A needs based methodology for classifying construction clients and selecting contractors: Comment

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This note is a comment on Chinyio, E.A., Olomolaiye, P.O., Kometa, S.T. and Harris, F.C. (1998) A needs based methodology for classifying construction clients and selecting contractors, *Construction Management and Economics*, **16**(10), 91-8, which describes research aimed at classifying clients by their needs rather than by the traditional public-private-developer approach. The paper also proposes a new method of selecting contractors by matching clients' needs to contractors' ability to satisfy them. The note offers constructive criticism of some aspects of the analysis.

Keywords: Classification, clients, construction, contractors, tender evaluation, scaling briefing.

Chinyio *et al*'s (1998) paper provides a step-by-step account of the analysis of data comprising forty clients' (12 public, 11 private and 17 developer) ratings of their "levels of desire" of seven groups of needs (economy, function, safety, quality, time, running/maintenance costs, and flexibility of use). The first part is aimed at classifying client organisations into groups and the second part proposes a new method for contractor selection. Taking these two parts in turn:

Needs-based classification of clients

Stability

As Runeson and Skitmore (1998) have observed in relation to tendering theory, the implicit assumption that an underlying stability exists is an important and crucial issue. In the context considered in Chinyio *et al*'s paper, the problem is that clients' needs may not remain constant over time but may, instead, vary according to circumstances, with different procurement preferences for different projects or different preferences for similar projects at different times. Love *et al*'s (1998) recent study of this has shed a little light on this but much more work is needed before we can treat the issue as insignificant. It would seem prudent, therefore, for any current approach to classification to have clients not only of similar needs but *similarly changing needs* as members of the same grouping. Otherwise, the classification may be only local and
transient - an unsatisfactory outcome for any quantitative research.

A priori vs a posteriori results

Aiming to produce a new typology of clients, the authors use a cluster analysis to identify six groupings of clients. At this point, they calculate a pair-wise 'coefficient of dissimilarity' between clients in the same group, recording the highest value for each group. This is then compared with the highest equivalent coefficient of dissimilarity in the three traditionally typed groups of public-private-developer. As the highest coefficients for the needs-based groups is much lower than those for the traditional groups, they claim, quite correctly, that "the five new [needs-based] groups of clients ... reflect clients' preference similarities more than the traditionally classified clients".

However, they then go on to say that the needs-based groupings will therefore "... provide a better basis for planning towards the attainment of clients needs". This latter point we think lacks the support of the analysis. No allowance has been made for the difference between the *a priori* traditional groups and the *a posteriori* needs-based groups. For a fair comparison to be made, the needs-based group membership function should be specified in advance of the model building (cluster analysis in this case). There are several ways of approximating this. Using 'out-of-sample' data is one. Cross-validation simulates this, with one case (client) being omitted from the data set during the analysis phase and then allocated a group by the resulting model for testing, this procedure being repeated throughout the data set. Another popular approach is simply to go out and get some more data for use out-of-sample.

Even if this is done, it is still necessary for an explicit grouping function to be derived from the in-sample data set. Cluster analysis is clearly a good start, as it groups 'similar' entities as the authors have shown. Following this with a discriminant analysis should then enable the desired function to be found. This would then help any new and, as yet unclassified, client to be placed into the appropriate group.

Needs-based contractor selection

Relative importance rank indices

This part of the paper considers the problem of best matching a client's needs with contractors' ability to satisfy those needs. This is done by computing "relative importance rank index" for the client grouping for comparison with a similar contractor index by means of proximity coefficients calculated by the block-city formula. Although very nice and tidy, this is certainly not the only way of solving the problem and readers should be alerted to the many issues and alternatives surrounding this approach.

A good starting point is to think of this as a seven variable problem. The client has scores on seven variables and each contractor has scores on the same seven variables. As analysts then, the basic problem is to find one contractor that is in some way 'better' than the other contractors from our analysis of the variable scores we have been given. The first problem is to decide what we mean by 'better'. Let us say that the client has scored the 'time' variable with a 5 (out of a maximum possible 7). Lets us also say that our three contractors, C1, C2 and C3, each have scored 4, 5 and 6 respectively. Which contractor is the 'best'? Chinyio *et al*'s approach implies that C2 is the best on this variable as C2's score is the same as the clients and therefore a perfect match. But wait, contractor C3 can do better on time than C2. Would the client object to having C3 instead of C2? Perhaps not. In fact is it not more likely that, all else being equal, clients will prefer a quicker contractor, despite weighting time as only 5 out of seven in importance? So this may not be a simple minimum distance problem after all. It may, in fact, be a problem in which some of the variables are constraints or inequalities (the client may be thinking of 5 as a minimum). This needs clarification. Probably what is really needed is some loss-function, or marginal utility factor, that provides a measure of the level of pain/pleasure that the client will receive in the event of the contractor not actually achieving a 5 on time. This loss-function will necessarily depend on the distance from 5 actually achieved but may not be linear or even continuous.

The next major issue involved in the authors' solution is the means by which the seven variable scores are rolled up and combined into just one score. Though not a new approach to this problem (cf., for example, Jeffrey, 1992; Russell, 1992), this is one of the major debated aspects of multiattribute analysis and, to many, a sleight of hand as it is, in effect, tantamount to comparing chalk with cheese. There are, nevertheless, very many approaches to this and a huge literature.

There are also several technical points that arise in this section. Firstly, the computation of the client relative importance index is done by using "repeated ratings" of one member of the group on the assumption that the group represents "a homogeneous set" and from which an overall ranking of needs is produced. This seems to be a confused mixture of two distinct problems, neither of which are satisfactorily solved. Either we wish to find the best contractor for an individual client or for a group of clients. If it is for an individual client, there seems to be no reason for using repeated ratings in preference to non-repeated ratings. If it is for the clients as a group, then it would seem to make better sense to use all the client data instead of just one. Also, in both cases, once calculated, no use seems to have been made of the rankings. This then questions the need to calculate the relative importance index at all as its sole purpose seems to be to enable the rankings to be made. If the problem is to consider a single client, as seems to be implied in the paper, we can see no difficulty with using the raw rating data. With grouped clients, the situation is a little more complicated but we can see no reason for not working with simple means and variances of the ratings.

A further point with this analysis concerns the proximity coefficients. There are several methods of measuring the distances between entities in both Cluster Analysis and Multidimensional Scaling the choice of which, in the absence of an explicit loss-function, is entirely arbitrary. Assuming that the X and Y values represent a pair taken from the set containing the contractors and client, the choice of *absolute differences* for the Cluster Analysis is therefore also arbitrary, in contrast with the equally arbitrary *squared differences* used in the earlier Multidimensional Scaling process. Also, we cannot see how the highest proximity coefficient of 69 is obtained, the largest in the paper being 19 (client-C2 'low maintenance costs').

Scores

Of great practical interest is the scores themselves. To what extent do they accurately reflect the true values? What does a client score of 5 out of 7 for time mean? Apart from perhaps being construed as a constraint (see above), maybe the client would accept a score of 4 or 6 just as well. Or maybe it just depends on circumstances that are continually changing (see even further above).

For contractors, even more problems arise. How are contractors assessed against these criteria? How are contractors scored on such variables as 'complexity of design' in, presumably, a traditional procurement situation? How accurate are the assessments?. Clearly some account needs to be taken of the difficulty in getting these scores right. Some kind of sensitivity analysis seems to be needed. Monte Carlo simulation perhaps.

Client groupings

In comparison with the magnitude of the problems raised by contractor selection, quite how to group clients seems to be trivial as contractor selection is usually thought of as a problem faced by individual, rather than groups, of clients. The inaccuracy of one client, however, has been mentioned. Perhaps the real point of client groupings is to reduce this inaccuracy. Like Skitmore and Marsden (1988), this argues that, for a group of clients with similar needs, if each need is vaguely expressed, then the aggregate of these expressions should be more accurate than any individual expression. Another possibility is that any one client might not be able to articulate the required scores and so we would have to use default values instead - those of the group aggregate.

Graphical representation

"Beyond five [bidders], more complicated plots are required. This restriction implies that ... the prequalification of contractors should end up with a short-list of three or at most four contending bidders". The mere fact that it is hard to represent more than two dimensions on paper is a very weak reason for not considering the possibility that there are really more dimensions involved.

As far as easing the comprehension problems for (non-technical) clients is concerned, would it not be simpler just to list the client-contractor proximity coefficients? Also, we fail to see how a client would be able to use the contractor-contractor coefficients.

Likewise, it has to be said that, despite the authors' claims to the contrary, the paper makes no significant contribution to the optimal number of bidders problem beyond pointing out the obvious dimensional limitations of graphical representations.

References

Chinyio, E.A., Olomolaiye, P.O., Kometa, S.T. and Harris, F.C. (1998) A needs based methodology for classifying construction clients and selecting contractors. *Construction Management and Economics*, **16**(10), 91-8.

Jeffrey, R.S. (1992) Decision models for analysis and evaluation of construction contractors. *Construction Management and Economics* **10**(3) 185-202.

Love, P.E.D., Skitmore, M. and Earl, G. (1998) Selecting a suitable procurement method for a building project. *Construction Management and Economics* **16**(2) 221-33.

Runeson, G. and Skitmore, M. (1998) Tendering theory revisited. *Construction Management and Economics* (in press).

Russell, J. (1992) Decision models for analysis of construction contractors. *Construction Management and Economics* **10** 185-202.

Skitmore, M. and Marsden, D.E. (1988) Which procurement system? Towards a universal procurement selection technique. *Construction Management and Economics* **6** 71-89.

Zavadskas, E., Peldschus, F. and Kaklauskas, A. (1994) *Multiple criteria evaluation of projects in construction*. Vilnius

Technical University, Institute of Technological and Economic Development (ITED) Series of Publications, **1**, Vilnius "TECHNIKA", ISBN 9986 05 046 4.

Mills, Anthony and Skitmore, Martin R. (1999) A needs based methodology for classifying construction clients and selecting contractors: comment. *Construction Management and Economics* 17(1):pp. 5-7.