

# DYNAMIC CONTRACTOR PRE-QUALIFICATION

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The general benefits of contractor pre-qualification/ registration are common knowledge. Many large clients follow 'periodical pre-qualification', which is usually termed 'registration' and maintain a list of pre-qualified/ registered contractors over the pre-qualification/ registration period. The 'pre-qualified'/ 'registered' contractors are generally categorized into static bandwidths such as Class 1, 2, 3 and 4 or Group A, B, C and D. The classification of contractors into various groups depends on assessments (against pre-qualification criteria) of all 'interested' contractors. There is usually no further distinction or ranking of 'pre-qualified'/ 'registered' contractors within the group/ category in which they are banded. Furthermore, some 'registration' practices do not consider current workload levels of contractors, while financial qualifications and guarantees are given prime importance as contractors are assumed to have similar capacities in all circumstances. This paper presents a proposed new 'dynamic' contractor pre-qualification model for 'periodical pre-qualification' (normally, on an annual basis)/ 'registration', by which 'registered'/ pre-qualified contractors will be assigned different capacity ratings. The proposed conceptual model envisages that contractors will be pre-qualified/ registered with 'dynamically' changing pre-qualification ratings (geared to current workloads and capacities) and that clients will advertise different rating levels required for every tender.

Keywords: pre-qualification, pre-qualification, registration, time, workload.

## INTRODUCTION

Various risks and complexities typify construction projects. Contractor selection is a critical and crucial task for any client/ client advisory team that may help to control some of these risks and manage the complexities. Various procedures such as open tendering, selective tendering, restricted tendering, registration/ pre-qualification, post-qualification are followed for selecting contractors. In general, many clients prefer contractor pre-qualification to minimize additional risks of contractor failures. Contractor pre-qualification/ registration is based on the assessment of contractors' attributes such as financial, technical, human resources, past performance, past experience, safety, quality, equipment and environment. Several researchers such as, Russell and Skibniewski (1988), Holt (1994), Kumaraswamy (1996), Rankin *et al.* (1996), Hatush and Skitmore (1997) have identified common criteria for pre-qualification and have proposed improved methodologies for contractor selection. Contractors are pre-qualified either on a project-by-project basis or on a periodical (normally, annual) basis. Russell (1996) compared both 'pre-qualification' approaches.

Generally, clients employ 'periodical pre-qualification'/ 'registration' for general projects and maintain a list of 'capable' contractors. In such a practice, tenders are issued to only those in the pre-qualified/ registered list of contractors according to their 'assessed' capacity levels. Some clients such as the Works Bureau, Hong Kong

and Services SA, Australia follow a ‘static’ approach, whereas, some clients such as Illinois Department of Transportation, USA follow a ‘dynamic’ approach. Generally, contractors’ performance levels differ under different workload conditions. The contractor selection approaches of some clients do not consider this truism. Various contractor pre-qualification/ registration approaches followed by different public-sector clients (in Australia, Canada, Hong Kong, India, Singapore, Sri Lanka and USA) were studied. This paper discusses some findings from this Hong Kong based study on various approaches to ‘periodical pre-qualification’ (also called ‘registration’) highlighting some of their strengths and weaknesses. A new model for ‘dynamic contractor pre-qualification’ is also proposed.

## **RESEARCH METHODOLOGY**

In the initial stages of the research, various contractor selection approaches in different client organizations in Hong Kong, Australia, USA, Canada, India, Sri Lanka and Singapore were studied. The scope of the overall study was later narrowed to focus on contractor selection for Design-Build projects; but the scope of this paper itself has been confined to contractor pre-qualification aspects in general, in view of the rich vein of knowledge ‘unearthed’ in the initial study. The ‘knowledge-mining’ phase of the research drew useful ‘knowledge’ from various documented and ‘experiential’ sources. Methods included extensive literature review and interviews/ correspondence with experts/experienced practitioners in various public client organizations. Initially, the interviews/correspondence were semi-structured, but later focussed on specific key issues that were identified. Both conventional means (such as postal/ fax correspondence and direct/ telephone interviews) and less traditional approaches (such as email and other internet resources) were used to expedite the knowledge acquisition process. Up to this time, 196 experts/ practitioners were contacted, following which 110 have been interviewed/ corresponded with, and 30 construction contractor pre-qualification practices were studied. An internet based questionnaire survey has now been launched to collect and consolidate available ‘knowledge’ on design-build contractor selection.<sup>4</sup>

## **‘STATIC’ PRE-QUALIFICATION**

In ‘static’ pre-qualification, the contractors are ‘pre-qualified’ or ‘registered’ in an array of fixed bands such as Categories 1, 2, 3 & 4; Levels 1, 2, 3 & 4; Groups A, B & C; or Classes 1, 2, 3, 4 & 5. Generally, the clients periodically review the contractors’ resources and capabilities to ‘maintain’ the list and to take any regulating actions such as warning/ demotion/suspension. The contractors who request promotion to a higher level in the list have to submit applications along with necessary proof of adequate compliance. In such ‘static’ approaches, there is no discrimination or ranking of contractors within a particular ‘pre-qualified’/‘registered’ level. A ‘pre-qualified’ contractor who is near the upper boundary of the ‘pre-qualification’ bandwidth (for example, Group B) is not distinguished from another contractor who is near the lower limit of the band. In other words, there is no difference between a ‘pre-qualified’ contractor in a pre-qualification band who has marginally failed to be pre-qualified for the higher band and another contractor who has just managed to be ‘pre-qualified’ in that band. Furthermore, some clients do not consider potentially varying levels of contractor performance under different workloads. The aforementioned approaches

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<sup>4</sup> The internet URL address of the survey questionnaire is <http://web.hku.hk/~palanees/form/index.html>.

are generally based on prime importance for financial qualifications/ guarantees and on the assumption that contractors have similar capacities in all circumstances.

### **Glimpses into some ‘static’ pre-qualification approaches**

Various clients categorize their list of ‘pre-qualified’ contractors on a periodical basis (which is also known as ‘approved’ or ‘registered’ contractors list) in ‘static’ bands with different terminology, but in a broadly similar manner. This section summarizes a sample of ‘static’ registration/ pre-qualification approaches

- The Works Bureau, Hong Kong (WB) is responsible for all public works of the seven works group departments (Architectural Services Department, Civil Engineering Department, Drainage Services Department, Electrical and Mechanical Services Department, Highways Department, Territory Development Department, Water Supplies Department). The WB manages the lists of approved contractors for these works departments. The approved contractors are listed in one or more of the categories such as buildings, port works, site formation, waterworks, roads and drainage. Contractors within each category are further divided into Group A, B or C according to the value of contracts for which they are eligible to tender. A contractor’s status in a particular group will be either ‘probationary’ or ‘confirmed’. Probationary contractors are limited in the number and value of contracts for which they are eligible to tender. A contractor wishing to be listed can submit his application at any time and the admission in to the list is subject to the assessment of financial, technical and management capabilities. A contractor is initially admitted on ‘probationary’ status in the appropriate group and category. A ‘probationary’ contractor has to apply for conformation after (a) a minimum probationary period of 24 months; and (b) satisfactory completion of works in his ‘probationary’ category in accordance with stipulated criteria (Works Branch 1997). A ‘confirmed’ contractor wishing to be promoted to the next higher group in a particular category has to apply in writing and the promotion is subject the contractor being able to meet similar requirements. The list of approved contractors is published annually in the Hong Kong Government Gazette. The WB reserves the right to remove any contractor from the list or to take other regulating actions such as suspension, downgrading to ‘probationary’ status or demotion to a lower group, in respect of all or any of the works categories. Circumstances, which may lead to such regulating actions, include unsatisfactory performance, failure to submit a valid competitive tender for a period of 3 years, bankruptcy and violation of laws.
- The Hong Kong Housing Authority (HKHA) maintains a separate list of ‘registered’ contractors. Contractors who qualify to ‘enter’ the list also undergo annual reviews, subject to which they may remain registered. The HKHA system provides quasi-rotational tendering opportunities to the contractors in the HKHA list and provides more tendering opportunities to the ‘better’ performing contractors (Kumaraswamy 1996). Like the WB, the HKHA approved list of contractors is also divided into ‘probationary’ and ‘confirmed’ in the three HKHA works categories (‘New Works’, ‘Maintenance’ and ‘Shopping Center Improvements’). All the contractors in the HKHA list are categorized as Group NW1 & Group NW2 for ‘New Works’ category and Group M1 & Group M2 for ‘Maintenance’ category.
- The Queensland Government in Australia has developed a system for pre-qualification of contractors known as Pre Qualification Criteria (PQC). On the basis of the PQC assessment, contractors are pre-qualified for a period of two years and are rated in any one of the following four levels such as Level 1 (Effective work

practices), Level 2 (Commitment to continuous improvement), Level 3 (Industry best practice) and Level 4 (World's best practice).

- The Department of Contract and Management Services (CAMS) of Western Australia operates a scheme to pre-qualify and categorize building contractors for contracts above AU\$200000 in value. The scheme incorporates five financial categories corresponding to the estimated contract values. These are Category A (no limit), Category B (up to AU\$5000000), Category C (up to AU\$2000000), Category D (up to AU\$1000000) and Category E (up to AU\$200000). Interested applicants are required to submit details such as target financial category, technical ability, staff structure, references, financial details, etc. The CAMS organizes periodic reviews of the categorizations, while interested 'pre-qualified' contractors can also submit applications at any time for transferring to a higher category.

### **Potential shortcomings of 'static' approach**

The following summarizes some identified (indicative, but not exhaustive) 'potential' shortcomings in most of the 'static' contractor pre-qualification approaches:

- All contractors are considered to be the same in a particular pre-qualification category, which is unrealistic. Each contractor may have different capacities even within that particular pre-qualification category itself.
- Some 'static' pre-qualification approaches (except those having built-in checking mechanisms) may possibly ignore the contractor workloads at any particular time. In many such instances, 'financial' qualifications/capacities alone are emphasized when justifying the acceptability of 'extra' workloads of pre-qualified contractors.

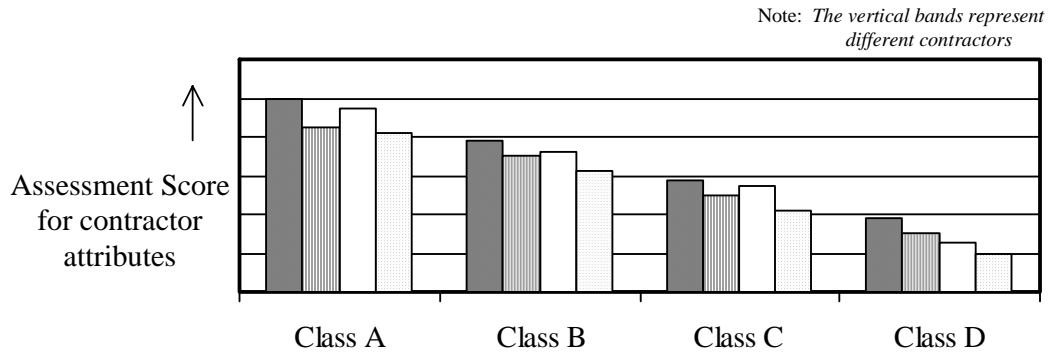
### **'DYNAMIC' PRE-QUALIFICATION**

In a 'dynamic' approach to contractor pre-qualification, all contractors are not categorized into 'static' pre-qualification bands. They will be pre-qualified on a 'pre-qualification ratings' basis. These ratings are initially assessed on an annual basis usually, and can be reviewed at any point in time. For example, review/re-assessment may be triggered when a contractor wishes to tender for a new project. Such ratings can be used for ranking and further short listing. Furthermore, tendering will be based on such ratings and hence they are useful to some extent in controlling risks of contractor failures/ poor performance.

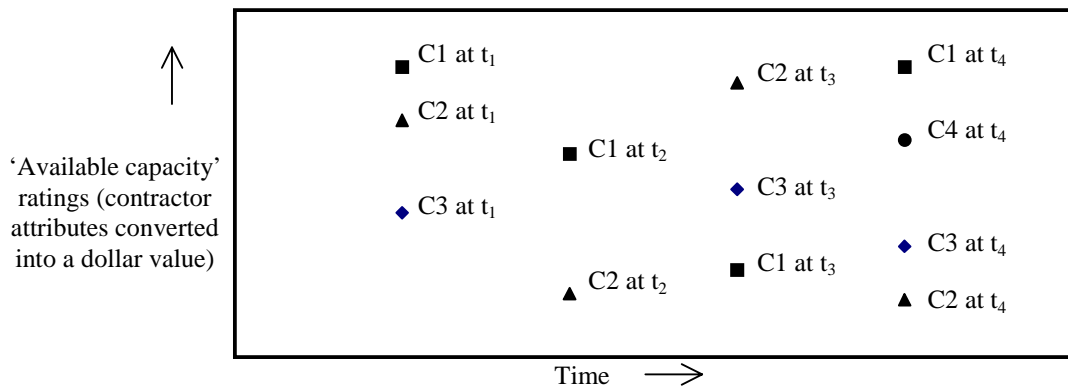
#### **Illustrations of some 'Dynamic' approaches**

In such 'dynamic' approaches, some public clients in USA use various pre-qualification ratings such as 'maximum capacity rating', 'project rating', 'bid capacity', 'available capacity', 'work rating', 'financial rating'. The pre-qualification ratings are used to define the parameters such as maximum dollar amount of work that can be allocated to a pre-qualified bidder during the pre-qualification period, maximum value of work that a contractor can bid for a particular project (by considering equivalent dollar values for contractors' resources, competencies and performance), e.g.:

- *Aggregate Rating* is the dollar limit of contract work that a contractor will be allowed to have outstanding at any given time, and includes the dollar value of all work in progress. This rating is used by the New Jersey Department of Transportation (NJDOT), USA.

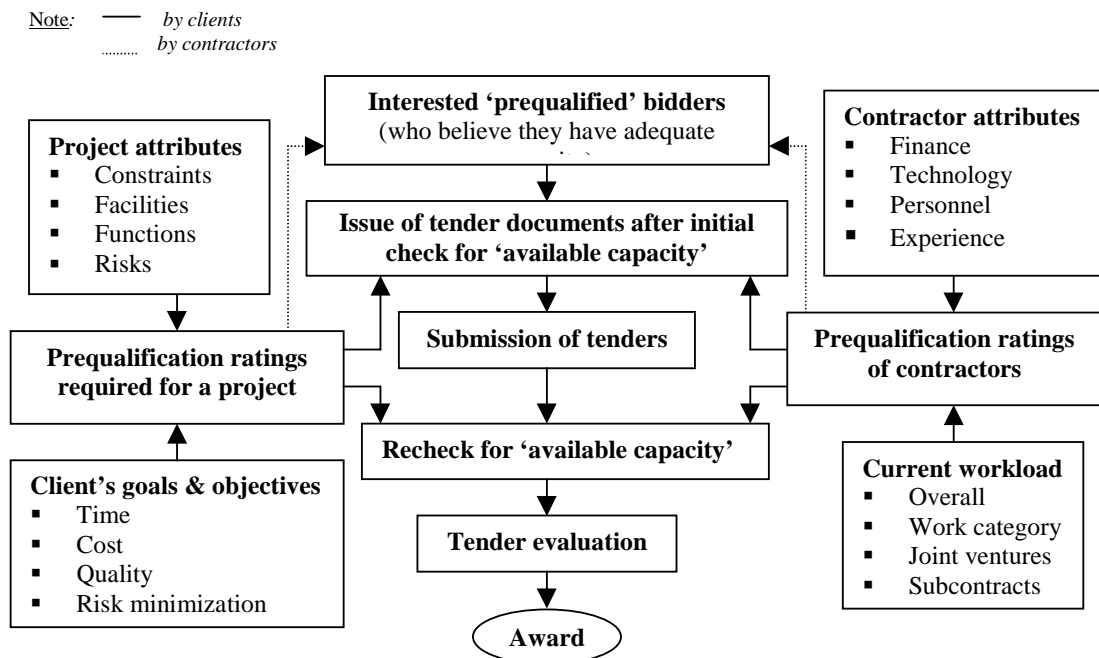


**Figure 1:** ‘Static’ pre-qualification



**Figure 2:** Dynamic pre-qualification approach in the USA

(Note: C1, C2, C3 & C4 are different contractors and t1, t2, t3 & t4 are different points in time)



**Figure 3:** A conceptual model of the proposed ‘dynamic pre-qualification’ system

- *Maximum Rating* is the dollar figure established by subtracting the contractor's current dollar amount of outstanding work from its Aggregate Rating. This rating is used by the NJDOT, USA.
- *Current Bid Capacity* is the lesser of a contractor's Project Rating or Maximum Rating. This rating is used by the NJDOT, USA.
- *Project Rating* is the maximum dollar amount, which a contractor shall be allowed to bid on an individual project. This rating is used by the NJDOT, USA.
- *Work class rating* is the maximum value within the class of work that is used to determine a firm's eligibility to receive a bid proposal document for a single project. This rating is used by the Washington State Department of Transportation (WSDOT), USA.
- *Maximum capacity rating* is the total value of uncompleted prime contract work a contractor is permitted to have under contract at any time. This rating is used by the WSDOT, USA.
- *Ability Factor* determined from the total Ability Score resulting from evaluations of the applicant's organization, management, work experience and letters of recommendation. This factor is used by the Florida Department of Transportation (FDOT), USA.
- *Maximum Capacity Rating (MCR)* is the total aggregate dollar amount of uncompleted work an applicant may have under contract at any one time as prime contractor and/or sub-contractor, regardless of its location and with whom contracted. This rating is used by the FDOT, USA.

Table 1 shows some examples of formulas/equations that were developed to summarize different pre-qualification ratings, as presently used by various clients.

## **POTENTIAL SHORTCOMINGS IN SOME US 'DYNAMIC' PRE-QUALIFICATION APPROACHES**

The majority of US public clients use some form of pre-qualification ratings, which convert the 'pre-qualified' contractors' attributes into dollar values. Although such pre-qualification ratings 'dynamically' pre-qualify contractors (effectively taking into account, contractors' workloads), it is not easy to convert all contractors' attributes into precise dollar equivalents. This drawback may possibly render such systems somewhat unrealistic and difficult to justify.

## **PROPOSED 'DYNAMIC' PRE-QUALIFICATION MODEL**

This section describes a proposed 'dynamic' pre-qualification model for contractor 'registration'/'periodical pre-qualification'. the model has been developed on the basis of the 'knowledge' distilled from the aforesaid cross-sectional study of various pre-qualification/ registration practices. Figure 1 is developed by the authors to illustrate banding in the 'static pre-qualification'. in that Figure, each vertical band represents different contractors. Figure 2 is developed to illustrate the conceptual framework of 'dynamic contractor pre-qualification', as in the us approaches discussed earlier. in that pictorial representation, each contractor would possibly have different pre-qualification ratings in dollar values along the y-axis, when assessed dynamically – at different points of time.

**Table 1:** Sample of pre-qualification ratings used in some US approaches

Client organization	Pre-qualification ratings used
The Florida Department of Transportation (FDOT), USA	Maximum Capacity Rating (MCR) $MCR = AF \times CRF \times ANW$ (in which AF = Ability factor; CRF = Current ratio factor; ANW = Adjusted net worth)
The West Virginia Department of Transportation (WVDOT), USA	Pre-qualification rating (R) $R = P(A + I + L + E)$ (in which, P = Performance factor based on contractor's past performance record in West Virginia; A = Net current assets; I = Cash surrender value of Life Insurance; L = Line of credit statements limited to 50% of net current assets; E = Unencumbered book value of highway and/ or bridge equipment in good operating condition)
The New Jersey Department of Transportation (NJDOT), USA	Aggregate rated capacity for contractors without NJDOT past performance = $9(WC + E) + 4L$ Aggregate rated capacity for contractors with NJDOT past performance = $P \times [15(WC + E) + 7L]$ (In which, WC = Net working capital; E = Net book value of equipment; L = Unsecured lines of credit) A contractor's aggregate rated capacity will be reduced by 15% if he neither owns nor leases, on a continuing basis, the equipment necessary to perform the work within its work category.
The Washington State Department of Transportation (WSDOT), USA	Maximum capacity rating (MCR) $MCR = 5(N + A) \times (1 + I)$ , in which, N = Contractor's reported net worth A = Additional resources, where, $A = (L + N_p + N_f)$ , in which, L = Acceptable operating line of credit $N_p$ = Acceptable personal pledge of net worth $N_f$ = Acceptable parent firm pledge of net worth I = Annual rate of increase, where, $I = \left(\frac{n}{2}\right)$ , in which, $(0 \leq n \leq 7.5)$ and n = number of years (provided the contractor has maintained a satisfactory performance record with the WSDOT and has completed a contract of \$50000 or more within the preceding pre-qualification year Work class rating (WCR) $WCR = 2.5 V_h$ , in which, $V_h$ = The highest value of work completed satisfactorily during the preceding pre-qualification year in the particular work class (for example, bridges and structures)

Kumaraswamy (1996) discussed pre-qualification criteria in four major categories such as finance, technology, personnel and experience. the proposed model considers all the four categories. Figure 3 is developed to show the conceptual framework of the proposed 'dynamic contractor pre-qualification' model. pre-qualification ratings in the proposed model are based on the following:

$$P_R = f(F, T, P, E)$$

In which,

F = Finance rating

T = Technology rating

P = Personnel rating

E = Experience rating

Note: F, T, P and E themselves vary with time, i.e., each by itself is a function of time.

### **THE PROPOSED 'DYNAMIC PRE-QUALIFICATION' MODEL CONSIDERS THE FOLLOWING PRE-QUALIFICATION RATINGS:**

- 'Permissible gross financial capacity' ( $F_g$ ) is the permissible upper limit (expressed in dollar value) for gross sum of all the contracts that a contractor will be allowed in a pre-qualification period. This includes the contracts undertaken in all the pre-qualified work categories of the organization in which the contractor is pre-qualified and works done for other organizations. This excludes the value of contracted work done by 'permitted' sub-contractors, but includes the value of work done by the 'main' contractor as a sub-contractor. This also includes the value of any portion of work done as a joint venture.
- 'Permissible gross technological capacity' ( $T_g$ ) is the permissible upper limit (expressed in absolute numbers) for contractor's 'technological' capacity in all the contracts that a contractor will be 'allowed' in a pre-qualification period. Other conditions are similar to those in ' $F_g$ '.
- 'Permissible gross personnel capacity' ( $P_g$ ) is the permissible upper limit (expressed in absolute numbers) for contractor's 'personnel' resources in all the contracts that a contractor will be 'allowed' in a pre-qualification period. Other conditions are similar to those in ' $F_g$ '.
- 'Permissible gross experience capacity' ( $E_g$ ) is the permissible upper limit (expressed in absolute numbers) for contractor's 'experience' criterion in all the contracts that a contractor will be allowed in a pre-qualification period. Other conditions are similar to those in ' $F_g$ '.
- 'Net available financial capacity' ( $F_a$ ) is the dollar limit of contract work that a contractor will be allowed to have outstanding at any specific time. It includes the dollar value of all work in progress (including any contracts in other organizations and any sub-contract works undertaken by main contractors).
- 'Net available technological capacity' ( $T_a$ ) is the limit of contract work (expressed in absolute numbers) that a contractor will be allowed (with respect to his 'technological capacity') to have outstanding at any specific time. It includes the corresponding rating value of all work in progress (including any contracts in other organizations and any sub-contract works undertaken by main contractors).
- 'Net available personnel capacity' ( $P_a$ ) is the limit of contract work (expressed in absolute numbers) that a contractor will be allowed (with respect to his 'personnel capacity') to have outstanding at any specific time. It includes the corresponding



rating value of all work in progress (including any contracts in other organizations and any sub-contract works undertaken by main contractors).

- 'Net available experience capacity' ( $E_a$ ) is the limit of contract work (expressed in absolute numbers) that a contractor will be allowed (with respect to his 'experience' criterion) to have outstanding at any specific time. It includes the corresponding rating value of all work in progress (including any contracts in other organizations and any sub-contract works undertaken by main contractors).

The proposed model envisages as conceptualized in Figure 3, that the above mentioned pre-qualification ratings have to be determined for contractors' attributes. If the contractors are registered for more than one work category, category wise 'available capacity' ratings should be determined for all the four dimensions (finance, technological, personnel and experience). Similar to the 'PQC system' described in Queensland Government, Australia (1998), the project attributes and client's requirements must be appraised to determine project-specific benchmarks for all four dimensions of pre-qualification ratings. Tender advertisements will then indicate the required minimum pre-qualification ratings. Interested bidders, who believe they have adequate available capacity ratings for all the four criteria, can then apply for tender documents; along with a standardized statement of their current workload which may be even required in the form of an 'affidavit' as by the Illinois Department of Transportation (IDOT 1997), USA. This statement/'affidavit' will be checked by the client organization. Tender documents will be issued to those whom the client perceives to as exceed the minimal 'available capacity' ratings (for the project) based on a preliminary check (or at the 'contractor's own risk' based on his affidavit, as by the IDOT). Initially, the tenders will be checked for 'available capacity' and primary 'responsiveness'. The bidders' available capacity ratings will be checked for compliance with the corresponding 'project rating' requirements. The 'responsiveness' check is to verify 'promptness', 'realism' and 'completeness' of tender submissions. An example of assessing 'responsiveness' was discussed by Palaneeswaran *et al.* (1999). Only those tenders passing these compliance tests will be considered for further tender evaluation.

## CONCLUSIONS

Some clients follow a 'static' approach for periodical pre-qualification/ registration, whereas, few others follow a form of 'dynamic' approach with more perceived benefits. Although 'competent' contractors are identified as 'pre-qualified' with a general objective of minimizing risks and failures, their performance levels differ widely under different workloads and dissimilar environments. The 'static pre-qualification' approach considers many contractors to be 'pre-qualified' on equal terms, within each bandwidth of pre-qualification/ registration. Furthermore, some approaches assume that 'financial' qualifications will compensate for any shortcomings in other attributes. In addition, issues such as sub-contracting workload and joint venture works are not clearly defined/ uncharted/ neglected in many practices. Some public clients in the USA follow some form of 'dynamic' approach with structured pre-qualification rating assessments in their contractor selection procedures. Some potential drawbacks of both approaches are discussed in this paper.

A new 'dynamic pre-qualification' model has been proposed in this paper with four dimensions (finance, technological, personnel and experience) to map both 'contractor attributes' and 'project requirements'. A set of pre-qualification ratings has been

defined for that purpose. These ratings will form the basis for a more structured and dynamic approach, defining various bidding boundaries for pre-qualified contractors. Moreover, this approach will to some extent accommodate the dissimilar contractor capacity levels, workloads, sub-contracting and joint venture issues. Regulations, resource constraints, cost-benefit considerations, and resistance to change the status quo may be some of the forces acting against implementing this virtual paradigm shift. An aspect that merits highlighting is the deliberate transparency in the model and the facility for an interested contractor to perform his own preliminary 'self-test' before applying for tender documents or for formal pre-qualification. The system is still being developed further, after which it must be tested and validated. However, this approach is proposed as a plausible answer to some of the identified problem areas in the current systems. It should therefore lead to an overall improvement of contractor selection systems.

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