified factors are hard, time-consuming and costly to be transferred into project data system. If some personals or organisations can create or update a cost estimating system including these factors, it would be much appreciated by all quantity surveyors. It also would be benefit for all construction industry.

References


