ABSTRACT: Adaptation of current procurement management practices is required to deliver projects in a rapidly changing environment. Construction projects historically go over budget, result in litigation, often failing to meet client expectations as a result of ineffective contract management. This paper proposes an innovative framework for major construction project selection, procurement, and implementation. Three opportunities will be identified and discussed. First, employ an experienced project manager at the earliest stage of the project. Second, appoint consultants to complete the design before a competitive tender is held. Third, separately contract the design and construction of the project. The paper suggests that combining these opportunities can lower the risk of project failure and ultimately deliver benefits through effective management of major construction projects.

Keywords: Benefits management, contracting out, collaboration within and between projects, delivering innovation, dynamic capability, temporary organising

The intention behind this paper is to provide a framework for improving procurement of major construction projects. The underlying argument will affect the costs and performance of major projects and procurement strategies. The proposed strategy for achieving this change is to involve the project manager (PM) and the project team in the development of procurement strategies. The paper starts with a review of what constitutes a major project to establish the context of exploring innovative procurement strategies. The development of more realistic, and therefore more accurate, time and cost estimates for major projects, before they are approved, may result in fewer recriminations about project performance.

Procurement has become a more central issue to the construction industry for several reasons. Clients have been demanding ‘better value for money’ since the early 1970s, driven partly by poor productivity performance, and partly by comparisons with manufacturing productivity growth. Clients are raising their expectations, determining the standards of performance, and are more vigilantly monitoring this performance. The procurement strategy establishes a framework for the major project, and to a large extent drives behaviour. Therefore, the choice of procurement method, contract type,
and payment mechanism are determining factors in the outcomes of a project. Here the argument is that early involvement of an experienced PM can make a significant difference to these outcomes.

The context for these ideas is based on two approaches suggested for managing the early stages of a major project. The first approach is the engagement of the PM or director during the initiation stage of the project, and retention of the PM through the project life-cycle. The second approach is the recruitment of key members of the project team during the design and development stage of the project, and their retention through to completion of the project. By adopting these approaches using a procurement framework there may be an increased likelihood of success for major construction projects in both the public and private sector.

**MAJOR PROJECTS**

There is no precise definition of a major project, as any project that is larger or more expensive than the average might qualify. The discussion there are a number of characteristics which indicate what may constitute a major project, such as the importance of clearly defining project scope, even though unforeseen changes are likely. A study conducted by Bryson and Bromiley (1993) suggests a major project may, within an existing program, include a change in the current program or organisation, specific construction projects, legislation, city planning, or international relations. A major project may also establish a new program or facility. The organisation leading the project was more likely to be state or local governments (58 percent), federal government (38 percent), other organisations such as non-profits (10 percent), and corporations (8 percent). As Bryson and Bromiley suggest, major projects “… predominantly, although not exclusively, involve Government change efforts but span a wide variety of projects” (1993, p. 322). These major projects, according to Jolivet and Batignolles (1986) “… are open systems in that they require an organization with the ability to adapt itself to new parameters” (Davidson & Huot, 1989, p. 139).
Projects move through a spectrum from simple to standard to major based on the criteria used to deliver the client brief. In the framework presented here, simple and standardised projects are projects without significant difficulties or differences, and can be described as commodity projects. As project characteristics change they become complicated, and these projects transition at some point to major projects. In this sense, major projects are characterised by some degree of complexity.

Dombkins (2008) suggests complicated projects as relatively common and manageable if scope is well defined at inception. Echoing Jolivet and Batignolles (1986), complex projects are open systems that are difficult to control. The issue here is not so much whether a project is complex or not, because a clear distinction between complex, major, or complicated projects is unlikely. It is sufficient for the project team or PM to determine if the project is complex, as argued by Morris (2013), if it involves “… the emergence, dynamics, non-linearity and other behaviours present in systems of interrelated elements” (Geraldi, Maylor, & Williams, 2011, p. 968).

There may also be a lack of detailed design specifications at the start of a major project, which was identified by Davidson and Huot (1989) as an issue, as specifications will develop over time as the project is refined and defined. To manage this lack of clarity it may be advantageous to identify innovative options to encourage an incremental approach based on the evidence available. This approach would allow contractors and suppliers the opportunity for input during the design of a major project. This has the potential to reduce uncertainty resulting from poor tender documentation, which may lower the risk and cost for tenderers. Inviting tenderers to challenge the design and/or specifications of a major project provides an opportunity to innovatively accommodate complexity.

The theories used to examine the issue of managing complex projects are based on a variety of sources, notably from a number of branches of economics. The examination starts with the decision to manage the major project in-house or contract work to an external party. Contracting work is underpinned by Incentive Theory and Incomplete Contract Theory, developed by Hart (1995) and
Hart et al. (1997). When Governments decide to procure projects from the private sector, the decision needs to be made as to who should own the completed work, who should operate it, and who should invest in the major project. In addition, whether different tasks can be given to different agents, and under what circumstances, must be decided. This approach to bundling and unbundling major public construction and operational work is based on Hart (2003) and Albano et al. (2006).

Clients then need to make a decision on how to select the best partner/s for the major project, which can be aligned to Auction Theory due to the impact of people’s actions when applying strategies for selection. The selection of partners or contractors raises a series of issues including: auction design (Bulow & Klemperer, 1996); mechanisms to assess operators and contractors, discussed in the construction procurement literature (Masterman, 2002); and how to prevent and detect collusion and the level of competition in public tendering (Laffont & Tirole, 1993).

A significant body of work exists on the requirements for delivering successful major projects (Belassi & Tukel, 1996; KPMG, 2010; NAO, 2010). In the UK success attributes and critical success factors were identified by Alzahrani and Emsley (2013) in a study of client, consultant, and contractor organisations involved mostly in infrastructure, residential, and commercial projects in the UK. Past performance attributed to success of a project, yet if the project did not have a completed contract it was more likely to fail. Identifying success factors leads to a review of failure factors in the delivery of major projects. In research conducted by Doloi (2012) with clients, contractors, and consultants involved in the Australian construction industry, a potential failure factor was found to be the “… lack of required technical support and competency among the key stakeholders (the contractors)” (Doloi, 2012, p. 271). Also, project failure during construction was more likely to occur if there were “… discrepancies in contract documentation” which did not include “… detailed scope and design for the project” (Doloi, 2012, p. 277).
Using available data from the evaluation and definition stages of previous major projects would be a transformative innovation in procurement management. This transformation would offer a more empirical approach for clients to collect and use data to make better decisions (Flyvbjerg, Garbuto, & Lovallo, 2009). For example, Independent Project Analysis (IPA) was established by Merrow in 1987, to conduct research into the capability of the process and extraction industries. In 2011 the IPA database included details of 318 major, or ‘megaprojects’, and over 11,000 projects in total. This database represents industries such as oil and gas (41 percent), petroleum (21 percent), minerals and metals (15 percent), chemicals (10 percent), and power, and LNG and pipelines (Merrow, 2011, p. 27). Depending on the project, between 2,000 and 5,000 data points were collected over the initiation, development, and delivery stages of these major projects. Using this data, organisations can compare major projects with other similar projects across a wide range of performance indicators, providing a comparative framework which may increase the likelihood of a successful outcome.

**PROCUREMENT STRATEGIES FOR IMPLEMENTATION**

Another key to enhanced outcomes is for the client to specify the right project, and the contractor to deliver the project as specified, on time and on budget (Merrow, 2011). From Merrow’s perspective, contractual relationships are more tactical than strategic, and cannot address any fundamental weaknesses in the client’s management of the project. This crucial point is now widely recognised by the private sector clients/owners of major engineering projects in Merrow’s (2011) studies. For example, both Shell and BP established project academies in 2005 because they understood that significant risk transfer from clients to contractors is structurally challenging on the major oil and gas projects they undertake. In the public sector, the UK Cabinet Office started a Major Projects Leadership Academy with the aim of reducing reliance on consultants. In Australia a similar Leadership Academy was announced in 2013 and six MBA-type courses on procurement developed with Government departments are now offered at Australian universities.
To take responsibility for project initiation and definition, the client requires larger and more capable project teams, which cannot be achieved solely through hiring consultants or interim employees. This issue was identified in the National Audit Office report on complex Government projects in the UK, which also strongly argued for improvements in the development and management of procurement expertise (NAO, 2010). The procurement strategy for Heathrow Terminal 5 developed by BAA PLC is a well-documented example of a client PM taking on the responsibility for risk on a complex megaproject which was delivered on time and within budget (Wolstenholme, Fugeman, & Hammond, 2008).

The primary reason clients in general, and the public sector in particular, should invest in the development of internal capabilities is because they are responsible for managing project risk across various agencies, departments and enterprises. While risk can be managed by contracts, it cannot be made to disappear through contracts. These client project teams are responsible for the process of project shaping (Merrow, 2011), which is a necessary prerequisite for creating value for the client. Importantly, they need not be, and typically should not be, responsible for construction project management, which is the contractor’s role.

There are three ongoing issues for clients managing procurement when implementing major projects. The first issue is the difficulty of keeping competent staff who tend to get recruited by the construction industry after they gain experience from other major projects. This leads to the second issue, which is the difference in the level of expertise which typically exists between the client team and the contractors and suppliers they engage. The third issue is the risk averse nature of large organisations that are clients. These issues are underpinned by a general lack of expertise in clients (Love, Skitmore, & Earl, 1998). The challenge of differing cultures and levels of experience indicates the need for an innovative procurement approaches to major projects such as hiring PMs in the earliest stages of a the project. The client PM can also take on the role of chair of the project.
control group (PCG). In the role of chair the PM can get agreement on key issues from the group, and act as the client representative when dealing with tenderers and suppliers. Thus suppliers will deal with one decision-maker rather than a committee, or more likely the PM plus a PCG member, minimising some of the implementation issues identified.

**DISCUSSION**

There are three opportunities to greatly improve the management and outcomes on major construction projects. While the idea of maximizing involvement and better design management are not in themselves new, what is proposed is a different perspective for those ideas to improve project outcomes.

**Opportunity 1**

The relevant public or private sector client hire an experienced PM to chair the PCG and act as the client representative, and start recruiting the key members of a client project team for each major project at an early stage of project development. The project team members are then employed for the duration of the project to manage design, procurement, risk, and delivery. It is not uncommon for clients to see early expenditure on a project as money spent for little gain. There is minimal visibility for this investment in scoping studies, design options and value engineering. Employing the PM at this stage is a cost factor. The client’s PCG is a cost to the project and is often not included in the project budget. Members of the PCG may not have relevant expertise in managing major projects, and have been engaged for other reasons. If the PM is experienced it can improve the coordination and performance of the PCG, which benefits the client and the project, the former through fewer and more focused meetings, the latter through quicker and more directed decisions.

The same rationale can be applied to recruit the project team. The project team could also investigate procurement strategies and systems which are more relational rather than the transactional win-lose paradigm. While not always applicable, there are opportunities for partial win-
win outcomes when managing major construction projects which reflect the ongoing nature of
tendering and procurement repeatedly encountered by the project team members (Cox, 2004a,
2004b). If framework agreements, serial tenders, or multiple projects are involved the arguments for
relational forms of contracting become more relevant (Cartilidge, 2004).

**Opportunity 2**

The PM and project team should be responsible for overseeing the design and documentation
of the project, and ensuring the most appropriate construction options are chosen. Despite the
proliferation of contracts used in the building and construction industry most of the major projects
are delivered using either the traditional design-bid-build or Design and Build (D&B) and Design
and Construct (D&C) contracts. The trend has been toward D&B and D&C contracts for major
projects, and account for a larger share of work done than number of projects (Hughes, Hillebrandt,
Greenwood, & Kwawu, 2006). The advantages and disadvantages of these single source contracts
are detailed in de Valence and Huon (1999). Nevertheless, Merrow (2011) argues the most effective
form of project organisation is traditional construction procurement. This is when consultants are
appointed to manage the design, and a competitive tender is held for one or more contractors to
execute the works on site against a complete design.

There is some support for design and construct procurement of buildings and social infrastructure
from school Public Private Partnerships (PPPs) in Australia (NSW Auditor-General, 2006) and
hospital PPPs in the UK (NAO, 2010). This may be due to the buildability issues found in complex
buildings with many services, like hospitals, or the emphasis on maintenance costs with schools.
However, the research conducted by Lam (Lam, Chan, & Chan, 2007) and Chan (Chan, Lam, Chan,
Cheung, & Ke, 2010), examining the problems found in D&C projects, concluded that design
changes by the client and conflict of interest between design team members and the contractor are
common.
Using evidence from the 11,000 private sector resource, industrial and engineering projects in his database, Merrow (2011) argues the best form of project delivery is what he calls ‘mixed’. This is where engineering design contractors are hired on a reimbursable contract, and construction contractors are hired on a separate fixed price contract. The evidence from the database suggests this is the most effective form of project organisation, and represents traditional procurement with consultants appointed to do the design, and a competitive tender run for one or more contractors based on the finished design. The approach advocated here combines elements of both the D&C and traditional procurement strategies. By engaging the PM and project team early, before detailed design work commences, the integration of design development with construction options retains the advantage of a D&C contract, as the PM manages the consultants as they develop the design solutions. However, the loss of control and the premium that is paid for management of a D&C contract is avoided.

There are a number of advantages of this strategy of unbundling design and construction for major projects. First, breaking a major project into smaller, sequential contracts spreads the cost over time, and does not incur interest costs on finance for design work, as it does in a PPP. This in turn makes quality control easier and more effective by being focused on each project stage, which is an important risk management tool. Separating the design stage from tendering and construction may also improve opportunities for consultation with the community and stakeholders. Second, completion of design and documentation before tendering reduces contractor risk, and therefore total project cost. Management of the interaction between designers and contractors is done by the client project team, which also takes responsibility for overall design management. Third, this approach will encourage more intelligent sequencing of major projects, particularly infrastructure projects. There are significant capacity constraints in the engineering construction sector, as the experience of cost blowouts and schedule slippage with major resource projects in Australia’s mining boom has shown (Commonwealth of Australia, 2011). Price data from the Australian Bureau of Statistics
(2014) shows that fuel, labour, and land costs rose in 2006–2007, immediately before the financial crisis, and again in 2010-12, with the peak in mining investment expenditure.

As the design work is completed for a major project it can be added to a pipeline of projects and released for tender when conditions are appropriate, or when other projects are approaching completion. As projects of different scale are prepared they can be put to tender or held back as required. Further, potential suppliers and contractors can use the pipeline of projects to build capacity in the knowledge that there will be ongoing opportunities for their staff and equipment, reducing the set-up costs incurred by re-establishing project teams. This is particularly relevant to the public sector, which regularly manages major construction projects.

Opportunity 3

Design and construction of major projects should be contracted separately to spread the cost over time, and reduce project costs and risks. As far as possible, design and documentation should be complete or nearly complete before tendering. The quality of documentation at tender is a well-known issue in construction. A major survey by the CSIRO in Australia (Tilley & Barton, 1997) found contractors significantly increased their time and cost estimates in their bids to compensate for poor quality documents. Ten years later Slater and Radford (2008) found that the problem had got worse for building, but not engineering, projects. This may be the result of engineering projects being clearly specified at tender, while building projects, generally, are not.

The ‘nearly complete’ qualifier is important. A simple project can be fully specified just because it is simple. However, there is a limit to how much design can be completed in the initial stages of a major project, because the specification of a major project develop over time as the project details are refined and defined. Therefore, it is unreasonable to expect a major project to be fully specified at tender, and in most cases this would not be possible. On the other hand, it is not
It may also be advantageous to look for innovative ideas or design options where an incremental approach will allow opportunities for input during the development of the design. This also has the advantage of reducing uncertainty from poor tender documentation when tenders are called, thus lowering risk and cost for tenderers. Further, tenderers can be invited to challenge the design and/or specifications if they can deliver an enhanced alternative for delivering a major project. This provides another opportunity for innovative ideas to address complexity or functionality, which may deliver enhanced benefits. However, because design input comes at a cost to tenderers, and only one tenderer is successful, clients should contribute to their design costs in return for ownership of the designs. If clients have purchased designs from unsuccessful tenderers, any of their innovative ideas can be incorporated into the final design. This can be seen as an extension of the bid cost reimbursement policies currently found in some countries. Canada typically reimburses a third to a half of losing bidders’ total external bid costs for design and legal components. In France, the government often reimburses up to 40 percent of design cost for the initial bid phase and 70 percent for the final phase to unsuccessful bidders, depending on the extent to which they participate in the competitive dialogue procedure and the detail of their offer (KPMG, 2010, p. 37). Australian state governments in Victoria and New South Wales have also trialled capped bid-cost reimbursement for recent transport PPPs.

**CONCLUSIONS**

The intention behind this paper is to provide a framework for improving procurement of major construction projects. The underlying argument is that the only way to significantly affect the outcome costs and performance of major projects is to change the business model by early recruitment of the PM and project team. This change is proposed through revising the procurement strategies and
implementation processes used when managing major projects. If clients wish to reduce complexity, costs, and time without sacrificing quality and performance there are, in reality, few opportunities to make a significant impact. While these are not major changes, current practice can be enhanced through hiring an experienced PM and client project team at an early stage of project development; project design and documentation is the responsibility of the PM and project team; and separating the D&C contract to spread the cost over time and reduce project costs and risks. The contracts, relationships and risk management strategies for both public and private sector clients should be sufficiently flexible to deal with the changes that emerge during the design and delivery of a major project, which is typically measured in years. The working definition of a major project is therefore one that presents challenges which are not found on smaller, less complicated projects.

The procurement methods used for major construction projects has evolved over many decades, as the industry itself has gone from being craft-based, to trade-based, to the modern industrial model. What is now thought of as traditional procurement, the design-bid-build method, has been extended through a range of project management, single source D&C or D&B and relationship based procurement methods. The procurement methods used in a construction project, particularly a major one, is a process that presents different characteristics in different contexts or countries. While this may be a limitation to the applicability of these recommendations, it applies to any discussion on procurement systems. Combining the three opportunities identified in this paper can lead to lower risks for both clients and contractors, and thus lower cost, ultimately delivering positive benefits from more effective management of major construction projects.
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