

EARLY STAGE COST ESTIMATION AND THE RELATIONSHIP OF ARCHITECTS TO QUANTITY SURVEYORS

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Understanding the dynamics between cost estimation and design in the project delivery process is essential if accuracy of early stage estimates must be improved. In Australia architects are the primary designers of buildings. Yet, in the Australian context very little work has examined how architects view cost estimation in order to understand cost dynamics. A first step in ascertaining the key issues in relation to cost estimation and design is when architects engage a Quantity Surveyor. The aim is to examine the costing of the conceptual design of projects rather than focusing on professional roles between architect and QS. The point at which a QS is appointed in the design process is identified. The types of issues that arise in relation to costing and design are recognized. To do this, 1132 architects were approached and 85 surveys were received. Each respondent was asked to answer questions related to the highest value project completed by their office. The types of design issues that were acknowledged were related to finishes, construction methods and materials. Of concern was the ability of the QS to cost accurately in situations that required expert knowledge related to a location or particular building type. The results are a first step in formulating further research investigating the ongoing cost messages and costing iterations that take place during the project delivery process. Understanding this dynamic in the first instance will aid research into value management, project benchmarking studies, bidding and tendering as well as stakeholder management studies.

Keywords: architecture, communication, costs, design, estimating, quantity surveying.

INTRODUCTION

Early stage cost estimation prior to the tender process is a critical point in the design and construction process. Early cost estimation may take place after the initial client contact, or as a part of a feasibility process or after the first concept or sketch design is made. For architects, it is the point at which they make the first estimate of how much the building will cost and inform the client of this. In Australia, as a result of architects being sued this is called an Opinion of Probable Cost. This situation came about because of litigation against architects who often underestimated the cost of their designs prior to a tender bid being received. For Quantity Surveyors (QS) the early cost estimates are their first involvement with the project when they begin to assess the architect's early designs design in terms of cost. For clients the early stage cost estimates is an important way for them to begin to gauge if the project is feasible

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in the first place. Moreover, if it is feasible the client will want to know if the strategic objectives of the project will be met given the parameters of the site and the budget.

In order to maximize value for money for the client, it is the architect's role to maximize the design outcomes, such as finishes, in relation to the available budget.

Early cost stage estimates are important because they set the cost parameters to which the design, as it evolves, must conform. If these parameters are incorrect then the cost estimate may overrun the budget in later stages of the process if it is discovered that some necessary design elements were missing in the early stage estimates. If the cost estimate is overestimated at an early stage then this may mean that the project does not go ahead. In Australia architects are not trained in cost estimation in the same way that Quantity Surveyors are. For this reason, the involvement of QS in the process is critical to a successful outcome. However, very little is known about the way in which architects and quantity surveyors communicate at these early stages. The dynamics of communication between architect and QS could affect the accuracy of early stage estimates. Accordingly, the objectives of this study are:

1. To investigate the point at which Australian architects involves the QS in the design process
2. To identify the kinds of conflict issues that could arise between the QS and architect in relation to design and cost during the design process.

The results provide useful information for developing a design that gives the client value for money and for improving the accuracy of early stage cost estimates. It will also aid further research into value management, project benchmarking, bidding and tendering as well as stakeholder's management. Next we reviewed the literature on factors influencing early stage estimate accuracy based on which we identify the gap in the literature.

Literature review on early stage estimate accuracy

Early stage cost estimation is the forecasting of the cost of a project during the planning and design stage (Serpell, 2005). An overview of previous studies suggests that a large number of factors may influence the accuracy of an early stage estimate. Gunner and Skitmore (1999a) reviewed previous studies and summarized the factors as follows: building function, type of contract, conditions of contract, contract sum, price intensity, contract period, number of bidders, good/bad years, procurement basis, project sector (public, private or joint), number of priced items and number of drawings. Gunner and Skitmore (1999a) analysed the estimates of 181 projects in Singapore. They found that a majority of the factors influenced the accuracy of estimates. Using data from 42 projects in Singapore Ling and Boo (2001) found similar results when they compared five variables against Gunner and Skitmore's (1999a) work. Skitmore and Picken (2000) studied the effect that four independent factors (building type, project size, project sector and year) had on estimating accuracy. They tested the four factors using data from 217 projects in the United States of America. They found that inaccuracies in the estimate of the projects are influenced by project size and year, while consistency in the estimates is influenced by project type, size and year. In a study of 67 process industry construction projects around the world, Trost and Oberlender (2003) identified 45 factors contributing to the accuracy of early stage estimates. They summarized the factors into 11 orthogonal elements. Of the 11 factors, the five most important include: process design, team experience and cost information, time allowed to prepare estimates, site requirements, and bidding and labour climate.

According to Gunner (1997) the factors influencing accuracy of estimates are inter correlated so that the true bias of one factor could be masked by one or more factors. For example, Gunner and Skitmore (1999b) theorize that “Price Intensity alone is both necessary and sufficient to account for systematic bias (inaccuracy) in building price forecasting”. Price intensity is the total cost of a building divided by the gross floor area. Price intensity theory states that buildings with low unit rates (cost/m² gross floor area) would tend to be overestimated, while those with high unit rates would tend to be underestimated. In a study of 89 construction projects in Hong Kong, Skitmore and Drew (2003) support the price intensity theory.

In another study, Skitmore and Picken (2000) using data from 217 projects in the United States found that ‘year’ was the underlying variable responsible for the bias and inconsistency in cost estimates, after partialling out confounding effects of the four factors put forward. The finding contrasts Gunner and Skitmore’s (1999b) ‘price intensity’ theory. However, their result supports Gunner’s (1997) theory which states that intercorrelations among variables cause confounding effects. It also supports Gunner and Skitmore (1999a) in their suggestion that a single underlying variable is the cause of bias and consistency seen in estimates. Pasco and Aibinu (2008) discovered that location, size and project procurement were the three top most contributory factors in the development of bias and consistency in the early stage estimating as perceived by 41 quantity surveyors in Australia. Whereas, using cost data collected from 56 construction projects completed in and around Melbourne for the past ten years Aibinu and Pasco (2008) found that bias in estimating vary according to principal type of structural material, contract sum and number of storey.

Gap in the literature

Most of the studies on early stage estimate accuracy made implicit assumption that estimating is only a science. Often cost estimation is a difficult and complex process and to some extent it may be regarded more as an art than a science. Little research has been done to examine communication between designer and Quantity Surveyor in terms of its implications of improving the accuracy of early stage estimate accuracy. Ling and Boo (2001) discovered that effective communication and co-ordination between members of the project team can improve estimating accuracy as there is better flow of information and synergy of ideas to solve problems. In earlier studies Flanagan and Norman argue that a feedback mechanism is needed to enable QS to account for their previous forecasts (Flanagan and Norman, 1983). Bowen and Edwards have produced a number of research studies looking at the relationship between the QS, architect and clients in South Africa. They employed a structured interview technique to asked 10 Quantity Surveyors and architects in South Africa regarding engagement, service agreements and cost plans. They argued that effective communication between these parties was vital to project success. They concluded that cost messages from the QS to both client and architect needed to be more explicit in detail rather than implied. They suggest that the cost messages are not always sent efficiently between architects, client and QS and saw this failure being the responsibility of the QS. In another study they argue that architects need a higher level of knowledge and practice in value management (Bowen and Edwards 1996; Bowen *et al.* 2009). This may be why one architect responded to our survey stating that of most importance was “communication, communication, communication.” In one of the few recent studies on early stage cost estimation in Australia, Aibinu and Pasco found that the QS needs to be directly involved in project briefing at project inception rather than relying on information from architect and or client (Aibinu and Pasco,

2008). Little research has been done to examine issues involved in communication between the team during the design processes. This study is the first step of a research aimed at filling the research gap.

METHOD

Sample and response rate

Our aim was to test the hypothesis that: in the design process architects give primacy to design issues over cost issues. In order to test this hypothesis we developed a survey to investigate how Australian architects work in conjunction with quantity surveyors to develop early stage cost estimates and when. Our objectives were to identify at what point architects and Quantity Surveyors become involved in different projects and the kind of conflicts that might arise between them. In order to test the hypothesis, the survey was sent to all members of the Australian Institute of Architects (AIA) – 1132 in total. There were 77 responses, representing around 7% response rate. This is not so large, but was considered adequate given the exploratory nature of this study.

Survey questions: firm and project context

Given that most architectural practices are SMEs and work on a range of projects in size and financial value it was decided to develop the survey around each practice's largest project. This was deemed to be a more substantive measure of an architectural firm's cost management practices. It is often the largest project in an architectural practice that generates the most fee income and in theory is given the most effort by the practice's directors. It is also often, but not necessarily, the project which receives the most design effort. We also chose to identify the project type as well as the monetary value of this project in order to ascertain the complexity of the project. Alongside this project context the number of staff in the practice was identified alongside the role, experience and involvement of survey respondent.

Having asked questions about the architectural firm the survey then included questions about the initial engagement and the stage at which the quantity surveyor was engaged. A question was included to understand why the QS was employed. For example, was it as a result of normal practice or was it the result of needing to remedy a cost over run? Having identified the context and details of the firm's largest project, the next stage of the survey was to ascertain how cost information was incorporated into the early stage design proposals. How did the architect use the cost information and what was its impact on the design process?

FINDINGS

Survey respondents

The characteristic of the respondents' firms were analysed using frequency and percentages of respondents. Table 1 shows that 84% of those who responded were directors of architectural practice. Of the 78 responded to the questions on year of experience, 71% had more than 20 years of experience. Most practice were SMEs with 26% being sole practitioners and 34% having less than 5 staff. Whilst the respondents undertook a range of projects the responses indicated that the majority of the projects undertaken by each office were either domestic projects or housing. However many of the respondents were also involved in commercial and institutional projects. Many of the projects were renovations. Whilst this emphasis on housing projects of one kind or another might suggest that their monetary value was low this was not the case. When asked to indicate the value of the largest projects respondents

have been involved with in their firm, around 31% of the projects were between \$AUD1 and \$AUD5 million dollars, 33% are between \$AUD5 and \$AUD20 million dollars. Assuming that each project was at the lower end of the range indicated in the questionnaire this would mean that the average value of the respondent's projects identified by the survey would be \$AUD19.39M dollars. 81% of the respondents also indicated that they were often involved in the conceptual to completion stage of projects. Another 16% were often involved from conceptual to tender stage. Thus, it was understood that the respondents are familiar with the design vs. cost estimation process. Their responses regarding communication dynamics between architect and QS during the design stages can be confidently relied upon. This study focused on the largest project executed by the respondents because responses relating the largest project would provide an indication of how firms communicate with other team members when operating on their most challenging project.

Table 1 Respondents' and respondent firm's characteristics

	Category	Frequency	Percentage of respondents
Professional position	Director	67	84.0
	Associate	1	1.0
	Architect	11	14.0
	Graduate Architect	1	1.0
	Total	80	100.0
Years of experience in architectural practice	0-1 Years	0	0
	1-5 Years	1	1.0
	5-10 Years	6	8.0
	10-15 Years	6	8.0
	15-20 Years	10	13.0
	Over 20 Years	55	71.0
	Total	78	100.0
Number of staff in respondent practice	Sole Practitioner	21	26.0
	2-5 Years	27	34.0
	5-10 Years	22	28.0
	10-20 Years	6	8.0
	20-50 Years	0	0
	Over 50 Years	4	5.0
	Total	80	100.0
Type of projects handled by respondent firm	Renovation	35	44.0
	Domestic	42	52.0
	Housing	48	60.0
	Institutions	29	36.0
	Commercial	37	46.0
	Retail	21	26.0
	Others	21	26.0

First, the respondents were asked to indicate on a Likert scale of 1 – Very Dissatisfied to 5 – Very Satisfied, how satisfied they are with QS services regarding cost advice on their design. Overall, Australian architects were satisfied or very satisfied with the services provided to them by quantity surveyors. Only 13% indicated that they are either 'very dissatisfied' or 'dissatisfied'. All of the survey respondents appear to have appointed QS on the largest projects in their office. On the issues of why QS was appointed, the data revealed that often this appointment was the result of normal office practice, but in 50% of the instances this was clearly in order to manage projects risks due to project complexity and ensure cost certainty for the project from the outset. In Australia, practice architects can be negligent for giving clients incorrect costing information. For this reason the Australian Institute of Architects advises architects to

term cost estimates Opinions of Probable Costs. On the largest projects in which the respondents have been involved in, 36% of respondents indicated that communication with the QS occurred prior to the conceptual design stage. Another 39% (or 28 respondents) indicated that QS was appointed at this stage. The remaining 25% of architects appointed a quantity surveyor after the outline design stage. This would indicate that for the majority of the architects surveyed, working with a quantity surveyor is seen as being a normal aspect of their practice.

47% of respondents indicated some kind of conflict over design issues vs. cost with their quantity surveyor. More specifically, 32% of respondents reported conflicts in regard to aesthetics, which was defined in the survey as “shapes and other elements integral to the design.” 30% of respondents saw materials as being an issue of conflict. Other issues mentioned by architects in response to this aspect included issues concerning cost disparities between tender prices and QS estimates or between cost data obtained at a local level and more global cost data. In other words they were concerned that the QS had accurate data based on local experience relevant to a particular place and project type and were not simply applying cost data based on aggregated or generic data. One respondent pointed out that the source of conflict between architects and quantity surveyors was because the QS was often “out of touch with actual building market costs and the reality of the tender.” This architect thought that they needed to warn the client that QS estimates may sometimes be 30-40% lower than tender bids. The overwhelming majority of these conflicts concerned how the cost of the design related to quality of finishes (54%). The next largest area of reported conflict was concerning construction methods and cost (41%).

Given the above conflicts, survey respondents integrated the cost information from the QS into the design in a number of ways. The architects chose from a range of cost reduction and integration techniques: 53% of respondents chose to change materials, 57% construction methods and 53% reducing floor areas were the predominant responses. Eliminating design elements was another approach but less popular as this technique was employed by only 47% of the architects who responded to the survey. Much less prevalent as a cost integration technique was the reduction in the quality of finishes. Arguably, the architect respondents saw this as being an area where they were obligated to maintain value for money for their clients.

56 architects commented on the relationship between the architect and the QS. Overwhelmingly, with two exceptions the architects commented that the relationship between these two disciplines was a positive one. In general the architects cited the importance of using a QS and the need for communication: The need to “establish communication in the same language” and they are the “experts in cost control so I to prefer to use them and encourage clients to do so.” As one architect noted: “I insist on their advice being obtained before the project can proceed to the next level” and an “essential part of the team” and “they are becoming a critical consultant where there is an absence of a builder who can provide cost advice.”

However, despite the above affirmation by architects for the use of QS services the survey did reveal a number of demarcation issues between the role and skills of the architect and the QS and in project teams. A number of architects feared that the QS might usurp the role of the architect and that costs related to design were not being properly valued. As one architect noted “architects pass far too much responsibility for cost identification and control over to the QS. It remains my practice to develop strong cost estimation records and procedures and challenge the QS whenever I believe their

advice is questionable or overly conservative.” Other architects also pointed to the idea that the relationship between architects and QS was in some instances “undermined by project managers” and that the “QS are now trying to usurp the Architects role in the preparation of contract documents and capture the project management component of the project.” Some respondents argued that the QS should restrict themselves to “advice on costing” and “avoid leading the design process”. Others felt that the QS needed to value the price of “good design” and perhaps take a “whole-of-life” approach when costs cannot be easily or tangibly valued using normative techniques of costing. Another respondent felt that the QS was overly pedantic in the way in which they criticized the architects design details. This respondent stated that “Our design work seldom gains by their criticisms of extravagant details (i.e. we seldom get extravagant) but I do value the more seasoned or second opinion as a kind of self-protective mechanism.

DISCUSSION

Design issues and aesthetics were often an area of conflict for both parties. The results suggest that tendering was the point at which the architect and the QS would confirm the validity of any early cost estimates. It is likely that it is at this point just prior to tender or after bids have been opened that conflicts may emerge. In their response, the architects responded that they employ a number of flexible design techniques in order to reduce costs such as changing materials, construction methods or reducing floor areas. A primary site of conflict as reported in the survey concerns quality of finishes. This is obviously a cost component that architects are sensitive about. From the survey, reducing costs using less expensive finishes appeared to be the architects least favoured methods of cost reduction. Another area of conflict was in relation to construction methods. Both of these areas of conflict might suggest disparities of knowledge and experience between the two parties. It is possible that Australian quantity surveyors understand less about client’s requirement on finishes when compared to architects because they are not as actively involved with clients at the project inception. Conversely, it is also possible that the architects understand less about construction methods and their cost estimation than the QS. Further research examining the relation of one particular project or relationship in detail would aid an understanding of these issues. Moreover this research could also be extended to how other members of the project team such as project managers, communicate cost information with these two disciplines, other consultants and clients.

Clearly the architects were concerned about the need to use a QS early in the project in order to manage their risks and those of their client. This goes against some common mythologies in the construction industry that architects are often responsible for increases in cost. The results suggest that of concern to a number of respondents was the accuracy of the QS estimates and whether or not these were based on appropriate cost data specific to the project type and its site context. Further research could examine the degree to which cost estimates increased as a result of either the architect’s actions or what impact these increases had on the architect-QS relationship. Clearly, a key issue in this relationship as noted by a number of respondents was the ability for architects and the QS to speak the same language and communicate.

CONCLUSION

Clearly for architects the QS is an important consultant however a number of fault lines between these two project disciplines appear to be revealed by this research. A number of respondents felt that the QS did not understand finishes or the design of

construction details. A number of architectural respondents were concerned that the QS were competitors who might capture the Project Management roles that architects take on some projects. They were also concerned that the QS had little concern for valuing good design and were overly critical of architectural detailing. Only further research examining these issues from the perspective of the QS will we begin to map the communication of cost messages and signals between these two very different professional fields of knowledge. The results are a first step in understanding how cost messages about design play themselves out in the context of project delivery. As Bowen and Edwards conclude interpersonal communication is obviously important in cost planning. However, as they suggest that the cost messages are not always sent between architects, client and QS is not always done in an efficient manner. Further research would investigate and examine the dynamics of the cost messages that are communicated between architect QS and client (Bowen and Edwards 1996). This may be why one architect who responded to our survey stated that of most importance was “communication, communication, communication.”

REFERENCES

- Aibinu, A.A. and Pasco, T. (2008) The accuracy of pre-tender building cost estimate in Australia. *Construction Management and Economics*, **26**(12), 1257-1269.
- Bowen, Paul A, Edwards, P J., and Cattell, K., (2009) Value management practice in South Africa: the built environment professions compared. *Construction Management and Economics*, **27**(11), 1039-1057.
- Edwards, P J and Bowen, P. A., (1996) Building procurement in the *new* South Africa: the communication imperative, CIB W92 International Symposium on Building Procurement, Durban, CIB, January, 1996.
- Flanagan, R., Norman, G., (1983) The accuracy and monitoring of quantity surveyors' price forecasts in building work. *Construction Management and Economics*, **1**(2), 157-80.
- Gunner, J. (1997) *Accuracy of construction pre-bid forecasts*. Unpublished PhD thesis, University of Salford.
- Gunner, J. and Skitmore, M. (1999a) Comparative analysis of pre-bid forecasting of building prices based on Singapore data. *Construction Management and Economics* **17**, 635-646.
- Gunner, J. and Skitmore, M. (1999b) Pre-bid building price forecasting accuracy: price intensity theory. *Engineering, Construction and Architectural Management*, **6**(3), 267-275.
- Ling, Y. Y. and Boo, J. H. S. (2001) Improving the accuracy of approximate estimates of building estimates. *Building Research and Information*, **29**(4), 312-318.
- Morrison, N. (1984) The accuracy of quantity surveyors' cost estimating. *Construction Management and Economics*, **2**, 57-75.
- Pasco, T. and Aibinu, A.A. (2008) Project factors influencing the accuracy of early stage estimates. In: Richard Haigh and Dilanthi Amaratunga (Eds.), *Building Resilience, Proceedings of the International Conference in Education and Research (BEAR)*, Kandalama Hotel, Sri Lanka, 10-15 Feb, 102-112.
- Serpell, A. F. (2005) Improving conceptual cost estimating performance. *ACE International Transactions* EST.13: EST.13.1-13.6.
- Skitmore, M. (1991) *Early stage construction price forecasting*. London.

- Skitmore, M. and Drew, D. (2003) The analysis of pre-tender building price forecasting performance: a case study. *Engineering, Construction and Architectural Management*, **10**(1), 36-42.
- Skitmore, R. M. and Picken, D. (2000) The accuracy of pre-tender building price forecasts: an analysis of USA data. *Australian Institute of Quantity Surveyors Refereed Journal*, **4**(1), 33 -39.
- Trost, S. M. and Oberlender, G. D. (2003) Predicting accuracy of early cost estimates using factor analysis and multivariate analysis. *Journal of Construction Engineering and Management*, **129**(2), 198-204.