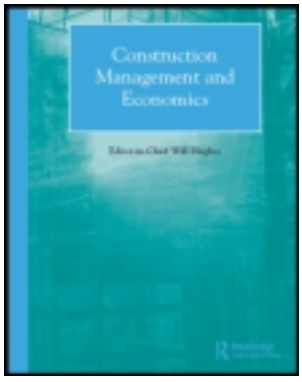

Construction Management and Economics
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rcme20

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Available online: 21 Oct 2010

To cite this article: Peter J. Edwards & Paul A. Bowen (1998): Practices, barriers and benefits of risk management process in building services costs estimation: comment, Construction Management and Economics, 16:1, 105-108

To link to this article: http://dx.doi.org/10.1080/014461998372646

Construction Management and Economics (1998) **16**, 105–108

NOTE

Practices, barriers and benefits of risk management process in building services costs estimation: comment

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Received 23 May 1997; accepted 17 July 1997

This note is a comment on Mok, C.K., Rao Tummala, V.M. and Leung, H.M. (1997) Practices, barriers and benefits of risk management process in building services cost estimation, *Construction Management and Economics*, **15**(2), 161–75, which describes research into the risk perceptions and risk management practices of building services engineers in Hong Kong. The note questions statements made in the paper and parts of the research design and data analyses.

Keywords: Risk, risk management, survey research, cost estimating

Building services cost estimates and risk

Mok *et al.* (1997) point out the major contribution of building services costs towards total construction costs of building projects, and stress the consequential importance of accuracy in cost estimates for building services installations. They go on to describe the 'traditional' method used by most engineers to prepare cost estimates, indicating that a fixed contingency amount is normally included to cover any risks eventuating during the course of the project.

It is at this early point in the paper that potential problems start to arise for readers. The authors do not make immediately clear what 'estimates' they are referring to. From the description of a survey sample later in the paper, it seems likely that these are budget estimates (price forecasts) produced by consultants for building clients during the design phase, as distinct from estimates prepared by contractor's estimators for bidding purposes. Similarly, references later in the paper suggest that the authors are looking at construction risks rather than investment risks, but this is not made explicit.

If the authors are dealing with consultants' estimates, then the use of a contingency amount must be a reasonable practice. The consultants are not being exposed to any of the risks themselves, and are therefore in no position to engage in complete risk control procedures. Nor could consultants reliably predict how tenderers would make risk decisions. For a consultant to spend time (a risk management practice barrier discussed later by the authors) in speculating upon a myriad of potential construction risk events, trying to duplicate the tendering decisions of a contractor, would be counterproductive, as this speculation would also have to include the identity and risk profile of each potential tenderer. The task would be overwhelming.

For the contractor's estimator, the situation is only slightly less daunting. At least he or she should be in a better position to identify the construction risks involved in the project, but the estimator's difficulties will start with the measurement and analysis of these risks. In the first place, the assignment of probabilities will be difficult. It is unlikely that it could be done objectively; historical data for construction are unlike those used in the insurance industry for such misfortunes as death and car accidents. Our samples are far too small. We then are faced with employing *a priori* or subjective methods to establish probabilities (Raftery, 1995). Both are feasible but unlikely solutions to a practical dilemma. The use of *a priori* methods should include at least a reasonable justification for their use, but such a rationale might be elusive. Subjective probability assignment almost certainly would be subject to the same sample size limitations as objective methods: what estimator is going to assemble a sufficiently large panel of experts to produce credible results? Theoretical (e.g. beta) distributions such as highest, lowest, most likely, could be used, but these are criticized by Wall (1997) in favour of lognormal distributions. In any event, would estimators bother to do this in practice?

Given these constraints, it is not surprising that consultants, and contractors' estimators, should use contingency amounts in estimates to signify some degree of risk absorption. Provided it has been done, as Mok *et al.* suggest is preferable, as a result of an explicit risk management process, then few could argue against such a practice. The authors imply that this is not always the case, noting that the risks are not separately identified, nor are the contingency amounts updated during the design phases. Unfortunately, it is not clear if this is the authors' opinion or information extracted from their survey.

A more definitive statement is offered in the authors' review of risk management studies, where they aver that Monte Carlo simulation is the most appropriate technique for risk management in cost estimation. This is open to debate, as both Chau (1995a,b, 1997) and Fellows (1996) have shown. Again, the problem is that of establishing probabilities, notably dealing with bias in subjective probability assignment. If the probability density function curve is unreliable, then no amount of simulation will improve matters.

The research design

Consideration of the authors' research design reveals three concerns. In the first place, the paper does not indicate what *population* they sampled from. We cannot, therefore, deduce the adequacy of their sampling frame, but their stated awareness of the limitations of the sample suggests that some problem exists.

Second, the authors give a demographic breakdown of survey respondents, in terms of public and private sector participants, estimating experience, size of firm, value of projects and sources of projects. However, none of these variables is used to produce cross-tabulated analyses of the survey data, but are simply stated as justification that the sample is representative of the practitioners and practices of Hong Kong building services estimators. Given that we are not told how these strata are distributed in the *population*, the justification cannot be sustained. Some useful insights may have been gained by cross-tabulating the data, unless the data sets were too small to allow this.

Examination of Figure 1 reveals the third concern about the research design, the validity of the survey instrument. Figure 1 reflects respondents perceptions of the term 'risk'. It appears that the survey participants were offered five definitions and asked to rate the *accuracy* on a 1–5 scale. The definitions appear to have been the same (or similar) to those used in an earlier survey, but we are not told how these definitions were arrived at originally, or if respondents were given an additional 'open' opportunity to create their own definitions. Repeating the possible errors of previous work is not conducive to good research.

The authors offer no guidance as to how (or if) the ratings were calibrated during the instrument design process, but it is likely that some rating distortion has occurred in the survey answers, given that abstract qualitative words such as 'very' and 'slightly' have been used to qualify differences in rating the accuracy of definitions. A better approach might have been to ask participants to rank the definitions. The placing of 'uncertain' in the middle of the rating scale must create distortion in the analysis, as it is not a qualifying descriptor of accuracy. For this option, a '0' rating would have been preferable, using 'uncertain' as a rating interval is itself unfortunate, given that some of the definitions also refer to uncertainty.

Calibration of rating scale intervals is not easy, and there is not an abundant literature to consult. This is an area where we have experienced difficulty in our own work. Comment from other researchers would be valuable. Bass *et al.* (1974) describe their experimental work in estimating the magnitude of expressions of frequency and amount. For example, they found that adverbs relating to frequency calibrated acceptably in the ratio 5:4:3:2:1:0 for 'always', 'very often', 'fairly often', 'sometimes', 'seldom', and 'never'. This suggests that a six-point frequency rating interval scale based on this ratio could be used as a basis for scoring answers in a survey questionnaire, but this is an inexact approach at best. The work of Bass *et al.* (1974)

indicates also that the importance of the topic may affect each individual's anchoring point, and their research (carried out mainly among college and high school students) did not attempt to test for cultural and linguistic effects.

The data analyses and data presentation

The authors have perhaps had misgivings about the validity of their data, as Figure 1 presents an analysis of only the positive accuracy opinions. However, this presentation is confusing. The bar chart has a '%' value scale along the top horizontal axis, but we are not told what this represents, either in the label or in the text. On the right hand vertical side of the figure, a series of mean values is presented, but we are not told what these represent, nor how they were calculated. It is likely that they describe scores established by multiplying the number of responses by the rating values. If this is so, then it is possibly a mis-application of parametric statistics, given the data validity problems referred to above. The survey instrument was obviously intended to produce nominal and ordinal data, which would require the use of non-parametric statistical techniques. Surely the modal response values, for each of the ratings (including the negative and uncertain options), would have been a more appropriate statistic? From the analysis presented, we have no idea if the differences between the stated mean values are significant. These analytical and presentation weaknesses persist throughout the tables and figures presented in the paper.

In Figure 2 one of the descriptive options offered to survey participants is "(C) Not knowing the state of nature that will apply". The authors do not indicate the 'uncertain' responses to this category: given its vagueness, the number is likely to be high.

In the accompanying explanation to Figures 1 and 2, the authors state that uncertainty involves assessing probability. This is not so. Uncertainty, being a lack of complete information, could be dealt with by assumptions, without the involvement of probability. It is only if we wish to explore the consequences of different and potentially adverse outcomes to these assumptions that probability assessments might be involved. Later in the same paragraph it is suggested that the survey findings show that Hong Kong building services estimators accept both risk and uncertainty as representing "variability of return (both positive and negative)". This appears to be an extrapolation by the authors beyond the supporting capacity of the presented data, since the survey question did not explicitly identify this level of meaning.

Figures 3–5 show the survey findings with respect to respondents' opinions about the sources of construction risks and their methods of measuring risks. Some confusion surrounds the categories in the figures. Figure 3 includes sources of risk (which presumably were stated in the survey instrument) which are not self-explanatory or not directly associated with construction risk *per se*. For example, what risks do 'Client/Government', 'Project organization', Logistics' and 'Estimating data' represent? How is 'Client/Government' associated with construction risk?

The authors go on to describe respondents' opinions about the degree of importance of using risk management processes associated with different types of building project. This would have been a valuable opportunity to distinguish, through data cross-tabulation, between public sector and private sector respondents, but this level of analysis is not provided. The categories and rating scale intervals in Figure 6 lack clarity. What is the difference between 'very unimportant' and 'somewhat unimportant'? What is the range distinction between 'very complex' and 'very simple' types of project? Do 'government' projects *never* have any 'commercial' elements?

In looking at trends in the use of risk management for services cost estimating, the authors infer that about 75% of respondents thought that it had not been important over the past five years. This is a slight mis-representation of the data, as it includes the 'no change' value (38%). Furthermore, the value for 'less important' (28%) is almost balanced by the 'more important' (26%) opinions. A fairer comment might be that it is not possible to deduce any historical trend in the importance of risk management over the past five years. A minor quibble here is the use of 'less ' and 'more': we would have to ask "less or more than what?".

One aspect overlooked by the authors, in their investigation into attitudes towards risk management and the barriers to using it, is the issue of fees. Assuming that many of the survey sample (52%) were private consultants, it would have been interesting to discover to what extent their attitudes were coloured by the prevailing fee situation. Anecdotal evidence in Australia and South Africa suggests that professional consultants do not include risk assessment in cost estimating services unless clients specifically ask and pay for it. The survey findings for the 'time involvement' barrier might be seen to support this evidence, but the lower score for 'cost justification' (Figure 8) tends to contradict it.

Conclusion

It is difficult to say how much the Mok *et al.* paper contributes to our knowledge of risk management. As

a snapshot of current practice in Hong Kong it is useful, and gives some indication of weaknesses which could be addressed. We have found similar results in our own survey work dealing with cost information management practices among professional building consultants in South Africa. Such surveys, however, tend to produce findings which are typically broad, often with little long term currency. Ideally, we believe they should be followed up quickly by individual case studies, capable of yielding richer, more detailed information about specific practices, and leading to the development of specific and appropriate remedies where necessary. It would be interesting to know if the authors have any plans for doing this.

In this comment on the Mok *et al* (1997) paper, we have expressed concern about the survey design and the nature and level of the data analyses and presentations. More general concern arises about the need to calibrate survey instruments in construction management research, but it seems likely that the problem can be addressed only on a survey by survey basis, through more exhaustive pilot survey testing which specifically explores respondents' perceptions of definitional and rating scale interval differences. This would impose additional time and cost constraints on our research, but can we afford *not* to take these precautions?

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