UK CIVIL ENGINEERING PRACTITIONERS' PERCEPTIONS OF CONTRACTOR PREQUALIFICATION CRITERIA

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The issue of contractor prequalification has achieved a central focus within the mainstream of construction management research. It is recognised that an effective selection process contributes significantly to a client entering into contract with a 'good' contractor. This paper examines one aspect of a research programme performing in-depth analysis of contractor selection criteria, specifically, with respect to civil engineering (CE) works. A structured questionnaire survey conducted in the UK has accrued substantial data relating to practitioners' perceptions of prequalification criteria; and significant differences are discovered among such cognition (e.g. regarding levels of importance assigned to these criteria implicitly or otherwise). Findings show that most CE clients view contractor *financial stability* as being one of the most important attributes to be satisfied. The research findings offer useful benchmarks in striving to streamline current prequalification practices. The implications of the research are assessed in detail. Finally, the paper explores the possibility that any new prequalification paradigm should be viewed as a process for establishing a '*reciprocal relationship*'. That is, contractors' abilities (attributes) should meet clients' expectations thereby contributing to less adversarial (client / contractor) business interaction. This is of course, perfectly in tune with the aspirations of the industry's new way of thinking and reflects the ideals of Latham and Egan (et al).

Keywords: prequalification, client, civil engineering, statistical analysis.

INTRODUCTION

Contractor prequalification is related to the assessment of contractor capabilities, typically in terms of financial soundness, managerial capability, health and safety record, technical expertise, and past performance achieved (Holt et al, 1994; Hatush and Skitmore, 1997a). The prequalification process may occur on a project-by-project basis or represent an on-going process to sustain a (prequalified) contractor list for future project(s). Russell and Skibniewski (1987) found that the 'environment' for decision-making is of vital importance during prequalification. This includes the use of a well-structured strategy to identify and determine a set of suitable criteria (for meeting client and project needs), and objective weighting strategies for these criteria to be applied during the evaluation process. Lower (1982) captured the essence of contractor prequalification in public sector CE projects, and cited that effective prequalification benefits both construction clients and contractors through the elimination of a multitude of subsequent problems. For contractors, effective prequalification provides fair competition based on a reasonable and reproducible selection process.

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Prequalification criteria (PC) have increasingly been studied (Holt et al, 1994; Hatush and Skitmore 1997a; Ng et al, 1999). Recent research and 'good guidance' documents have confirmed that judicious selection of a contractor can only be achieved if the prequalification criteria are well defined and evaluated as objectively as possible (CIB, 1997; CIRIA, 1998; Holt, 1998a). In the present study, PC were investigated through a postal questionnaire survey, of UK construction practitioners. Their perceptions regarding the use of PC in CE projects are analysed. The *level of importance assigned* (LIA) to these criteria by respondents were based on their past two years' prequalification experience. Statistical analysis of those data collected observed relationships among the PC, for given types of client in CE projects.

METHODOLOGY

A detailed literature review was undertaken prior to the nation-wide structured questionnaire survey. The questionnaire consisted of three components : (1) data classification, (2) respondents' opinions regarding use of prequalification criteria; and (3) ditto for tenderer evaluation criteria. It is components (1) and (2) that are discussed in this paper. Component (1) enabled data classification based on types of client and types of project. A *Likert scale* (1 to 5) was used to measure respondents' opinions in component (2) i.e. regarding LIA for each PC based on respondents' experience in procuring CE projects over the two years prior to survey. The survey sample comprised: 250 public clients; 200 private clients; and 250 contractors. There were 156 (22%) questionnaires returned completed. Of these, 74 were from public clients, 47 from private clients and 35 from contractors.

The data analysis was performed in SPSS version 9.0. The following summarises the statistical methods used, and their rationale in this context:

Spearman Rank Correlation Coefficient (SRCC) test: to test for association between the rankings of criteria, based upon LIA.

Non-parametric test (Kruskall-Wallis) and *parametric test* (analysis of variance, ANOVA): to investigate the power of statistical tests and, to check for violation of parametric assumptions of the observed data.

Interaction Plot and: *two-way ANOVA*: to show any inconsistency of LIA among the PC in regard to organisation types.

Error Bar Chart: to identify the confidence intervals of LIA for each PC and make comparisons among the sample groupings diagrammatically.

Post-Hoc Multiple Comparison Procedure analysis: to confirm exactly where the LIA differences lay (with the particular PC) among the three different sample groupings.

Highlighting the significant differences in mean response (i.e. between mean levels of importance attached to PC using non-parametric tests), was discussed in Russell *et al* (1992). They used the SRCC and Kruskal-Wallis tests for quantitative analysis of prequalification criteria opinions, among US construction practitioners. However, parametric tests are able to provide more powerful and precise results in finding any differences (e.g. respondents' LIA on PC) within the sample data (Norusis, 1995:p341). Therefore, the use of parametric tests in finding significant differences of LIA with regard to the particular PC, among the different groupings of respondents, are used (the issues of parametric test pre-requisites are explained later).

ANALYSIS OF SURVEY DATA

In order to analyse how important PC were perceived and to observe the usage of PC among respondents, the analysis first began with the study of LIA correlation (with regard to particular PC). Statistical correlation describes an association between two varaibles, or as here, between the sets of ranks where the increments / decrement in one variable occurs together with increments / decrement in others. The quantifiable relationship between these two sets of variables can then be measured by an index called the correlation coeffient-*r* (Cohen and Holliday, 1996).

The SRCC test was employed in this instance, to test for association of LIA between the combination of any pairs of sample groupings i.e. between public client and private clients; public clients and contractors; and private clients and contractors. The SRCC calculates the correlation of PC rankings (ranked accordingly based upon LIA). The average LIA for each criterion was calculated based on aggregated sample response measured by the Likert scale.

The value of correlation (*r*) can vary from -1 to 1, indicating negative or positive association respectively. A value of *zero* indicates no correlation; 1 indicates perfect positive correlation and –1 indicates reverse rankings correlation (Hayslett, 1988: p180; Ruddock, 1995: p97). In this correlation analysis, all sets of rankings for criteria based on LIA were tested statistically using SRCC; to find out if these sets of data closely correlated among public and private clients, and contractor organisations. Table 1 shows the observed LIA for each PC in CE works, for each of the three sample groupings. The approximate correlation coefficients are: **0.83** between public and private sector clients; **0.76** between public clients and contractors; and **0.84** between private clients and contractors in CE projects. All results are significant at the 0.01 level.

In order to compare the computed coefficients (*r*), the coefficient of determination (r^2) is required. This provides an indication of how far variation in one variable is accounted for by others (Bryman and Cramer, 1999; p181). For instance, if r=0.83 (between public and private client respondents), then r^2=0.69 this means that 69 % of the variation in (public respondents) LIA was attributable to the LIA variance in private respondents. To consider this another way, 31 % of the variance in private respondents' LIA is attributable to factors other than in public respondents' LIA. Results show a strong relationship between public clients and contractors i.e. 58%; and between private clients and contractors i.e. 71%. A set of *top-fifteen* PC ranked in accordance with the aggregated mean responses was also identified. These are shown in bold in Table 1.

However, a strong association between the three sample groupings (in terms of LIA) does not show which variables are causing this relationship; or which are considered significantly different from others across the sample groupings.

The following analyses discuss how these significant differences were confirmed via the use ANOVA.

ANOVA Assumptions

Assumptions for parametric tests have long been debated and remain to some extent unresolved (Bryman and Cramer, 1999). ANOVA requires the assumptions of: (1) independent samples; (2) normal distribution of the population sample scores; and (3) equal sample variances (Norusis, 1995:p283). Assumption (1) is well conditioned here since the response was based on individuals' experience and the samples were randomly selected from different organisations.

Table 1: Observed LIA of 45 PC for civil engineering projects

Prequalification Criteria	[a]*Public*	**Rank**	[a]*Private*	*Rank*	[a]*C'tor*	*Rank*
1. Current work load	3.417	28.0	3.846	*20.0*	4.050	*18.0*
2. Location of home office/ place for business	2.833	38.0	3.000	*42.0*	3.167	*38.0*
3. Ability to innovate	2.583	41.0	3.385	*35.5*	3.583	*30.5*
4. Insurance Cover	**4.542**	**6.0**	3.769	*24.0*	3.250	*35.5*
5. Past performance in terms of time	**4.375**	**8.0**	**4.385**	***[b]6.5***	**4.417**	***8.0***
6. Past performance in terms of cost	**4.333**	**9.0**	**4.462**	***4.0***	**4.417**	***8.0***
7. Quality performance record	**4.500**	**7.0**	**4.385**	***[b]6.5***	**4.333**	***[b]10.5***
8. Experience in particular work type(s)	**4.583**	**5.0**	**4.385**	***[b]6.5***	**4.667**	***3.0***
9. Contractor maximum capacity	**3.917**	**[b]15.5**	3.747	*25.0*	3.750	*25.5*
10. Staff training regime	3.125	35.0	3.077	*41.0*	3.083	*39.0*
11. Home office support	2.792	39.0	3.154	*40.0*	3.075	*40.5*
12. Annual turnover	3.208	31.0	3.462	*32.5*	3.417	*32.5*
13. Risk management system	3.625	25.0	3.231	*38.5*	3.917	*20.5*
14. Financial stability	**4.792**	**1.0**	**4.538**	***[b]2.5***	**4.167**	***[b]14.5***
15. Health and safety (record/awareness)	**4.750**	**2.0**	**4.231**	***13.0***	**4.667**	***3.0***
16. Technical ability and expertise	**4.667**	**4.0**	**4.308**	***10.0***	**4.667**	***3.0***
17. References / third parties	3.744	21.0	3.462	*32.5*	3.833	*23.5*
18. Bonding capacity	3.708	22.0	3.385	*35.5*	3.250	*35.5*
19. Environmental impact awareness	3.292	30.0	3.308	*37.0*	3.583	*30.5*
20. Design ability	2.542	42.5	3.731	*26.0*	3.075	*40.5*
21. Dispute and claim history	**4.042**	**14.0**	4.077	*16.5*	2.667	*43.0*
22. Experience: local or international	3.667	23.5	**4.308**	***10.0***	4.083	*17.0*
23. Resources(manpower/equipment/labour)	3.792	19.0	4.077	*16.5*	**4.167**	***[b]14.5***
24. Project management skills.	3.875	17.0	**4.308**	***10.0***	**4.154**	***16.0***
25. Interface of contractor with others	3.333	29.0	3.692	*27.0*	3.833	*23.5*
26. Company size and organisation	3.667	23.5	3.462	*32.5*	3.667	*28.0*
27. Site management	**4.127**	**12.0**	**4.244**	***12.0***	4.000	*19.0*
28. Quality and experience of key personnel(s)	**4.250**	**11.0**	**4.538**	***[b]2.5***	**4.500**	***6.0***
29. Reputation/Image	3.171	32.5	3.615	*28.0*	3.667	*28.0*
30. Employees and Subcontractors details	3.042	37.0	3.462	*32.5*	3.250	*35.5*
31. Understanding of contract/legal issues	3.125	35.0	3.482	*30.0*	3.417	*32.5*
32. Number of years in business	2.625	40.0	3.231	*38.5*	3.250	*35.5*
33. Past performance to particular project	3.750	20.0	**4.154**	***[b]14.5***	4.333	*10.5*
34. Financial exposure (local or international)	3.475	27.0	3.835	*21.0*	3.879	*22.0*
35. Prior business relationship	3.125	35.0	3.538	*29.0*	3.750	*25.5*
36. Contractor negotiation skill	2.542	42.5	2.918	*43.0*	3.000	*42.0*
37. Past performance in client's previous project(s)	**3.917**	**[b]15.5**	**4.154**	***[b]14.5***	**4.583**	***5.0***
38. Company nationality	1.542	45.0	2.231	*45.0*	1.917	*44.5*
39. Trade union record	2.215	44.0	2.769	*44.0*	1.917	*44.5*
40. Contractor specific experience	3.602	26.0	3.830	*22.5*	**4.250**	***[b]12.5***
41. Quality assurance and control procedure	3.171	32.5	4.000	*18.0*	3.917	*20.5*
42. Contractor success/failure contract record(s)	3.871	18.0	3.830	*22.5*	**4.250**	***[b]12.5***
43. Credit rating	4.292	10.0	3.918	*19.0*	3.667	*28.0*
44. Management capability	**4.125**	**13.0**	**4.335**	***[b]6.5***	**4.417**	***8.0***
45. Contractor capability to carry out the work	**4.738**	**3.0**	**4.900**	***1.0***	**4.811**	***1.0***

Note: All PC arranged (in random sequence) from 1 to 45 for cross reference with Tables 2 and 4, and Figures 1 and 2. All bolded are Top-fifteen PC.
[a] A Likert scale from 1 to 5 was used, where: 1= no impact, 3= moderate impact, 5= high impact.
[b] Tied rank

The assumptions (2) and (3) can be determined by running non-parametric and parametric tests on the same data. If the results from both tests do not differ greatly then it can be concluded that the data have been drawn from a population which does not violate either assumptions (2) or (3) (Bryman and Cramer, 1999:p119).

Non-parametric and Parametric Tests for Violation Conditions

One-way ANOVA is a parametric test used to test a hypothesis about two or more population means. It compares: variability *between* the group means; and observed variability *within* group means (Norusis, 1995:pp279-301). The Kruskal-Wallis test is a non-parametric alternative to one-way ANOVA and assumes less stringent assumptions than the parametric test (Norusis, 1995:p349). Table 2 shows the non-parametric and parametric tests results; containing only those PC with significant differences in mean scores across the sample groupings. There are *eight* PC highlighted in the parametric test results and *nine* PC from the non-parametric test results. Of these, 100% of the PC in the parametric test and 89% of PC in the non-parametric test match. This shows that the results from both tests (based on the same sets of data) do not differ greatly. Drawing on this, it can be assumed therefore that the data have been drawn from a population which does not violate the assumption conditions. Therefore, the following discussion will focus upon the use of the parametric test to investigate each LIA (i.e. the differences between, and within, those organisations' perceptions measured).

The Interaction Plot

The interactions of PC and organisation types are plotted in Figure 1. The vertical axis represents LIA reported by different organisations and, the horizontal axis represents the 45 number of variables (PC) (*refer* Table 1). Cursory perusal of the interaction plots, show those LIA influenced by the effects of organisation types and different PC used during tender evaluation. However, whether these effects are statistically significant can only be determined by testing them via a two-way ANOVA. The two-way ANOVA confirms whether the population means of LIA are equal for the corresponding PC among the organisation types and, whether there is an interaction between PC and organisation types to give equal or unequal effects on LIA.

Two-way ANOVA

The dependent variables i.e. LIA, may be expected to show some variation resulting from external factors such as PC or organisation types. For instance, some LIA may have been rated higher in one of the PC compared to others, similarly, variance in LIA may (or may not) be due to a second factor i.e. type of respondent organisation. Thus, the anticipation is that some degree of 'interaction' may exist within the PC and organisation types. Such interaction can be statistically tested and determined by using two-way ANOVA. The *General Linear Model* (GLM) *Univariate* ANOVA procedure in SPSS 9.0 was used to test the *interaction* and *main effects* of these surveyed data. The first test to look into two-way ANOVA is the *interaction effects* of PC and organisation types. The null hypothesis for the *two-way interaction* terms is that the effect of type of PC on the mean value of LIA is the same for all organisation types (i.e. no interaction exists to contribute an effect on LIA).

Table 3 shows that the observed significance level for the no-interaction (null) hypothesis is 0.000 ($p<0.0005$). The alternative hypothesis is therefore accepted, i.e. there is an interaction between PC and organisation types. The remaining null hypothesis is that the *main effects* of PC and organisation types to the LIA are all the same. Table 3 shows that the observed significance levels in main effects analysis are 0.000 ($p<0.0005$). Therefore, the hypothesis that main effects of PC and organisation types to the LIA are equal is rejected.

Table 2: Parametric and non-parametric tests comparison in civil engineering projects

Parametric (One-way ANOVA)						Non-parametric (Kruskal-Wallis test)		
		Sum of Squares	*Mean Square*	*F*	*Sig.*		*Chi-Square*	*Sig.*
*PC3	Between Groups	11.834	5.917	5.226	*0.009*	*PC3	8.789	*0.012*
	Within Groups	52.084	1.132					
*PC4	Between Groups	13.276	6.638	4.793	*0.013*	*PC4	8.755	*0.013*
	Within Groups	63.703	1.385					
*PC14	Between Groups	2.992	1.496	5.290	*0.009*	*PC14	7.853	*0.020*
	Within Groups	13.008	0.283					
*PC20	Between Groups	11.767	5.884	4.708	*0.014*	*PC20	7.818	*0.020*
	Within Groups	57.485	1.250					
*PC21	Between Groups	17.448	8.724	11.615	*0.000*	*PC21	15.425	*0.000*
	Within Groups	34.552	0.751					
*PC33	Between Groups	3.184	1.592	3.892	*0.027*	PC32	6.015	*0.049*
	Within Groups	18.816	0.409					
*PC38	Between Groups	5.834	2.917	3.396	*0.042*	*PC33	6.947	*0.031*
	Within Groups	39.513	0.859					
*PC41	Between Groups	6.771	3.386	3.611	*0.035*	*PC38	7.510	*0.023*
	Within Groups	43.124	0.937					
						*PC41	6.643	*0.036*

Note: All PC Significant different at .05 levels. All PC are arranged in the sequence as per Table 1 according to the I.D. number cited
** Constantly matching in both tests.*

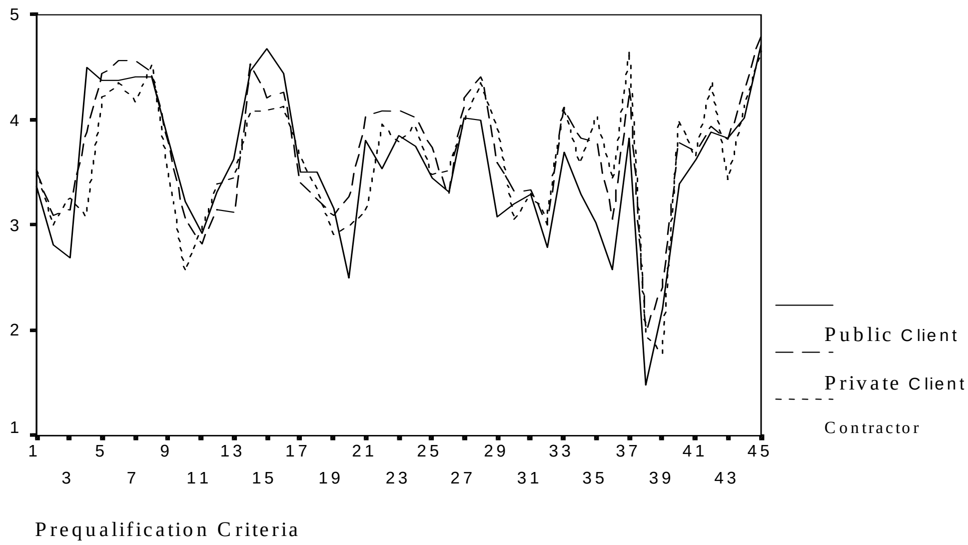

Figure 1: Interaction plot in LIA for civil engineering projects

Table 3: Two-way ANOVA for PC in civil engineering projects

			Sum of Squares	Df	Mean Square	F	Sig.
LIA	Main Effects	(Combined)	759	46	17	21	.000
		Organisation Types	17	2	9	11	.000
		PC	742	44	17	22	.000
	2-Way Interactions	Organisation Types / PC	122	88	1	2	.000
	Model		1002	134	7	10	.000
	Residual		1568	20252	1		
	Totals:		2570	21599	1		

These results confirm that the effects of PC and organisation types upon the LIA were different. The results also show an interaction between PC and organisation types; this means that the LIA relationships (i.e. means) were different among PC in respect of organisation types. For instance, it might be that private clients assigned one of the criteria (e.g. *dispute and claim history*) more importance than public clients, while the same is not necessarily true for contractors. Therefore, it is appropriate to consider particular PC and types of organisations when investigating the variance and relationships of LIA.

Error Bar Chart

Mean is the most familiar measure to describe the central tendency or average of a distribution for a set of given variables' scores (Cohen and Holliday, 1996:p22). Investigation of respondents' means provides information about how a distribution of the means is centred / grouped together. A *confidence interval* (CI) is use to indicate how representative a sample mean is, with regard to the population from which the sample was drawn (Holt, 1998b: p106). It also gives predicted mean range for the same population. In this instance, it was found that a diagrammatical plot i.e. error bar plot is more effective for distinguishing the surveyed respondents' 95% CI means among respondent types and PC. Each error bar plot is centred on the mean of a distribution and extends above and below to show a 95% CI means (or standard deviation) rather than being indicated in numeric tables (for easier comparison). An error bar chart for 95% CIs of LIA means (for the particular PC) among clients and contractors in CE projects is therefore plotted in Figure 2. For brevity and to avoid confusion (i.e. to reduce the number of *error bars*), public and private clients' response are combined in this plot.

As can be seen from Figure 2 most of the CIs overlap (clients and contractors) in CE works, meaning that 95% CIs for estimated LIA means for clients and contractors in CE projects are very close. This also indicates that the degree of importance attached to the PC, by both clients and contractors are very similar. It is apparent that there is a strong correlation in opinion (on criteria that 95% CIs overlapped) regarding the use of PC between construction clients and contractors. It is also likely to suggest that, during prequalification most clients' objectives are satisfied (on criteria that are compromised) and also considered very important for their requirements. Whilst for contractors, it indicates that they perceive most of these criteria as being important for them to become prequalified. To investigate the possibility of differences in opinions (i.e. among LIA means) the *post hoc multiple comparison* procedure was used.

Post Hoc Comparison Analysis: Investigating for 'True' Differences

The post hoc multiple comparison procedure in ANOVA confirms exactly where differences exist among respondents' LIA means of the observed PC. To perform this, 0.017 levels of significance (cut off points) were used (Bryman and Cramer, 1999:p161). For brevity, only PC with significant 'true' difference among the respondent groupings are shown in Table 4.

Table 4 shows *four* PC significantly different among the three respondent groupings. Public sector clients viewed *insurance cover* (PC4) and *financial stability* (PC14) significantly different from contractors. The former could be attributed to clients' awareness of mitigating risk, particularly, in CE contracts, so insurance inevitably plays an important part in this. Insufficient insurance coverage may also give rise to contractor (and client) financial difficulty as a consequence of project delay or failure. Furthermore, there are significant administration and 'frustration' costs of replacing a contractor (incurred in the case of contractor failure) to continue the contract.

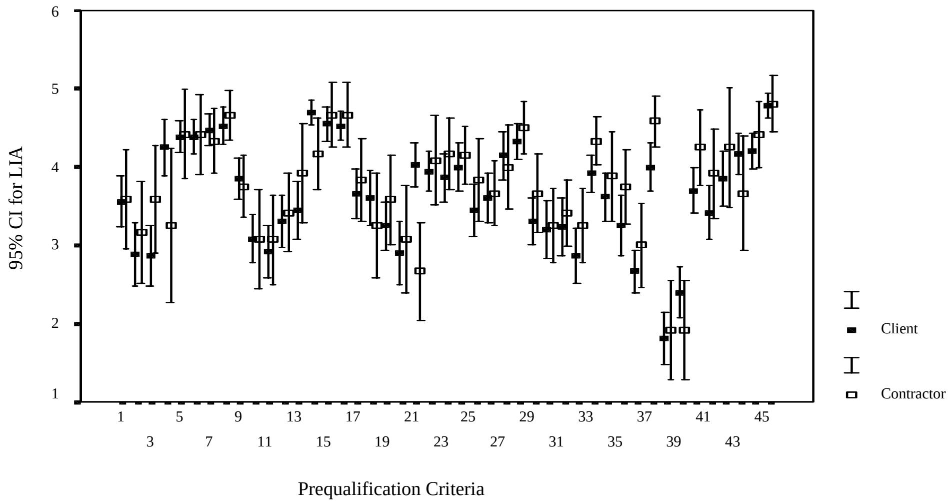

Figure 2: Error bar chart plot: LIA confidence intervals for civil engineering projects

Table 4: Post Hoc Multi Comparisons in civil engineering projects

PC[1]		*Mean*[2]		Mean	*Mean Difference*[3]	*Std. Error*	*Sig.*
PC4	Public	*4.542*	Contractor	3.250	1.292	0.419	*0.012*
PC14	Public	*4.792*	Contractor	4.167	0.626	0.189	*0.006*
PC20	Private	*3.731*	Public	2.542	1.189	0.379	*0.011*
PC21	Private	*4.077*	Public	4.042	0.035	.309	*0.000*
			Contractor	2.667	1.410	.341	*0.000*

[1] All PC arranged in the sequence as per Table 1 according to the I.D. number cited.
[2] Highest mean values among the sample groupings
[3] The mean difference is significant at the .017 level.

The construction industry is a high risk business. The number of insolvencies is higher than in other industry sectors (Abidali, 1990). Contractors' *financial stability* is arguably one of the most important factors and has been consistently cited by many as worthy of evaluation in prequalification (Hunt et al, 1966; Russell 1991; Russell and Jaselskis 1992; Holt, 1996; Hatush and Skitmore, 1997b). The financial stability of a contractor determines whether the company will stand or fall. Clearly, if contractor potential failure can be recognised at the prequalification stage it can thereby minimise project failure risk. It is not surprising that public clients assigned this criterion more importance (i.e. highest LIA) than private clients and significantly different from contractors.

Private sector clients showed more concern with *design ability* (PC20) and *dispute and claim history* (PC21) and viewed these PC significantly different from public clients and contractor organisations. The importance of *design ability* may be due to the project nature, such as complexity and early contractor involvement (i.e. contribution of a contractor to design proposals).

It seems that a contractor's inability to carry out the obligation of a legally binding contract caused great concern in private sector clients. *Dispute and claim history* may give rise to private clients' attention upon contractors' likelihood of experiencing contract disputes. According to Holt (1996), project cost overruns are often caused by price fluctuations, variations in the works and monetary claims by contractors. The latter constituted contractors' 'opportunistic behaviour' of claim tendency and it could be more likely to trigger contract litigation / dispute between a client and contractor.

The importance of *dispute and claim history* may also be caused by other intervening factors such as a contractor's failure to complete a contract, and time / cost overruns.

CONCLUSIONS

The research findings facilitate additional knowledge of contractors' attributes in procuring CE projects. For instance, the correlation tests i.e. SRCC analysis (based upon LIA ranks) identified a strong association in opinions regarding the use of these PC among the respondents, in their two years' CE procurement experiences. A set of *top-fifteen* PC ranked according to the aggregated mean responses was also identified. However, despite this strong association of grouped LIA opinions among the respondents, significant views in differences of particular LIA criteria were also found. The interaction plot shows inconsistency of LIA among the PC in regard to organisation types. This was further confirmed by the two-way ANOVA i.e. that significant *interaction effects* and *main effects* result from the type of PC and organisations. That is, effects of PC and organisation types upon the LIA were different.

The error bar chart showed significant overlap of all 95% CIs of LIA means between clients and contractors. This could be attributed to the implication that during prequalification, clients place more emphasis on certain PC in order to satisfy their needs as well as to achieve project requirements. From the contractors' viewpoint, they perceive most of these criteria as important for them to become prequalified. Clearly, at prequalification stage most of these 'compromised' criteria are most desirable for contractors to impress clients and consequently achieve an invitation to tender. It is obvious that prequalification may not be regarded as an isolated exercise by contractors, but, to secure their opportunity they must adequately convey their potential ability to meet clients' expectations. The post-hoc multiple comparison analysis confirmed exactly where the LIA differences lay (with the particular PC) among the three different sample groupings. The response from public sector clients indicated that they are more aware of *time* and *cost overruns* caused by contractors' poor financial performance and lack of insurance cover. Private sector clients viewed *design ability* and *dispute and claims* as their major concerns.

To summarise, these findings provide useful information for clients regarding 'up-to-date' prequalification criteria preferences. For contractors, the empirical survey offers useful feedback as to what prequalification criteria are essential to meet clients' prequalification evaluation aspirations. Furthermore, a client might benefit from elimination of the multitude of problems from selecting a 'poor' performance contractor. On the other hand, contractors will benefit from fair competition and time and cost savings (knowing their capability limits) in the course of preparation for tender.

The issues identified in this research provide a focus mechanism for future development of contractor selection investigations. For instance, in extending this, those identified LIA (for each particular PC) might be implemented into a quantitative contractor prequalification process, in aiding clients' decision-making process via more objective, and 'standard' means.

REFERENCES:

Abidali, A.F. (1990) *A Methodology for predicting company in the construction industry.* PhD. Thesis, University of Loughborough, Loughborough, U.K.

Bryman, A. and Cramer D. (1999) *Quantitative Data Analysis with SPSS Release 8 for Windows- A guide for social scientists.* London: Routledge. ISBN: 0-415-20697-9

CIB (1997) *Framework for a national register for contractors.* Working Group 5, Construction Industry Board, London: Thomas Telford.

CIRIA (1998) *Selecting contractors by value.* Construction Industry Research and Information Association, London: CIRIA. ISBN: 0 86017 491 3

Cohen, L. and Holiday, M. (1996) *Statistics for social scientists.* London : Harper and Row.

Egan, J. (1998) *Rethinking Construction.* Department of the Environment, Taransport and the Regions.

Hayslett, H.T. (1988) *Statistic.* Willian Heinemann, ISBN: 0 434 98474 4.

Holt, G.D. (1996) *A methodology for predicting the performance of construction contractors.* PhD Thesis, University of Wolverhampton, Wolverhampton, 1995.

Holt, G.D. (1998a) Which contractor selection methodology? *The International Journal of Project Management*, **16**(3): 153-164, Oxford: Pergamon Press.

Holt, G.D. (1998b) *A guide to successful dissertation study for students of the built environment.* 2nd ed, The Built Environment Research unit, University of Wolverhampton. ISBN: 1 902010 01 9

Holt, G.D., Olomolaiye, P.O. and Harris, F.C. (1994) Evaluating prequalification criteria in contractor selection. *Building and Environment,* **29**(4): 437-448, Oxford: Pergamon Press.

Hunt, H.W., Logan, D.H., Corbetta, R.H., Crimmins, A.H., Bayard, R.P., Lore, H.E. and Bogen, S.A. (1966) Contract award practices. *Journal of the Construction Division Proceeding of ASCE,* **92**(C01): 1-16.

Hatush, Z and Skitmore, M. (1997a) Criteria for contractor selection. *Construction Management and Economic*, **15**(1): 19-38, E. & F.N. Spon.

Hatush, Z and Skitmore, M. (1997b) Evaluation contractor prequalification data selection criteria and project success factors. *Construction Management and Economic,* 15(2): 129-147. London: E. & F.N. Spon.

Lower, J.(1982) Prequalifying construction contractors: *Journal of American Water Association*, 74, 220-223.

Ng S.T., Skitmore, R.M., and Smith, N.J. (1999) Decision-makers' perception in the formulation of prequalification criteria. *Engineering, Construction and Architectural Management*, **6**(2): 155-165, Black-well Science.

Norusis, M.J. (1995) *SPSS 6.1 guide to data analysis.* Chicago: SPSS inc. ISBN: 0 13 437054 6.

Russell, J. and Skibniewski, M.J. (1987) A structured approach to the contractor prequalification process. In the USA, *Proc. CIB-SBI 4th Inst. Symp. on Building Economics, Danish Building Research Inst.*

Ruddock, L. (1995) *Quantitative methods for the built environment- Volume one: Statistical analysis*. The White Caste Press, ISBN 0 952 557908.

Russell, J.S., Hancher, D.E. and Skibniewski, M.J. (1992) Contractor prequalification data for construction owners. *Construction Management and Economics*, **10**: 117-135

Russell, J.S. (1991) Contractor failure: analysis. *Journal of Performance of Construction Facilities,* ASCE. **5**(3): 163-180.

Russell, J.S. and Jaselskis, E.J. (1992) Predicting construction contractor failure prior to contract award. *Journal of Construction Engineering and Management*, ASCE, **118**(4): 791-811.