

PERFORMANCE-BASED EVALUATION FOR ENGINEERING CONSULTANTS: A STUDY OF ASSESSMENT CRITERIA

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Selection of engineering consultants by bid price alone is considered problematic, as the quality of service provided by incapable or unsuitable consultants could in turn affect the time, cost and quality throughout the entire project life cycle. In view of the deficiencies of fee-based methods, project owners in many advanced countries now in favor of adopting Quality-Based Selection (QBS) approaches for selecting consultants. When determining consultant's competence, previous performance should be carefully examined as the quality of consultants can be directly or indirectly reflected through their performance of similar previous assignments. The importance of performance evaluation is reflected by the high weighting attached to performance-related criteria in many real-world QBS systems. Despite its significance, Consultant Performance Evaluation (CPE) has never been a subject of thorough investigation. In practice, various owners have their own evaluation procedures, criteria and emphasis (reflected in the weightings assigned to the evaluation criteria), and it is difficult to establish a transparent and objective practice for CPE. There is a need to examine whether a universal set of CPE criteria and weightings can be derived for project owners in order to prevent any discrepancies in consultant selection decisions. This paper reports the results of an empirical study conducted with owners and engineering consultants in Hong Kong. The significance of CPE criteria is examined and a list of predominant CPE criteria for QBS approaches is proposed.

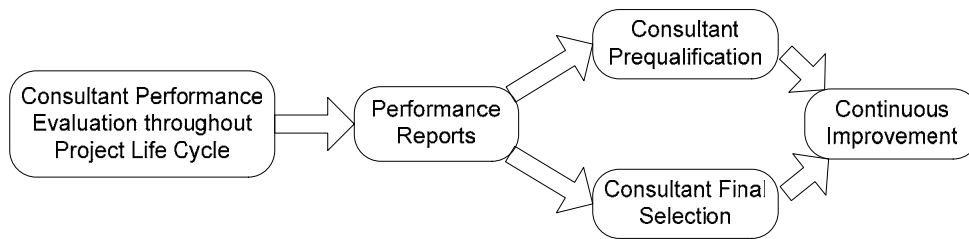
Keywords: consultant selection, consultant's performance, evaluation criteria.

INTRODUCTION

Good engineering consultants could bring genuine value to the organization they serve (Cooley, 1994), and it is therefore essential for the clients to appoint capable and reliable consultants to represent their interests. Nowadays, many clients have adopted a Quality-Based Selection (QBS) approach whereby candidates' professional competence, managerial ability, resource availability, and quality control ability are evaluated along with their fee tenders to determine who should be awarded the consultancy assignments (FIDIC, 1997; CIB, 1997).

Despite the importance of scrutinizing the current status of consultants through an examination of candidates' general capabilities, their retrospective performance records should not be ignored (Ingram and Peltier, 2001). In the United States, it is now a statutory obligation for some government bodies (e.g. DFD, 1996; DCAM, 2000) to conduct a Consultant Performance Evaluation (CPE) throughout the project life cycle, and there is also a growing trend for clients around the globe to include CPE in the QBS process (ASCE, 1995; Works Bureau, 2001, 2002; MTO, 2002) as there is a common belief that continuous improvement in consultant's performance can be achieved through the CPE process (Figure 1).

Figure 1: Utilization of performance reports in consultant selection



An examination of the CPE guidelines collected from the US, Australia, Canada and HK, however, reveals that the process, criteria and importance (as reflected by their weightings) have exhibited a wide range of variations even within a particular constituency, and this precludes the exchange of performance information among the clients. There is a need to examine whether a set of universally applicable CPE criteria can be identified.

Research works so far have established a performance measurement framework that emphasized on the non-financial criteria (Geanuracos & Meiklejohn, 1993). A study conducted by Cheung *et al.* (2002) investigated the CPE for architectural practices, while Ling's (2002, 2003) research focused on the task and contextual performance of consultants in design and build projects. This paper reports the results of an empirical study aimed to unveil the criteria used for evaluating the performance of engineering consultants in Hong Kong. The paper investigates the significance of the CPE criteria and proposes a list of predominant criteria for CPE.

SURVEY METHOD

A list of forty evaluation criteria pertinent to CPE was extracted from of relevant guidelines and procedures obtained from the United States, United Kingdom, Canada, Australia, and Hong Kong. As indicated in some collected CPE procedures and confirmed with experts through semi-structured interviews, the CPE criteria should be classified into six main categories including (i) feasibility; (ii) design; (iii) tender; (iv) construction; (v) post construction [categories (i)-(v) are related to various stages of a project] and (vi) general performance (Figure 2).

The CPE criteria identified were then used for the design of a questionnaire. Respondents were asked to express their perception on the degree of importance of each of CPE criterion against other criteria in the corresponding sub-category on a six-point scale, with 0 stood for "not important", 1 denoted "least important" and 5 represented "most important". The questionnaire was distributed to 150 experts in various government departments, quasi-governmental organizations, and consultant practices randomly selected. A total of 45 valid replies were received which represents a response rate of 30%.

CRITERIA PERTINENT TO PROJECT LIFE CYCLE

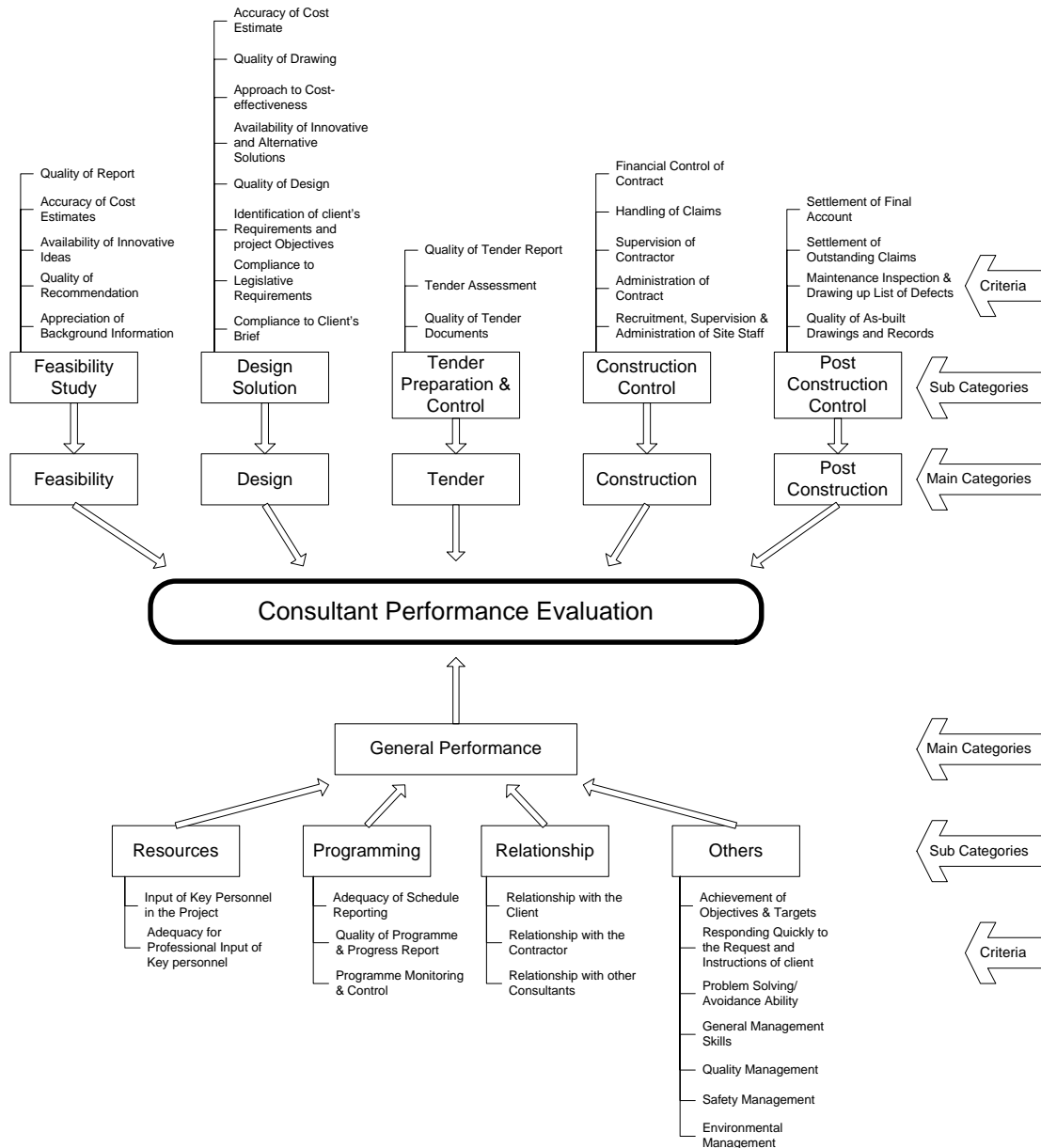
Table 1 highlights the mean importance rating and ranking of CPE criteria pertinent to the project life cycle.

Feasibility Stage

Quality of recommendation: This criterion was considered as the most important criterion (M=4.36, RSC=1) during the feasibility stage, and this concurs with the current practice of Works Departments (Works Bureau, 2002). Proper risks and

impacts estimation and assessment on social, economical and environmental aspects should be accomplished and demonstrated in the recommendation together with the advices and proposed mitigation measures.

Figure 2: CPE main categories, sub-categories and criteria



Appreciation of background information: Respondents rated this criterion the second highest (M=4.13, RSC=2) under the feasibility stage subcategory as it is necessary to identify all project requirements, objectives and constraints, and hence provide high quality planning and control for a project (DFD, 1996). Sufficient investigations are needed to allow the consultants to establish the social, economical and environmental constraints and requirements, as these would be the foundation for any subsequent recommendations and cost estimations.

Availability of innovative ideas: Ling (2000) claimed that consultants' initiative to provide the best possible solutions in terms of time, cost and quality is desirable. Consultants have to make every endeavour to suggest innovative and creative ideas so as to minimise the time, cost, and risks, and improve the overall quality of the project.

Table 1: Importance and ranking of CPE criteria

CPE main categories (MC), sub-categories (SC) & criteria (C)	Mean (M)	Ranking within sub-category (RSC)
MC1 Feasibility		
SC1 Feasibility study		
C1 Appreciation of background information	4.13	2
C2 Quality of recommendation	4.36	1
C3 Availability of innovative ideas	4.07	3
C4 Accuracy of cost estimate	3.89	4
C5 Quality of report	3.71	5
MC2 Design		
SC2 Design solution		
C6 Compliance to client's brief	4.47	1
C7 Compliance to legislative requirements	4.42	2
C8 Identification of client's requirements and project objectives	4.40	3
C9 Quality of design	4.24	4
C10 Availability of innovative and alternative solutions	3.56	8
C11 Approach to cost-effectiveness	4.22	5
C12 Quality of drawings	4.02	7
C13 Accuracy of cost estimate	4.04	6
MC3 Tender		
SC3 Tender preparation and control		
C14 Quality of tender documents	4.51	1
C15 Tender assessment	4.07	2
C16 Quality of tender report	4.00	3
MC4 Construction		
SC4 Construction control		
C17 Recruitment, supervision & administration of site staff	3.84	5
C18 Administration of contract	4.02	4
C19 Supervision of contractor	4.13	1
C20 Handling of claims	4.07	3
C21 Financial control of contract	4.13	1
MC5 Post construction stage		
SC5 Post construction control		
C22 Quality of as-built drawings and records	3.93	3
C23 Maintenance inspection and drawing up list of defects	3.82	4
C24 Settlement of outstanding claims	4.02	1
C25 Settlement of final account	4.00	2

Adequacy of cost estimates: Besides high quality recommendation, comprehensive and up-to-date cost estimate is also paramount important to the clients. Consultants have to perform careful analysis of major cost items, compare the rates with previous similar projects and investigate all project risks in order to provide realistic and reliable cost estimate with reasonable estimation of risk level.

Quality of report: All reports have to be presented in a systematic manner with adequate evidence to support all recommendations. Considerations should also be taken if the reports are necessary to present to laymen. All the drawings, plans and figures in the reports should be precise so that the proposed scheme can be visualised.

Design Stage

Compliance to client's brief and legislative requirements: "Compliance to client's brief" (M=4.47, RSC=1) and "compliance to legislative requirements" (M=4.42, RSC=2) were both ranked the highest at the design stage. It is essential to provide the services adhered to the client's brief throughout the design stage as the external environment might change radically. Non-compliance to legislation could lead to abortive work and delays.

Identification of client's requirements and project objectives: Consultants should not just observe the requirements as specified in the client's brief, but also put effort into assisting the client in identifying and developing other crucial objectives and requirements for the project (HM Treasury, 1997). By properly identifying the client's requirements and project objectives, best value design, i.e. one which is technically sound, practical, aesthetically good, and cost-effective, could be produced.

Quality of design: High quality design should meet *all* requirements in relation to the technical, financial, environmental, safety and quality standards set out in the design brief. Effective mitigation measures should be suggested if any threats/pitfalls are likely to occur. Design with high constructability is certainly appreciated as it can minimize the technical difficulties of contractors.

Availability of innovative and alternative solutions: Consultants should have the ability to propose innovative and alternative design to improve the quality standard and reduce the time, cost and risk (Ullman, 2001). Creative solutions in the design of individual elements are highly recommended to meet elemental estimates and uplift the overall quality of the design.

Approach to cost-effectiveness: Consultants have to consider all design options and adopt the most appropriate one under all prevailing constraints (e.g. political, traffic, etc.) to produce a value-added design. The life cycle cost of the project should be examined to optimally minimize the operation and maintenance costs.

Quality of drawings: Drawings have to be presented at professional standards with adequate details. It should be clear, uniform, comprehensive and free of errors.

Adequacy of cost estimate: Cost estimate have to be accurately compared to the contract price by analysing the costs of previous similar projects with due concern to contractor's commercial consideration. The estimate should be comprehensive, realistic, reliable, up-to-date and presented in a pertinent format.

Tender Stage

Quality of tender documents: High quality tender documents minimise the chance for tender addenda and/or subsequent variation orders (DCAM, 2000). Therefore, "quality of tender documents" (M=4.51, RSC=1) was regarded as the most significant at the tender stage. Preparation of high quality tender documents also requires due consideration of different procurement systems in order to ensure the most suitable one to adjoin all requirements and constraints of the project and the clients is selected.

Tender assessment and quality of tender report: The increasing popularity of design and build contract necessitates consultants to assess and comment on the technical aspects of the returned tender which increases the importance of tender assessment (M=4.07, RSC=2) and quality of tender report (M=4.00, RSC=3).

Construction Stage

Supervision of contractor: This is the key criterion (M=4.13, RSC=1) during the construction stage as close supervision to contractors should be provided to ensure the contractor have met their obligations and delivered the services to the requisite specifications and standards (HKHA, 1997). Prompt and appropriate follow-up actions should be taken if necessary.

Financial control of contract: Financial control of contract was also considered as an important criterion (M=4.13, RSC=1) at the construction stage. Consultants should

adhere to the contract budget by controlling the project finance precisely and promptly (DCAM, 2000), and they should be kept abreast of the financial position of the project which includes the cost of major variations.

Handling of claims: The importance of consultant's ability in handling any claims can be reflected by its relatively high ranking (M=4.07, RSC=3). Consultants should handle all the claims impartially and swiftly, as the clients would like to keep track of contractor's claims in terms of their potential time and cost implications.

Recruitment, supervision and administration of site staff: Consultants should propose a reasonable set-up of resident site staff. Suitably qualified site staff with the right calibre should be provided on time together with an effective site supervision and management system. Consultants should carefully manage the site staff, monitor their performance and provide them with adequate support.

Administration of contract: Exhaustive and impartial administration of contract should be carried out. It should also be accomplished in a timely and professional manner to keep the client informed on the progress and unforeseen developments.

Post Construction Stage

Settlement of outstanding claims: Settlement of outstanding claims is crucial as it would affect the cash flow of the contractor and the relationship among various stakeholders. Therefore, "settlement of outstanding claims" was considered utmost important (M=4.13, RSC=1) in the post-construction stage.

Settlement of final account: The relatively high ranking for the "settlement of final accounts" (M=4.00, RSC=2) could be explained in a similar way as that of "settlement of outstanding claims".

Quality of as-build drawings and records: Consultants should prepare as-built drawings and records effectively and efficiently for the completion of the project. The drawings and records should be clear, adequate, comprehensive and free of errors.

Maintenance inspection and drawing up list of defects: Precise and due investigation on the construction outcomes should be performed in order to construct a comprehensive defect list for forthcoming maintenance work. Careful maintenance inspection should be carried out to cover all aspects of identified defects.

GENERAL PERFORMANCE CRITERIA

The mean importance rating and ranking of CPE criteria in relation to consultant's general performance are summarised in Table 2.

Resources

Input of key personnel in the project & adequacy for professional input of key personnel: In certain circumstances, the key staff originally allocated to the project might have been assigned to another new job, which is particularly obvious when the fee is too low. This could affect the overall quality of project, therefore, "input of key personnel in the project" and "adequacy for professional input of key personnel" were regarded as the key criteria (M=4.20) in the resources sub-category.

Programming

Programme monitoring and control: Programme monitoring and control was found to be the most important criterion (M=4.11, RSC=1) under the programme monitoring and control sub-category, as clients expect the project and all milestones to be

achieved in a timely manner. Consultants should adhere to the programme, examine contractor's programme, monitor contractors' progress, and take action to minimise any delay or recover any time lost promptly. All possible risks to the programme by any unexpected factors to the clients should be highlighted.

Table 2: Importance and ranking of CPE criteria

CPE main categories (MC), sub-categories (SC) & criteria (C)	Mean (M)	Ranking within corresponding sub-category (RSC)
MC6 General performance		
SC6 Resources		
C26 Input of key personnel in the project	4.20	1
C27 Adequacy for professional input of key personnel	4.20	1
SC7 Programming		
C28 Adequacy of schedule reporting	3.60	3
C29 Quality of programme & progress report	3.71	2
C30 Programme monitoring & control	4.11	1
SC8 Relationship		
C31 Relationship with the client	4.00	1
C32 Relationship with the contractor	3.62	2
C33 Relationship with other consultants	3.40	3
SC9 Others		
C34 Achievement of objectives & targets	4.87	1
C35 Responding quickly to the request and instructions of client	4.22	3
C36 Problem solving/avoidance ability	4.40	2
C37 General management skills	4.13	4
C38 Quality management	3.80	7
C39 Safety management	4.09	5
C40 Environmental management	3.93	6

Adequacy of schedule reporting & quality of programme and progress report: The schedule should be constructed and reported according to the programme to ensure all progress reports are submitted at the right time to reflect the progress of all critical items in the project. Realistic, regular, adequate, clear and accurate programmes, programme updates, progress reports should also be provided. Furthermore, consultants should demonstrate the submitted programme is realistic by substantiating the time allowed in major critical activities in the programme.

Relationship

Relationship with the client: Consultants should be approachable and helpful to the client (*cf.* Ling, 2000; Ling *et al.*, 2000). Clients emphasize the importance of the relationship with consultants by allocating highest importance ratings for “relationship with the client” (M=4.00, RSC=1) under the relationship sub-category. Ineffective communication between client and consultants always leads to project delay and inferior works.

Relationship with the contractor: The opposed relationship between consultants and contractors always ravages their requisite communication and cooperation which results in poor quality outcomes, claims and disputes. Consultants should handle and deal with all opinions and complaints of the contractors impartially, and provide necessary support in order to build up/maintain good relationship with contractors.

Relationship with other consultants: Consultants should be able to manage and coordinate the work effectively if they were to have a good relationship with their sub-consultants. Consultants should promptly respond to any complaints from sub-consultants.

Others

Achievement of objectives and targets: This is the most important criterion under this sub-category (M=4.87, RSC=1), as successful achievement of all project objectives and targets is always the clients' solicitude. Consultants should meet the scope, objectives and targets of the project as specified in brief to ascertain all aspects of the project could be attained satisfactorily.

Responding quickly to the request and instructions of client & problem solving / avoidance ability: Consultants should be conscientious to the project by responding quickly to all requests and instruction of the clients promptly. In addition, consultants should identify and analyse potential problems and propose mitigation measures to prevent the problems from arising or escalating (Ling, 2003).

General management skills: GDOT (2002) points out that consultants should manage their personnel, budget and schedule effectively, and effective and efficient management systems for staff, time and financial monitoring and controlling are inevitable (Bordogna, 1998; ODOT, 2000).

Quality management: Consultants should comply with the specified quality standard. In addition, they should minimise the number of non-conformance and demonstrate their ability in identifying and dealing with non-conformances promptly (DPWS, 2000).

Safety management: Consultants should fulfil their safety obligations through the design and supervision. They should also prepare their safe work method statement and have effective communication with contractors on the safety issues. Proper safety management can minimise the number of accidents occurred on site (DPWS, 2000).

Environmental management: If environmental management can be carried out, the impacts on environment can be reduced, thus improving social satisfaction (DPWS 2000). Consultants should recognise and comply with any environmental-related undertakings, consent conditions and pollution control approvals.

CONCLUSIONS

In order to improve the rigorousness and reliability of consultant selection, the clients of should consider incorporating CPE into the QBS mechanism as previous performance is the best indicator for consultant's actual quality of services.

With an aim to devise a more informed framework for CPE, extensive works and semi-structured interviews are conducted to establish a list of criteria suitable for evaluating consultants' performance at different project stages. Forty criteria pertinent to (i) feasibility, (ii) design, (iii) tender, (iv) construction, (v) construction, (vi) post construction, and (vi) general performance were compiled.

The results of the survey reveal that the "quality of recommendation"; "compliance to client's brief"; "quality of tender documents"; "supervision of contractor" and "financial control of contract"; and "settlement of outstanding claims" were considered as the key criterion/criteria for the feasibility, design, tender, construction, and post construction stages respectively. The clients should pay more attentions to these criteria when the performance of consultants is evaluated.

Having identified the key criteria for different project stages, future works could be carried out to develop a rational framework to allow the results of CPE to be linked to consultant prequalification and/or final selection. Further works are being carried out

to investigate the needs for classifying the past performance reports according to different sizes, types and complexity of projects. The appropriateness of having different performance reporting frequencies and weightings to be allowed to more recently completed performance reports are also under investigation. The findings of these investigations will be reported once they become available.

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