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Influential Factors in Estimating and Tendering for Construction Work

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Abstract. Cost estimation, bid/no bid decision, estimating accuracy, and cost overrun are the four main cost estimating issues (MCEI) investigated by many previous researchers from different parts of the world for decades. Factors relating to client characteristics, consultant and design parameters, contractor attributes, project characteristics, contract procedures and procurement methods, and external market conditions [1] are examined for their influences on those four MCEI separately. However, very little attention is paid on the comparison of factors rankings across those four MCEI. Results from comparing those factors rankings improve the understandings on cost estimating issues. Thus, this study aims to compare the factors rankings across the four MCEI and evaluate the degree of agreement between the four sets of ranks for their influential factors. Four previous studies, each examining factors affecting each of the four MCEI are selected through literature survey for analysis. Influential factors from each previous study are assigned to their related categories: client, consultant, contractor, project, contract, and environment. Kendall's coefficient of concordance is used to assess interjudge reliability. The computed correlation indicates a moderate degree of association between the four sets of ranks. It is found that the four MCEI are influenced by different factors with different ranks and hence should be treated as different MCEI and be managed differently.

1 Research Background and Motivation

Factors with respect to client characteristics, consultant and design parameters, contractor attributes, project characteristics, contract procedures and procurement methods, and external market conditions [1] are often examined for their influences on the four MCEI separately. For instance, factors related to contractual arrangements [2,5], contractor attributes [2], market conditions [5] are found to be the main causes of cost overrun; factors related to client characteristics, contractor attributes are found to be the major determinants for bid/no bid decision [3]; and factors related to market conditions and

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contractual arrangements are found to be the critical determinants of estimating accuracy [4]. But studies on comparing factors rankings across those four MCEI are rare. Results from this kind of study are useful in two ways. First, if there is a high correlation among the factors rankings, a list of factors can be produced in assisting practitioners to manage the four different MCEI concurrently. Second, if there is no correlation among the factors rankings; it simply provides a clear conclusion on what and when a factor is impactful on those four MCEI. Therefore, this study aims to compare the factors rankings across the four MCEI and evaluate the degree of agreement between the four sets of ranks for their influential factors.

2 Research Methodology

Unlike many other studies in the field of estimating and tendering for construction work that collected and analysed primary data, this study analyses secondary data collected from high impact journal articles. The data used in this study are hence reliable. Because there is a lack of studies in this nature, it is reminded that this study is conducted with an exploratory purpose. Therefore, at the first stage, 4 previous studies examining factors affecting the four MCEI are selected through literature survey for analysis. Each of these 4 previous studies is examining factors affecting only one of the four MCEI. To ensure currency of the results from this study, the 4 previous studies selected are all published in 2014 and 2015. Studies on factors affecting the four MCEI received very little attention in 2015. They are found in 4 high impact journals relating to the field of construction management and economics. Cheng's study [2]: 'An exploration into cost-influencing factors on construction projects' is published in *International Journal of Project Management*; Jarkas *et al.*'s study [3]: 'Critical factors determining bid/no bid decisions of contractors in Qatar' is published in *Journal of Management in Engineering*; Mahamid's study [4]: 'Factors affecting cost estimate accuracy: Evidence from Palestinian construction projects' is published in *International Journal of Management Science and Engineering Management*; and Rosenfeld's study [5]: 'Root-cause analysis of construction-cost overruns' is published in *Journal of Construction Engineering and Management*.

At the second stage, a content analysis is used to analyse textual information in all the four journal articles and systematically identify influential factors from each journal article. A conceptual analysis is carried out to analyse and interpret the influential factors by coding them into the six categories of factors: client, consultant, contractor, project, contract, and environment [1]. These six categories are employed because they are broad enough to include all possible factors affecting the four MCEI. At the third stage, Kendall's coefficient of concordance is used to assess interjudge reliability. Interjudge reliability is the degree to which two or more judges are in agreement with one another. It examines the degree of agreement between the four sets of ranks for their influential factors assigned to their related categories. The value of Kendall's coefficient of concordance (W) ranges from 0 to +1, with '0' indicating no agreement and '1' indicating complete agreement. Other details about the technique including the conduct of the test can be found in Sheskin [6]. In this study, the null hypothesis: there is no agreement between the four sets of ranks for the six categories of factors (H_0: $W = 0$); and that the alternative hypothesis: there is a significant agreement between the four sets of ranks for the six categories of factors (H_1: $W \neq 0$) are to be tested.

3 Results and Discussions

Table 1 to Table 4 show the results from the conceptual analysis done in this study. Based on severity indices by descending order, factors influencing construction projects cost [2] are coded into the categories of factors of Contract, Contractor, Environment, Project, Consultant, and Client, respectively, Table 1. Based on relative importance indices by descending order, factors determining bid/no bid decisions of contractors [3] are coded into the categories of factors of Client, Contractor, Project, Environment, Contract, and Consultant, respectively, Table 2. Based on importance indices by descending order, factors affecting cost estimating accuracy in construction projects [4] are coded

into the categories of factors of Environment, Contract, Client, Contractor, Consultant, and Project, respectively, Table 3.

Table 1. Ranking of cost-influencing factors on construction projects [2].

No.	Factor	Severity Index	Rank	Related Category
1.	Clearly define the scope of project in the contract	94.78	1.5	Contract
2.	Cost control	94.78	1.5	Contractor
3.	High fluctuation in commodity	89.57	3.5	Environment
4.	The gap between the construction plan and the reality is too great	89.57	3.5	Project
5.	Project team (coordination capability and the understanding of operational procedure)	86.96	5	Consultant
6.	Project valuation does not match the collected payment	86.09	6	Client

Table 2. Ranking of factors determining bid/no bid decisions of contractors [3].

No.	Factor	Relative Importance Index	Rank	Related Category
1.	Previous experience of contractor with employer	87.39	1	Client
2.	Need for work	86.30	2	Contractor
3.	Size of project	84.13	3	Project
4.	Availability of other projects	81.52	4	Environment
5.	Tender documents quality level	80.00	5	Contract
6.	Identity of designer	57.39	6	Consultant

Table 3. Ranking of factors affecting cost estimating accuracy in construction projects [4].

No.	Factor	Importance Index	Rank	Related Category
1.	Fluctuation in the currency exchange rate	86.29	1	Environment
2.	Contract management	85.48	2	Contract
3.	Financial status of the owner	83.87	3	Client
4.	Previous experience of the contractor	79.84	4	Contractor
5.	Lack of coordination between designers and contractors	69.35	5	Consultant
6.	Project location	58.87	6	Project

Table 4. Ranking of universal root causes for construction-cost overruns [5].

No.	Factor	Percentage	Rank	Related Category
1.	Premature tender documents (drawings, bill of quantities, specifications, contracts and legal documents)	86.70	1	Contract
2.	Tender-winning prices are unrealistically low (suicide tendering)	65.10	2	Environment
3.	Insufficient, unstandardized owner's brief	35.90	3	Client
4.	Insufficient information about ground conditions	28.70	4	Project
5.	Shortage in high-quality management personnel	27.90	5	Contractor
6.	Lack of standard requirements from designers and poorly enforced professional liability of designers	16.90	6	Consultant

Based on percentages by descending order, universal root causes for construction-cost overruns [5] are coded into the categories of factors of Contract, Environment, Client, Project, Contractor, and Consultant, respectively, Table 4. Contractor and Contract are found to be the two most important categories affecting construction projects cost, Client is found to be the most important category affecting bid/no bid decisions of contractors, Environment is found to be the most important category affecting cost estimating accuracy in construction projects, and Contract is found to be the most important category affecting construction-cost overruns, Table 5. The computed correlation $W_c = 0.38$ indicates a moderate degree of association between the four sets of ranks. The tabled critical 0.05 and 0.01 values for $m = 4$ and $n = 6$ are $W_{0.05} = 0.512$ and $W_{0.01} = 0.629$. Since $W_c = 0.38$ is less than $W_{0.05} = 0.512$, the null hypothesis H_0: $W = 0$ cannot be rejected.

Table 5. Summary for the rankings of related categories of factors for cost estimation, bid/no bid decision, estimating accuracy, and cost overrun.

	Related Category						
MCEI	**Client**	**Consultant**	**Contractor**	**Project**	**Contract**	**Environment**	**Totals**
Cost estimation	6	5	1.5	3.5	1.5	3.5	
Bid/no bid decision	1	6	2	3	5	4	
Estimating accuracy	3	5	4	6	2	1	
Cost overrun	3	6	5	4	1	2	
$\sum R_j$	13	22	12.5	16.5	9.5	10.5	$T = 84$
$(\sum R_j)^2$	169	484	156.25	272.25	90.25	110.25	$U = 1282$

Apparently, the rankings of the same set of categories of factors for the four MCEI are not similar. The contractor is the party who is responsible to estimate the construction costs and he or she should refer to the contract-related documents when performing the construction cost estimation tasks. This is because the contractor is the one who constructs the project and therefore only he or she will know the exact costs of the construction. An experienced contractor will be wary when deciding whether to bid or not to bid for a project. He or she will definitely stay away from a client who is known to be a bad paymaster or difficult to deal with. The environment which is beyond the control of the parties involved in construction has a huge impact on estimating accuracy especially the market conditions. During a poor market condition, construction prices will go up and as a result affect the accuracy of the estimate. Changes either addition or omission made to the contract during the construction stage will change the scope of work and subsequently increase the project costs.

4 Conclusions and Recommendations

It is found that the four MCEI are influenced by different factors with different ranks and hence should be treated as different MCEI and be managed differently. Nonetheless, it is worth noting that as contractual arrangements are impactful on construction costs, contract management staffs should always deliver high quality of work to minimise project costs and prevent cost overruns. Another point to note is that the consultant has very little impact on all the four MCEI and therefore allowing the client to engage him or her without much hurdles. Seeing that this study is exploratory in nature, replications and further studies on this topic can test and confirm the finding from this study.

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