

Procurement Method Selection in Practice: A Journey to Discover the Optimal

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Abstract

Determining the optimal procurement approach for capital works is a challenging task considering the array of procurement methods available and criteria that must be assessed. To assist a public sector client with this complicated decision making process, a procurement method selection process was developed. A focus group comprising of key stakeholders involved with an educational capital works project used the developed approach to determine an appropriate solution for their needs. Overwhelmingly, participants supported the outcome albeit, a small minority who had limited wider exposure to alternative methods initially perceived their bastion (i.e. a default Traditional Lump Sum (TLS), to be a credible option. Indeed, those participants with limited knowledge procured almost 95% of capital works projects using a TLS and did not adopt a formal approach to procurement method selection. As a clear indicator of demonstrable impact, it can be reported that the approach presented in this paper is now being used by the public sector agency responsible for capital works. The pragmatic approach developed enabled decision-makers to constantly re-evaluate outcomes during each stage of the process in the form of recommendations that were grounded in practice, reflection and detailed evaluation.

Keywords: Capital works, outsourcing, procurement, public sector, risk

1. Introduction

A plethora of techniques have evolved to assist decision-makers in reaching an informed decision about the various procurement method options when delivering a supply chain solution. Deciding which procurement method to adopt has become a complex and challenging task for decision-makers not least because the number of methods available has proliferated in recent years, and their characteristics have become a major field of study in their own right (Morledge *et al.*, 2006). While such techniques have their merits, they tend to be prescriptive and fail to recognize the inherent complexity associated with the selection process. Numerous stakeholders are often involved in the selection process and decisions are dependent upon the interaction of several variables that incorporate a high degree of subjectivity and intuitive judgement. To assist clients with their decision making, a procurement method selection process is hence developed and tested by a public sector agency.

2. Procurement systems

Procurement systems can be broadly classified as *traditional, design and construct, management or collaborative* methods; albeit, sub-classifications of these systems proliferate within the Australian industry (Love *et al.*, 1998). Whilst not exhaustive, novation, design and manage, and alliancing are but a few examples. It is common for procurement systems, contract forms and price determination mechanisms to be regarded as synonymous or inextricably related. Procurement systems have become increasingly flexible and the interchange that exists between them has made it essential to distinguish the procurement system from its subsystem.

A subsystem can be used interchangeably to enable the procurement system to be finetuned to the clients' circumstances and requirements (Love *et al.*, 1998). Kurmaraswamy and Dissanayaka (1998) identified several sub-systems of a typical procurement system including work packaging, type of contract (functional groupings and payment modalities) and selection methodologies. The packaging of work is vital to achieving economies of scale in a project and so work must be allocated appropriately. Parties can be selected using an array of methods, for example, prequalification, selective tendering, and negotiation.

2.1 Procurement selection criteria

Public agency satisfaction with buildings and the procurement path taken are a primary issue that is often raised when considering the delivery of a capital works. Consequently, it is important to evaluate the clients' criteria, their importance and then seek performance to match the criteria. All public sector agencies require their buildings to be completed on time, within budget and to the highest quality. Some public sector agencies, however, stress that certain criteria are more important than others (Rowlinson, 1999). While such criteria can be broadly used as a guide to assist decision-makers with an initial understanding of the basic attributes of a particular procurement system they should not be used as the sole basis for

selection. This is because of the underlying complexity associated with matching client needs and priorities with a particular method (Kumaraswamy and Dissanayaka, 1998). The National Economic Development Organisation (NEDO, 1985) identified nine generic criteria that public sector agencies could use to select their priorities for projects. These are:

1. *Time*: is early completion required?
2. *Certainty of time*: to what extent is project completion of importance?
3. *Certainty of cost*: is a firm price needed before any commitment to construction is given?
4. *Price competition*: is the selection of the construction team by price competition important?
5. *Flexibility*: are variations necessary after work has begun on-site?
6. *Complexity*: does the building need to be highly specialised, technologically advanced or highly serviced?
7. *Quality*: is high quality of the product, in terms of material and workmanship and design concept, important?
8. *Responsibility*: is single point of responsibility the client's after the briefing stage or is direct responsibility to the client from the designers and cost consultants desired?
9. *Risk*: is the transfer of the risk of cost and time slippage from the client important?

In addition, several studies have used modified versions of the NEDO criteria in an attempt to develop a procurement selection framework (e.g., Skitmore and Marsden, 1988; Love *et al.*, 1998; Ambrose and Tucker, 2000). Luu *et al.* (2003) state that the use of a limited number of factors, such as those identified by NEDO (1985), may inadvertently give rise to the selection of a sub-optimal procurement system. Since the selection of a procurement system is influenced by *client characteristics* (Moshini and Botros, 1990), *project characteristics* (Ambrose and Tucker, 2000), and the *external environment* (Alhamzi and McCaffer, 2000), selection criteria representing the constraints imposed on the project should be considered before a decision is made. Identifying the project criteria is the major challenge facing public sector clients when selecting a procurement method. However, if projects are different in nature and their needs are constantly changing due to internal and external demands, would the same criteria be applicable for all projects? The weighting for criteria invariably changes as the needs and requirements for capital work projects change. Yet, Love *et al.* (2008) revealed that public sector agencies eschew from using extensive lists of selection criteria such as those identified by Luu *et al.* (2003), inasmuch as they are cumbersome to use in practice, and purport that *generic* criteria are required because they provide consistency throughout the decision making process.

2.2 Selection tools and techniques

Despite these aforementioned difficulties associated with procurement method selection, a number of structured methodologies, tools and models have been developed. The approaches developed range from weighted models (Franks, 1990) and the use of multi-attribute utility analysis (MAUA) (e.g., Skitmore and Marsden, 1988; Love *et al.*, 1998) to highly complex decision support systems founded upon case based reasoning and fuzzy logic (e.g., Kurmaraswamy and Dissanayka, 1998; Luu *et al.*, 2003). It is important, however, that method selection is done logically, systematically and in a disciplined manner by the key stakeholders in the capital works project (Love *et al.*, 1998). The range of choice of procurement systems is now so wide, and capital works projects are becoming so complex, that the selection process must be disciplined, objective and carried out within the framework of the client's overall strategic project objectives.

Many of the procurement selection systems developed (e.g., NEDO, 1985; Skitmore and Marsden, 1988, Moshini and Botros, 1990; Ambrose and Tucker, 2000) ignore an array of factors, are limited in the options available for consideration, are conditional and not widely applicable, and are simply not user friendly (Alhazmi and McCaffer, 2000). It seems to be a ubiquitous failing of the academic community to exploit complex models and systems developed via the patenting of commercially robust products that have significant and demonstrable impact. One notable exception being Al-Tabtabi (2002) who broke through the standard academic *modus operandi* to actually produce work that was tried and tested in practice over a period of time. The major difficulties associated with procurement selection include:

- no single person or knowledge 'czar' has been found who is familiar with all primary procurement methods (Hamilton, 1987);
- no consensus has been found between experts which easily systemises procurement selection; and
- no mutually exclusive sets of criteria uniquely and completely determine the appropriate procurement method for a specific project (Love *et al.*, 1998).

Each of the tools and techniques identified in Table 3 attempts to cross-reference project variables with existing procurement systems that are available in the marketplace. As a result, Sidwell *et al.* (2001) suggest that this 'shoe-horns' one-off projects and their particular parameters, priorities and external conditions into off-the-shelf delivery systems, which can lead to a sub-optimal solution being used.

2.3 Procurement selection process

Tools and techniques that have been developed to date have their merits but almost all fail to account for the dynamic nature of procurement public sector needs as well as provide practical application. Recognising the need to select an optimal procurement system for delivering an effective supply chain solution, a systematic procurement toolkit was developed that encompasses both quantitative and qualitative considerations. The approach to procurement selection being proposed in this paper encompasses six steps and is presented in Figure 1. Noteworthy, it is deemed that the business case

for the capital works project is undertaken before the procurement system is selected. Steps to be undertaken prior to the selection of the procurement system include the:

- identification and quantification of the need and demand for a new facility;
- identification of options to meet the needs of stakeholders and undertaking of preliminary risk analysis;
- justification of preferred option(s) and undertaking of financial and economical appraisals; and
- selection of an ideal project option/brief, conducting of a risk/benefits analysis, business case and obtaining the client’s authority to proceed.

The determination of project objectives and constraints is pivotal to the selection process. At the end of each step identified in Figure 1, the actions undertaken should be compared with the project objectives and constraints to ensure that they are being considered appropriately. After each step is completed and key decisions are made, the justification for these decisions should be carefully documented so as to aid the process of transparency and provide a learning tool for future capital works projects. Before the procurement method can be chosen, all relevant project information (e.g. business case and risk assessment) should be reviewed and summarised by the project team members and stakeholders to assist with the selection process. Information derived from these documents should be used to inform the procurement method selection process. There are essentially *two* distinct stages to the procurement selection process that is proposed:

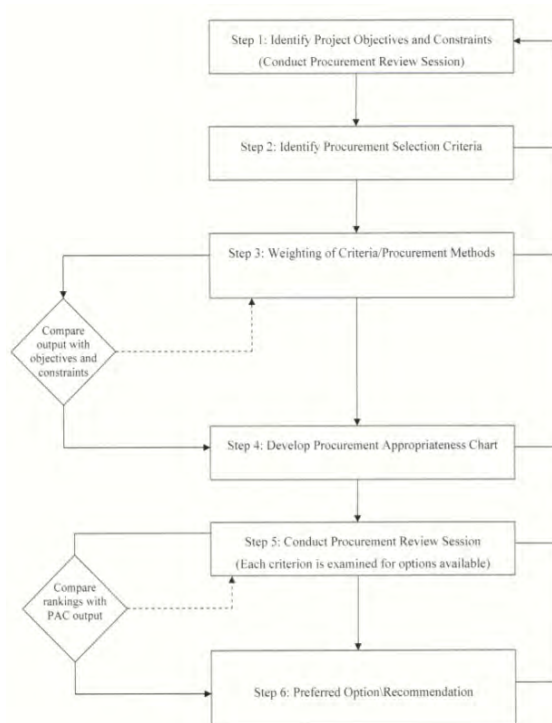


Figure 1. Procurement method selection process

Stage 1 encompasses steps 1 to 4. During these steps the procurement methods are identified and evaluated during a 'Procurement Review Session' with project team members/stakeholders. Once completed a number of procurement options are identified and evaluated using a quantitative weighting approach and a qualitative review process, both of which are described hereinafter in the real-life case example.

Stage 2 encompasses steps 5 and 6. Each of these steps should commence with a review of what has been undertaken and the re-examination of the procurement choices made in the context of the project objectives and constraints.

3. Research approach

In testing the proposed approach, a major Western Australian public client was approached and the process that was developed explained. The agency agreed to test the procurement selection process on a real-life project where the procurement method was about to be determined. In evaluating the process key stakeholders were invited to join in the process to select and evaluate procurement options using focus group approach. The focus group was used to elicit viewpoints and examine the application of the proposed approach for a real-life capital works project. Unlike conducting multiple individual interviews, participants in the focus group can listen to and comment on each other's original responses, discussing their perceptions and ideas with each other in an often enjoyable and comfortable shared environment (Patton 2002). Construction work is also notably managed by teams and therefore the team response in many ways has more meaningful value and credibility than an individual's view. All too often construction researchers fail to acknowledge this critical fact when assessing organisational performance and instead rely heavily upon feedback from individually completed interviews and questionnaires (Patton, 2002).

The focus group was used to gather information relating to the views and opinions of stakeholders in a non-threatening environment. As a common method of selecting stakeholders for focus groups, convenience sampling was used. Essentially, participants for the public works department were selected for their familiarity with the project procurement selection process of their organisation. All project team members and key stakeholders were invited to attend a focus group. The workshop comprised of 12 stakeholders that included the project director, finance manager, project managers, client, architect, quantity surveyor, and users of the project. Ideally focus groups should contain between 6 and 12 participants (Stewart and Shamdasani, 1990). While the focus group progressed, participants were given freedom to discuss issues, listen to fellow participants, provide reflective comment and arrive at a shared understanding of collective experiences regarding the procurement selection process proposed. Whilst working with the group, the facilitator appeared to be 'genuinely naïve' and avoided leading questions so as to allow corroboration to naturally occur.

4. Real-Life case example

The procurement selection process explained below is performed in congruence with a real-life example to demonstrate the decision-making process that was addressed by a public sector agency. The agency required a new school for children with disabilities. The achievement of these criteria did not necessarily require the agency to retain design control and risk throughout the supply chain. Achieving the desired quality on the development was not anticipated to be onerous and could be delivered *via* the agency's professional team setting the design parameters for a contractor to achieve. The project's budget has not yet been fully established but it is envisaged that the final cost would vary significantly to the budgeted cost as stakeholders requirements may change. Cost certainty would be required prior to commencement of the production process on-site and all works had to be competitively tendered. The data presented below and Tables 1 to 5 were derived from the focus group participants and the initial outline brief provided to the researchers.

Step 1: Identification of project objectives and constraints

Before the project team members and stakeholders commenced the initial 'Procurement Review Session' they were asked to familiarise themselves with the different types of procurement methods available within the marketplace, the project objectives and constraints. Key *project objectives* should address:

- *Programme and phasing* – key milestone dates should be specified such as the target date for the facility to be operational.
- *Design criteria* – is a whole life cycle solution required? Is an attractive architectural statement required reflecting the facility's status in the community? Is there sufficient space to meet the client's immediate and possible future space requirements? Is the site potential being maximized?
- *Cost certainty* – has the budget for the project been finalised? Would the final cost of the project expect to vary from the budget cost? Do all works have to be tendered?
- *Other objectives* – in addition to the foregoing project, specific objectives should be highlighted and addressed.

Identification of key *project constraints* should address:

- *Programme constraints* – a master programme should be developed for the whole project to review the achievability of the key milestones.
- *Planning* – is the design sympathetic to the needs of the planning authority and local stakeholders?

- *Site condition* – what type of site is required? How will contractors price for any risks associated with the site conditions? Have extensive reviews of the site been undertaken as part of the design development process? Is the client willing to retain full control of the design and accept the potential unknown risks?
- *State Government procurement procedures* – the procurement strategy should comply with Western Australian procurement regulations. How will the project be tendered?
- *Risk allocation* – is the agency risk averse? What degree of risk are they prepared to accept?
- *Degree of client involvement* – what degree of involvement would the agency like to have?
- *Flexibility for change during design and construction* – is cost certainty required? How early in the project will cost certainty need to be fixed? Does the procurement strategy need to be responsive to change and integrate key supply chain participants?
- *Market interest* – will the procurement method solicit a good response from contractors?
- *Other constraints* – in addition to the foregoing project specific constraints should be highlighted and addressed.

Table 1. Project constraints and key issues for an educational capital works project

<p>Programme Constraints: Key programme dates as noted above. A master programme should be developed for the whole project, to review the achievability of the key milestone dates.</p>
<p>Planning: The design proposals should be sympathetic to the needs of the planning authorities and local stakeholders in the development.</p>
<p>Site Availability: The site should become available in line with the date to be defined on the master programme</p>
<p>Site Condition: The site is a Greenfield site that will require standard site investigations at an early stage. Contractors will price for the risk of any residual unknown site conditions. The following options are available:</p> <ul style="list-style-type: none"> • Undertake extensive surveys as part of design development prior to entering into the construction contract. • Retain full design control and accept the risk of potential unknown risks.
<p>State Government Procurement Procedures: The procurement strategy must comply with State Government procurement regulations. The construction works will have to be advertised through the GEM Website with competitive tenders invited on a restricted basis (i.e. prequalification), unless an alternative suitable and compliant framework is available to the Department of Education.</p>
<p>Risk Allocation: The Department of Education is a publicly accountable body and is risk averse. It is limited by the risks that it can accept. The procurement strategy must ensure that risk is placed with those best suited to managing those risks, whilst ensuring that no significant premium is unduly paid in attempting to pass risk to another party.</p> <p>Early constructability and logistics advice would be beneficial in ensuring that the most appropriate construction forms are selected and site co-ordination activities are pre-planned.</p> <p>The financial risk implications of alternative procurement methods, as a separate exercise, could be undertaken to assess whether this would affect the preferred procurement method identified by this 'Procurement Method Assessment' process.</p>
<p>Degree of Client Involvement: Department of Education wished to limit its direct involvement in the management of construction contracts.</p>
<p>Flexibility for Change during Design and Construction: Whilst the design of the finished facility will need to be capable of accommodating future changes in response to changing education needs and demand, in order to obtain cost certainty the design will need to be fixed at an early stage. It is therefore not anticipated that the procurement strategy will need to be responsive to changing client requirements during the detail design and construction phases.</p>
<p>Market Interest: A key consideration in the current construction market is the selection of a procurement method that will elicit a good response from contractors. This is essential to maximise the competitiveness of the tender process and to secure an appropriately experienced and resourced contractor for the project.</p>

Once the objectives and constraints were identified by stakeholders (Table 1) it became apparent to experienced practitioners which principle procurement methods *could* be considered appropriate. The advantages and disadvantages of the procurement options identified in the *context of the specific capital works project* were listed. If more than *four* options were identified then this list would be reduced prior to commencing Step 3 by ranking the options in order of preference. In the case of the new school project, four procurement options were identified from an examination of the project objectives and constraints identified in Table 1 from preliminary discussions. The options identified were: design and construct (D&C) single stage, D&C two stage, traditional lump sum (TLS) single stage, TLS two stage. During a two stage process the contractor would be appointed earlier to assist in the pre-planning and design of the project.

Step 2: Identify procurement assessment criteria

Despite criticism from Luu *et al.* (2005), it is suggested that the generic criteria identified by NEDO (1985) should be considered as they represent the underlying issues considered by public sector agencies (Love *et al.* 2008). If this list of procurement assessment criteria is *not* deemed to be appropriate for the specific capital works project, and do not specifically marry with the project objectives and constraints they can be amended accordingly. During discussions with the focus group members the criteria identified were deemed to be appropriate and to encapsulate the essence of the decision-making process for the identified capital works project. However, for more complex projects such as hospitals, it was noted that more specific criteria could be identified that specifically address aspects of risk apportionment. Noteworthy, this procurement selection process does not consider PPP type arrangements as the decision to use this route is typically recommended by the Department of Treasury after extensive economic modelling.

Step 3: Weighting of client criteria and procurement methods

Once the procurement assessment criteria are identified they are given weightings by workshop participants. In this instance, the importance of each criterion for the agency was determined and entered into Table 2. The procurement methods identified should be listed and then evaluated according to their suitability using the 'procurement ranking method', which is described below. This ranking method enables an objective assessment to be made against pre-defined procurement assessment criteria. The output of this ranking process should not be treated as indicative, but rather as a guide for the project team to make informed decisions.

A weighted score method is used to evaluate the procurement options that have been initially identified from Step 2. Each criterion for the client is weighted depending upon their relative importance, and the *most* important is awarded the highest weighting. A score was also assigned to each procurement method under consideration (Table 3). The product of the criterion weightings identified and the procurement method scores was calculated. The method with the highest final score is considered as a possible supply chain solution.

The first stage considers the relative importance of identified criteria impinging upon the new school project. A score for each criterion is weighted (W) using a scale of 1 (low) to 5 (extreme) to reflect their importance to the project was undertaken. In addition, each criterion was weighted according to its degree of importance and related to the score (P) of each procurement method using a scale of 1 (poor) to 5 (excellent). The process used to determine the overall weighting for procurement methods is as follows:

1. The procurement assessment criteria shown in Table 2 were weighted according to their *degree of importance* for the educational project to be undertaken on a scale of 1 to 5 (*low, moderate, high, very high, extreme*).
2. The score, on a scale 1 to 5 (*poor, acceptable, good, very good, excellent*) was awarded to each criterion for each of the available procurement methods in Table 3.
3. The product of the agency criterion weightings and scores were calculated (shown in column 3) in Table 4.
4. The sum of the products for each of the procurement methods was calculated (shown in the total score row) in Table 4.
5. The preferred procurement method was that with the highest total score.

During this step, a detailed case addressing advantages and disadvantages of using the identified procurement methods was made and documented. In the case of the educational project the comments from participants were summarised documented for each of the procurement methods identified below:

- *Traditional lump sum contracting/BoQ*: This approach has been the most prevalent procurement method choice by state government, although its popularity is waning within the industry due to the ‘adversarial’ approach it can engender. This route requires all agency/user decisions to be made and surveys/investigations and design to be fully completed and recorded prior to the award of any contract.
- *Two stage lump sum contracting*: The two-stage approach maintains all of the principles for the traditional lump sum approach, but accelerates the process through overlapping the design and tendering period. Design is still completed prior to construction, but the contractor is appointed in two stages. The 1st stage tender is typically awarded on the basis of tenders for preliminaries, management/site supervision staff, overheads and profit and approximate quantities or schedules of rates for the major sections of work that have been designed to outline or scheme design stage. Provisional sums are inserted for work not designed at the first stage. The 2nd stage involves works packaging, tendering (by the contractor using competitive sub-contract procedures) and formalising of costs of the works themselves based on the pre agreed schedule of rates or on an open book basis, for example. An updated risk analysis should be used to calculate the contingencies required.

- *Design and construct:* D&C is a procurement method that has been used before by the agency for procuring schools. The overlap of design and construction phases can enable significant programme advantages to be taken, whilst transferring risk ownership to the contractor in a measured and sustainable manner. Issues relating to the delivering of a quality product can be a disadvantage of this route; however a detailed client's requirement document will mitigate this risk to some extent.
- *Two stage design and construct:* A *two-stage* form of procurement is particularly suitable for fast track, large and complicated projects, whereby a contractor's practical construction expertise may be fully exploited and a single stage design and construct route would not be appropriate.

Table 2. Importance of agency criteria for educational capital works project

Procurement Assessment Criteria	Weighting (W)
<i>Time:</i> Is early completion required?	2
<i>Certainty of time:</i> Is project completion of time important?	5
<i>Certainty of cost:</i> Is a firm price needed before any commitment to construction is given?	5
<i>Price competition:</i> Is the selection of the construction team by price competition important?	5
<i>Flexibility:</i> Are variations necessary after work has begun on-site?	4
<i>Complexity:</i> Does the building need to be highly specialised, technologically advanced or highly serviced?	1
<i>Quality:</i> Is high quality of the product, in terms of material and workmanship and design concept, important?	3
<i>Responsibility:</i> Is single point of responsibility the client's after the briefing stage or is direct responsibility to the client from the designers and cost consultants desired?	5
<i>Risk:</i> Is the transfer of the risk of cost and time slippage from the client important?	3

The *Two Stage* approach maintains all of the principles for the single design and build route, but creates a defined pre-construction period during which the design can be developed in conjunction with the contractor and the site can be fully surveyed and residual risks ascertained. Design is still completed prior to construction, but the contractor is appointed in two stages. The 1st stage tender is awarded on the typical basis of tenders for preliminaries design fees, management/site supervision staff, overheads and profit. Works tenders (including robust schedules of rates) for the major sections of work that have been designed can also be produced. The 2nd stage involves works packaging, tendering (by the contractor using competitive sub-contract procedures) and formalising of costs of the works themselves based on the pre-agreed schedule of rates or on an

open book basis, for example. An updated risk analysis should be used to calculate the contingencies required.

Lump sum cost certainty is achieved at the end of the 2nd stage when all surveys/investigations are complete, the vast majority of sub-contract tenders are obtained and all risks quantified. The 2nd stage appointment is concluded following ratification of the final price with contract documents executed as if under a single stage arrangement. The stage one / stage two arrangement acts as a break-clause. In the unlikely event of the parties failing to agree lump sum agreement at the 2nd stage, the client can tender the fully designed project in competition but will suffer programme consequences as a result.

Table 3. Scoring of criteria against procurement method

Procurement Assessment Criteria	TLS single stage (P)	TLS two stage (P)	D&C single stage (P)	D&C two stage (P)
<i>Time:</i> Is early completion required?	2	2	3	5
<i>Certainty of time:</i> Is project completion of time important?	2	2	3	5
<i>Certainty of cost:</i> Is a firm price needed before any commitment to construction is given?	2	2	3	4
<i>Price competition:</i> Is the selection of the construction team by price competition important?	4	5	2	2
<i>Flexibility:</i> Are variations necessary after work has begun on-site?	2	2	2	2
<i>Complexity:</i> Does the building need to be highly specialised, technologically advanced or highly serviced?	2	2	2	2
<i>Quality:</i> Is high quality of the product, in terms of material and workmanship and design concept important?	4	3	2	3
<i>Responsibility:</i> Is single point of responsibility the client's after the briefing stage or is direct responsibility to the client from the designers and cost consultants desired?	2	2	5	5
<i>Risk:</i> Is the transfer of the risk of cost and time slippage from the client important?	2	2	5	5

Step 4: Procurement appropriateness chart

Each of the procurement methods identified in the 'Weighted Procurement Method Scoring' Table 4 were examined in greater detail against factors within the context of *time*, *cost* and *quality* or factors that have not been previously identified so as to obtain a balanced view of selection using the 'procurement appropriateness chart' identified in Table 5. Note the inherent simplicity of this chart and the potential to easily transfer the calculations and outputs in user-friendly software packages to enhance user experience. This particular attribute goes some way to addressing concerns raised about the complexity of previous systems developed (by doing this, the output can be evaluated with some contextual meaning, specifically with regard to the prevailing market conditions). Table 5 identifies the qualitative descriptors to be used during this step. The educational project used demonstrates how the process and the comments for each of the procurement methods were identified. This not only

improves transparency in the decision-making process, but also enables learning for future procurement method selection decisions.

Table 4. Weighted procurement method scoring table for the educational capital works project

Procurement Assessment Criteria	Weighting (W)	TLS single stage W x P =	TLS two stage W x P =	D&C single stage W x P =	D&C two stage W x P =
<i>Time:</i> Is early completion required?	2	4	4	6	10
<i>Certainty of time:</i> Is project completion of time important?	5	10	10	15	25
<i>Certainty of cost:</i> Is a firm price needed before any commitment to construction is given?	5	10	10	15	20
<i>Price competition:</i> Is the selection of the construction team by price competition important?	5	20	25	10	10
<i>Flexibility:</i> Are variations necessary after work has begun on-site?	4	8	8	8	8
<i>Complexity:</i> Does the building need to be highly specialised, technologically advanced or highly serviced?	1	2	2	2	2
<i>Quality:</i> Is high quality of the product, in terms of material and workmanship and design concept important?	3	12	9	6	9
<i>Responsibility:</i> Is single point of responsibility the client's after the briefing stage or is direct responsibility to the client from the designers and cost consultants desired?	5	10	10	25	25
<i>Risk:</i> Is the transfer of the risk of cost and time slippage from the client important?	3	6	6	15	15
$\Sigma =$ Rank		82 (4)	84 (3)	103 (2)	124 (1)

Each aspect from Table 5 was discussed by the project team and stakeholders in the second *Procurement Review* session. The following points were reviewed in relation to the alternative procurement methods available for the educational project and summarised as follows:

- *Agency will be financially risk averse* - a D&C, particularly Two Stage D&C, would give greatest cost certainty at each key decision stage.
- *Agency will discourage late changes* – D&C is less flexible to late change and would therefore be preferred. A clear and thorough briefing process and the agency's requirements to an appropriate level of detail would be required.
- *Programme is important*; (as early a finish as possible is sought) – D&C would offer the greatest programme advantages.
- *Quality is important* – the traditional approach provides the best ongoing opportunity for design quality control, but at an increased cost risk compared to D&C. D&C can provide an adequate level of design quality control and that direct control of design quality passes to the contractor under D&C at the novation date of the design team.
- *Market conditions* – an early approach to, and early involvement of, the contractor would be beneficial in current market conditions. Two stage would therefore be most appropriate in this respect.

- *Partnering* – the agency favours partnering arrangements, but it is unlikely that a suitable contractor framework would be available in time to support this project. Two stage would bring early contractor involvement and therefore offer the best alternative to partnering that can be achieved through the Government Electronic Marketplace (GEM) process.
- *Potential for phased completion* – given the overall programme pressures, the potential need for phased completion was discussed. Early involvement of the contractor would allow the most efficient and economical introduction of phased completion if required.

Table 5. Procurement appropriateness charts for school project.

Key	☺ Good	☹ Average	☹ Poor
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Time	Traditional Single	Traditional 2 Stage	D&C Single	D&C 2 Stage
Completion date certainty (once let)	☹	☹	☹	☺
	Introducing a 2 nd stage produces a potential extra risk of delay to overall completion.			
Ability to meet current programme	☹	☺	☹	☺
	In order to obtain full design prior to tendering, traditional routes require a significant lead in as no overlap occurs between design and construction, which may be difficult to achieve.			
	Whilst the D&C contractor can overlap their design and construction the programme must reflect sufficient time for defining the client's Requirements. A Two-Stage form of procurement is particularly suitable for fast track, large and complicated projects, whereby a contractor's practical construction expertise may be fully exploited.			
Facility to phase construction	☹	☺	☹	☺
	A 2 stage process provides an opportunity for contractor input into pre-planning for phased delivery.			

Cost	Traditional Single	Traditional 2 Stage	D&C Single	D&C 2 Stage
Cost certainty prior to major commitment.	☺	☹	☺	☺
	This single traditional route provides a high degree of cost certainty providing that full detailed design is produced prior to tendering. As with D&C provides a high degree of cost certainty providing the client's requirements are fully defined up to performance stage. Lump sum cost certainty is achieved at the end of the 2 nd stage when all surveys/investigations are complete, the vast majority of sub-contract tenders are obtained and all risks quantified. Two Stage options require payment during the 1 st phase without certainty.			
Transfer of cost risk.	☺	☺	☹	☹
	The transference of risk to the contractor is an obvious benefit of the D&C procurement method, but the passing on of these risks will have an effect on the contractor's price, which reduces the benefit of this transference. Design risk will however stay with the client via the design team. Under traditional systems risk of design is retained by the client. Transference of cost and programme risk to the contractor under a D&C procurement method to enable the client to establish a robust risk profile before entering into any significant financial commitment with the contractor. The downside is the transference of ownership of detailed design responsibility to the contractor; unless this is done in a measured and informed way the end product may not meet the design criteria expected or demanded.			
Competitive tendering in current market conditions	☺	☹	☺	☺
	The D&C 2 stage route appears to be the most attractive option for the current market situation. All options provide for competitive tendering.			

Quality	Traditional Single	Traditional 2 Stage	D&C Single	D&C 2 Stage
Ability for contractor to add value in design development	☹	☹	☺	☺
	Traditional – Due to design being retained by the client's appointed designers a greater level of design quality may be anticipated. However, this means that the contractor is not involved with the design, which could cause some problems in terms of areas such as constructability. Two Stage tendering can bring significant quality and constructability advantages. D&C – D&C routes provide maximum ability for contractors to add value in design. Because the design responsibility is transferred to the contractor's team the client loses direct control over design development. However, production of comprehensive documentation clearly defining quality standards and effective design checking procedures can mitigate this.			
Flexible to accommodate change orders	☹	☹	☺	☺
	Continuation stage changes should be avoided when adopting D&C.			
Single point responsibility for design & construction	☺	☺	☹	☹
	Under traditional the design and construction responsibilities are split.			
Ability to control / respond to unknown site conditions	☹	☹	☺	☺
	2 Stage process can provide the opportunity for contractors to investigate the site conditions fully prior to site start.			
Client retains control over development of design	☹	☹	☺	☺
	Under 2 Stage D&C the client has greater influence on design development later in the process.			

Step 6: Recommendation

The consensus preferred option at this stage was a *two stage D&C* procurement method. The key consideration in reaching this conclusion was the potential overall advantages with respect to programme, cost risk/certainty and the potential for phasing.

5. Conclusions

A six step approach to procurement method selection was developed and tested using a real-life capital works project. The proposed approach (and system used) was well received by the focus group participants and all were satisfied with the solution identified within a three hour period. The process was considered to be transparent and reflective and at no point was the choice of procurement method deemed to be *fait accompli*. While participants were satisfied with the outcome, there were moments when public agencies argued in favour of *bastion*, (that is, the default traditional lump sum) most notably when they admitted having only experience with this method. The public agency procured almost 95% of its capital works projects using a TLS and had no formal approach to procurement method selection in place (Love *et al.*, 2008). A major limitation identified by participants was the inability of the proposed procurement selection process to account for PPP forms. These forms of procurement method are recent phenomena to the public sector in WA and so for this they were excluded from the process. Consideration will be made to include additional criteria so PPP options can be included.

References

- Alhazmi, T., and McCaffer, R. (2000). Project procurement system selection model. *ASCE Journal of Construction Engineering and Management*, **126**(3), pp.176-184.
- Al-Tabtabi, H.M (2002). Construction procurement selection strategy using analytical hierarchy process. *Journal of Construction Procurement*, **8**(2), pp.117-132.
- Ambrose, M., and Tucker, S.N. (2000). Procurement system evaluation for the construction industry. *Journal of Construction Procurement*, **6**(2), pp.121-134.
- Hamilton, I.W. (1987). Developing expert systems for management applications. In P.S. Brandon (Ed.), *Building Cost Modelling and Computers*, E&FN Spon, London, pp.441-451.
- Kumaraswamy, M.M., and Dissanayaka, S.M. (1998). Linking procurement systems to project priorities. *Building Research and Information*, **26**(4), pp.223-238.
- Love, P.E.D., Skitmore, R.M., and Earl, G. (1998). Selecting an appropriate procurement method for a building project. *Construction Management and Economics*, **16**, pp.221-223.

- Love, P.E.D. Davis, P., Baccarini, D., and Edwards, D. (2008). Uncertainty avoidance: Public sector clients and procurement selection. *International Journal of Public Sector Management* **1**(7), pp.753-776.
- Luu, D.T., Ng, S.T., and Chen, S.E. (2003). A case-based procurement advisory system for construction. *Advances in Software Engineering*, **34**, pp.429-438.
- Luu, D.T., Ng, S.T., and Chen, S.E. (2005). Formulating procurement selection criteria through case-based reasoning approach. *ASCE Journal of Computing in Civil Engineering*, **19**(3), pp.269-276.
- Morledge, R., Smith, A., Kashiwagi, D.T. (2006). *Building Procurement*. Blackwell, Oxford, UK.
- Moshini, R.A., and Botros, A.F. (1990). *PASCON an expert system to evaluate alternative project procurement processes*. In Proceedings of CIB 90 Conference, Building Economics and Construction Management, Vol. 2, Sydney, pp.525-537.
- NEDO (1985). *Think About Building: A Successful Business Customer's Guide to Using the Construction Industry*. National Economic Development Organisation, London.
- Patton, M.Q. (2002), *Qualitative Research & Evaluation Methods*, 3rd ed., Sage, Thousand Oaks, CA
- Rowlinson, S. (1999). A definition of procurement systems. In Rowlinson, S., and P. McDermott. *Procurement Systems: A Guide to Best Practice in Construction*. E & F Spon, London, pp.27-53.
- Sidwell, A.C., Kennedy, R., Bennett, J., and Chan, A.P.C. (2001). *A Value Alignment Driven Procurement Decision Tool*. Research Program C, Construction Project Delivery Strategies, Report 2001-003-C-05, Cooperative Research Centre for Construction, Queensland University of Technology, Brisbane, Australia
- Skitmore, R.M., and Marsden, D.E. (1998). Which procurement system? Towards a universal procurement selection technique. *Construction Management and Economics*, **6**, pp.71-89.
- Stewart, D.W. and Shamdasani, P.N. (1990), *Focus groups: Theory and practice*, Sage, London.