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Title page

CM06-02 CUSTOMER INVESTMENT STRATEGIES DEVELOPED WITH THE BENEFIT OF HINDSIGHT: PRE-CONTRACT AWARD CRITICAL SUCCESS FACTORS FOR NEW DEVELOPMENT PROJECTS

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Abstract
Before a contract is awarded, a customer's new project conceptualization and design require investment in resources so that the project can be properly developed. Suppliers over this period also require the time and costs for their investment in tendering for the project. This research investigates these investments and establishes new insights into how a customer's past project investment data could be used to improve resource allocation investment in future projects. Based on a sample of eleven Australian defence projects, new insights into a customer's pre-contract award investments are provided as well as how this information could be used for estimating and allocating investments for future projects. There has been virtually no empirical research of this phenomena which has the potential to improve project delivery outcomes for both customer and supplier.

Key words: innovation, project management, customer, supplier, transaction costs, critical success factors

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Introduction

Successful projects are dependent upon the customer making the right decisions through project development, tender processes, contract award, delivery and completion (BIS, 2010). Pre-contract award, customers find managing these processes complex and uncertain involving the coordination of many industries, entities, tasks and stakeholders with differing priorities and objectives (Forschner, 2006). There is potential for moral hazard problems (Dembe and Bowden, 2000) which many customers try to limit through highly specifying contracts, close control and distrust (Kadefors, Gerle and Nyberg, 2004). Post contract award, incomplete project contract arrangements require that when a customer chooses to change requirements or when errors or omissions in the specifications are found, the supplier has the right to carry out the additional work based on supplier costs not subject to competition (BIS, 2010). Such specification defects and customer changes cause extra costs for the customer and moral hazard opportunities for a supplier to improve profits for little or no risk (Kadefors et al, 2004). This creates relationship difficulties because the customer fears the supplier will scrutinize the contract for errors and ambiguities that may lead to claims, exploit its monopolistic position by excessive pricing of the extra work, or save money by skimping on quality - a customer is very dependent upon the good will of the supplier both to deliver good workmanship and to handle unforeseen circumstances in a cooperative way – the scope for emotions and social tensions to influence relationships is considerable (Kadefors et al, 2004).

Purpose

This research examines a customer's pre-contract award project investments with a view to using past resource investments as the basis for estimating and allocating future pre-contract award project delivery resource investment and improving governance structures.

Information Governance and organisational processes

The role of information governance is important in understanding organisational processes because information is never complete, either because it is not available or because of its abundance which inhibits grasping the entire complexity of a given situation (Lindstadt 2001). As a result, customers are always faced with making decisions in uncertainty, and information is often distributed unequally. Some customers are better informed than others and are capable of turning this information into favourable outcomes for themselves. However, the problem of incomplete information is particularly pronounced in procurements such as construction contracting (Milgrom and Roberts, 1992, Ch5).

In an effort to reduce such uncertainties and complexities, a customer may choose transaction cost economics as a means to assist in assessing project delivery performance. Dahlman (1979) defined transaction costs as 'search and information costs, bargaining and decision costs, policing and enforcement costs'. Transaction cost economics holds that all complex contracts are unavoidably incomplete (Williamson 2002; 2000; 1991a,b). An incomplete contract can cause costly inefficiency. Transaction costs associated with project delivery may be able to help customers identify costly inefficiencies and assist in the development of governance structures which have superior adaptive properties which will yield efficiency gains (Williamson 2002; 2000; 1991a,b). Williamson (2002; 2000; 1991a,b) argues that transactions align with governance structures differing in their cost and competence in an economizing and efficient way. For these reasons, the unit of analysis for this research is the transaction, where economy of transaction will be measured over the pre-contract award period. This is the period over which the customer designs and develops its project delivery model for which large numbers of suppliers register and are transformed into smaller numbers of suppliers during the tender process. One supplier is awarded the project contract. Williamson (2002;

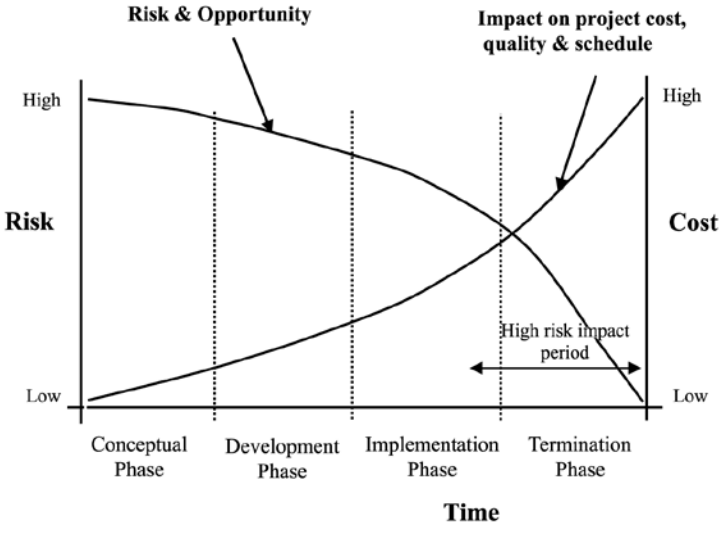
2000; 1991a,b) maintains that efficient project delivery governance will arise mainly from economizing on the transaction costs of these processes.

Chan and Chan (2004) concluded in their review of journals on project success that time, cost and quality were the three basic and most important critical success factors in construction projects. Aspects of the early consideration of critical success factors are sometimes overlooked by those who view the marketplace in a theory of choice way ie the meeting of rational 'faceless' customers and ubiquitous sellers in a commodity marketplace for instantaneous exchange gains (Williamson 2002; 2000; 1991a,b). Even those who are inclined towards a transaction cost economics and theory of contract approach may not take into account some of these considerations. Project delivery is in the interests of the customer organization, or there would be no project in the first place. Suppliers respond to customer demand, unless a supplier can orchestrate marketplace demand to its goods and forecasts (Galbraith, 1967). A measure of the transaction costs associated with a customer's 'search and information costs, bargaining and decision costs, policing and enforcement costs' (Dahlman, 1979) may provide the means to examine the 'three basic and most important critical success factors'.

A customer's vision and strategy deepen into capability concepts

It is in the pre-contract award phases of procurement that a customer's vision and strategy are deepened into capability concepts. These are in turn further developed , requirements determined, specifications decided, 'make or buy' decisions made, tenders called and contracts let. The importance of transaction economy over these phases is that of increasing the alignment between customer and supplier, improving future adaptive properties and flow of information, while reducing self interest and uncertainty gains (Williamson 2002; 2000; 1991a,b). During a customer's project concept and development phases there is high risk cost but also high opportunity for trade-off between the impacts of project cost, quality and schedule (Hlaing, singh, Tiong and Ehrlich, 2008). Hlaing et al (2008) relate that recent changes in the corporate environment have exposed participants in the construction industry to more and more surprises in project management. As a result, customers are allocating greater risks to contractors. This means there is a need to examine the whole life of a project from inception to use. But such research has been undertaken mostly from the construction industry's perspective. For example, the Hlaing et al (2008) research was an investigation based on a survey of construction contractors, not customers. Yet project risk and opportunity is highest and investment lowest over the conceptual and development phases where customers are instrumental in making decisions (Figure 1).

Fig 1 Customer's Ability to Influence Risk and Opportunity for Lowest Cost

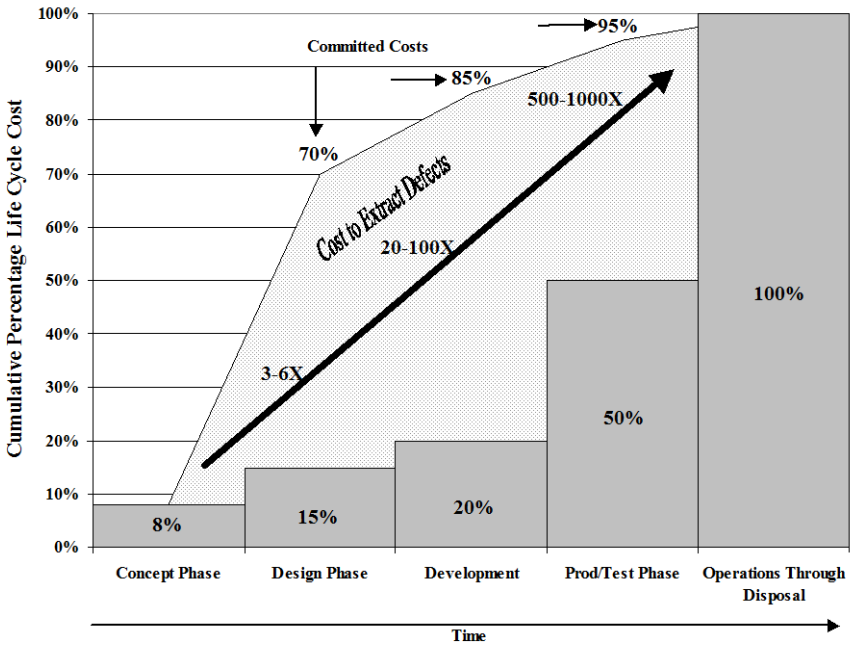


Source: Project Management Institute (2004)

Source: Project Management Institute, (2008), A Guide to the Project Management Body of Knowledge (PMBOK) 4th Edition, Project Management Institute, PA, USA;

This is further highlighted by Artisan (2008) which found that committing to investment in the early development of a project's concept, design and development may avoid significant customer costs to extract defects. This research indicates that 20% of the cumulative percentage of a project's life cycle costs should be invested during the concept (8%), design (7%) and development phases (5%). The costs to extract defects beyond these phases increase rapidly (Figure 2).

Fig 2 Cumulative Percentage Life Cycle Cost over Time and Cost to Extract Defects



Source: Artisan, 2008, Defense Systems Management College 9/93, in Model based systems engineering – opportunity to improve efficiencies with sysMI, Artisan Software Tools, p 6;

Adequate and timely preconstruction planning

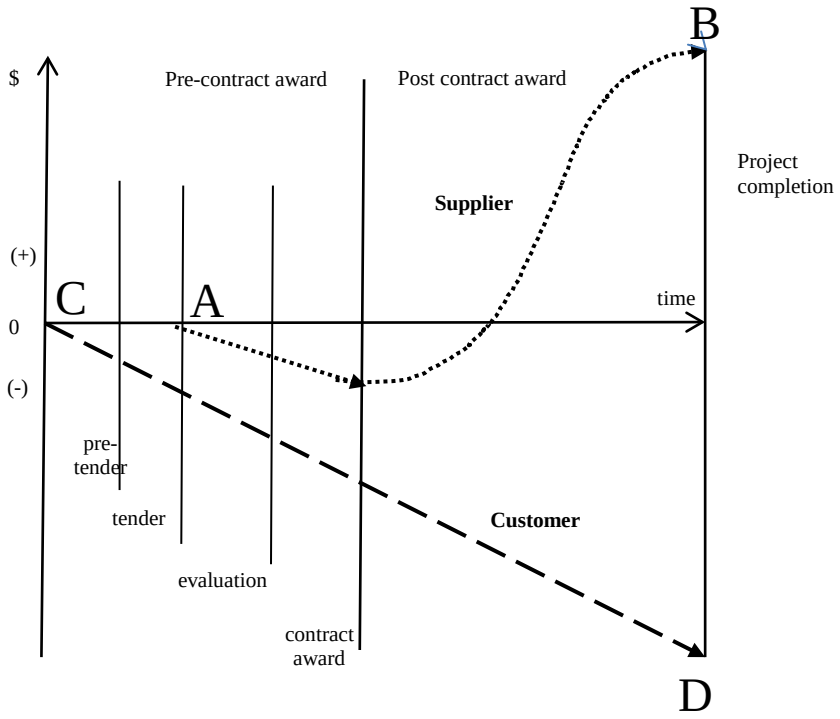
Adequate and timely preconstruction planning is essential for the successful delivery of projects (Hwang and Ho, 2012 p567). Such planning commences with the project 'customer', not with the construction industry. A project 'customer' is defined as the organization responsible for commissioning and financing a project (Barlow, 2000). The effectiveness of a customer's front-end planning will profoundly affect project cost and schedule performance as well as the overall success of a project (Gibson and Hamilton 1994). While project planning provides a common reference point that serves as a basis for project monitoring, control, and corrective action (Rosenau and Githens 2005), it is necessary for construction industry professionals to understand the customer's needs prior to any project commencement (Hwang and Ho, 2012 p567). Many things are in motion as the supplier's curve goes through its cycle, and a supplier's ability to execute them will determine its success in bringing the project satisfactorily to completion. From a customer's perspective however, there are various stages through which only the customer can progress the project.

Customers need to manage both uncertainty and equivocality,

Levander, Engstrom, Sarden and Stehn (2011) found that customers needed to manage both uncertainty and equivocality, and that a customer's ability to do this was limited - consequently, when

customers are moved beyond their current frame of reference, their information processing practice does not support decision making. Gannon and Smith (2011) suggest that market information is poorly considered within a (customer's) business case and that more transparency and commitment is required from suppliers. Currently, suppliers become involved when invited to register their interest in a project and are then shortlisted for tendering purposes. Tenderers are then obliged to develop and submit a tender for which there can be significant transaction costs. Only one tenderer is awarded the contract, so the others remain in debit. The contractor needs to move as quickly as possible into credit (Figure 3, A to B), while the customer continues to invest uncertainly and equivocally in the achievement of the required capability at some time in the future (Figure 3, C to D).

Fig 3 The stages, timing and cash flow of new project development



In Australia, many customers attempt to reduce this uncertainty and equivocality through the use of 'traditional' processes. 'Traditional' pre-contract award processes typically comprise four main phases: pre-tender, tender, evaluation, and award (Australian Government, 2011; State Government of Victoria 2011).

The Pre-tender Phase

In the pre-tender phase, customers draw on their organization's vision and strategy to identify future performance needs, often expressed through a capability brief. Once agreed, the capability brief provides the basis for a business case which is then developed into the project's scope. But pre-tender, 'many customers do a poor job of adequately defining a project's scope leading to a poor design basis' (Cho and Gibson Jr, 2001 p115). The development of the project's scope can include not only construction but also many other industries such as finance, venture capitalists, equity/debt providers, manufacturers, industrialists, and marketers. The construction component may be but a lesser fraction of the total project. The resources a customer allocates to the pre-tender planning phase are often well intentioned but inadequate or excessive. Because there are few relevant pre-tender investment guidelines a customer can draw upon to fit a particular future project, this may result in excessive transaction costs. For example, Gannon and Smith (2011, p186) provided empirical evidence which demonstrated that abortive transaction bid costs for the procuring authority

(customer) on three Light Rapid Transport Public Private Partnership projects ranged between 5.8% and 9.5% of total capital costs.

Tender

Mohemad, Hamdan, Othman, and Noor (2010) found that successful new construction projects are heavily dependent on making the right decisions during the tender process, and that managing tender processes is very complex and uncertain involving coordination of many tasks and individuals with different priorities and objectives. Laryea (2011 pps 275-286) established that in the UK, 'tendering is one of the stages in construction procurement that requires extensive information and documents exchange', that 'a significant amount of tender queries, amendments and addenda were recorded' and that 'poor quality tender documents are a source of inaccurate estimates, claims and disputes on contracts' (Laryea, 2011 pps 275-286).

For customers, the tender stage is complex. It includes selection of the tender model and method, checking and signing off drawings, specifications and consistency with requirements, checking market conditions, confirming pre-tender estimates and key selection criteria, contract conditions, drawings and specifications, bills of quantity, full documentation including the requirements for detailed submissions of price and program details, advertisement arrangements and tender closing details, the tentative timed program including the level of allowable delays and float time, and latent conditions considerations. Shortlisted suppliers are subjected to financial and risk assessments by the customer, and a request for tender consisting of detailed tender documents is issued to the surviving shortlisted suppliers, normally between three to six (State Government of Victoria, 2011). It is usual to accept the lowest priced conforming tender when projects are fully documented (State Government of Victoria, 2011). A construction program is required to be provided by suppliers showing duration of the project, start and finish times for critical activities, extension of time claims, monthly cash flow and allowances for expected delays such as weather, regular site meetings, and so on.

The suppliers' perspective is that a customer's tender documentation is usually expressed through a 'design brief'. A 'design brief' may be defined as '…a written description of what a new project or product should do, what is needed to produce it, and how long it will take' (Cambridge Dictionaries online, 2014). Typically the 'design brief' and not the customer's capability brief or business case is the document most used to communicate a customer's performance needs to the construction industry. This means that less of the argument, input and discussion from the many and varied broad base of customer's stakeholders is communicated either selectively or publicly to the marketplace. This in turn limits a supplier's design team decision making and collaborative efficiency, and the ability to achieve team goals and objectives (Yin, Qin, and Holland 2011). Laryea (2011 pps 275-286) revealed that the extent of clarity and adequacy of tender documents in format and structure varied considerably and that the volume of information provided was too extensive to allow tenderers to process and estimate a price and programme for the works in a short time, while the quality of tender documents was perceived to have dropped markedly in the past 15-20 years. This has caused extensive problems for tenderers. Larayea (2011) identified four main reasons for the decrease in quality of tender documents. These were customer impatience, reluctance to invest more in good quality documents, ignorance and incompetence. Suppliers were found to respond to unclear tender documents in five main ways - queries, assumptions, clarifications, qualifications or not bidding at all. Lack of clarity in tender documents was identified as a major source of claims and disputes at the construction stage. Laryea (2011 pps 275-286) suggested that customers should improve the quality of their tender documents, know what they want, describe it very clearly, do not assume that the other person knows what is wanted, tell them what is wanted, make no changes, allow a sensible tender period; and be reasonable about risk sharing.

Evaluation

Mohamed et al (2010) argue that a lack of clarity of information, customer preferences, potential competitors and the overall marketplace make bidding a very complex process (Figure 3). This is evident from the findings that 'industry reliance on performance metrics fixed at the project outset is being superseded by increasing use of emergent customer judgments to characterize success' (Thomson, 2012). But customers may still consider a 'project that fails to meet formalized time, cost and performance goals successful if it satisfies emergent requirements not understood during the initial briefing' and that 'construction practitioners do not routinely recognize that customer awareness of requirements improves as projects progress' (Thomson, 2012). Further, 'internal conflict among the customer stakeholders and their reflections on the emerging project solution help customer stakeholders to better understand their needs'. However, it has been found that 'dissatisfaction results when these emergent requirements are not acknowledged'. These findings indicate customer distress with current process and regulation (Thomson, 2012). In Australia, the customer's evaluation stage applies key selection criteria and weightings to conforming tenders, checks referees, negotiates variations such as options, re-confirms the budget and recommends the preferred supplier. During this process, a tenderer will often have to maintain the bid team including 'a mix of expertise and knowledge to enable it to handle requests for clarification and information from the customer (Industry Commission, 1994 p102). This can represent significant transaction costs for each tenderer.

Award

The contract award stage includes discussions and negotiations with tenderers concerning contract variations, tradeoffs, options, budget confirmation and final vetting of the preferred tenderer for viability (Capital Projects and Service Planning, 2011). These are expensive and time consuming processes for both customer and suppliers, which add to the pre-contract award transaction costs of all parties (Thomson, 1995).

Methodology

The methodology for this research should not only be helpful and improve practice but also contribute to a theoretically and scientifically useful body of knowledge. For such frames to be achieved, 'it does not necessarily follow that theory leads practice' (Lawler, Mohrman, Mohrman, Ledford and Cummings, 1985 p5). 'The most useful research is that which takes a more fine-grained approach, the challenge being to extract from it some general conclusions, insights and frames that contribute to theory … with the problem of gathering (empirical) data in such a way that it is replicable' (Lawler, 1985 p11). Durkheim (1952) applied induction by observing, describing and comparing, so providing a 'form of empirical evidence' achievable through the use of case studies (Blaikie 1993, p138). Gannon and Smith (2011 pps 186, 188) found that current business case practice had evolved from common practice on traditional procurement forms. This approach was a costly, ad hoc method of developing a business case and at worst was likely to lead to decision making based on inappropriate information (Yin, 2003 a,b; Soy, 2006). Phelps and Horman (2010, p58) suggested that 'traditional research methods have not enabled advances in understanding construction industry phenomenon', and that 'the methods are not adequate to enable understanding of the complex interactions leading to many of the industry's pervasive social and technical problems'. Further, Phelps and Horman (2010, p58) propose a need to 'complement quantitative and case study methodologies with qualitative theory-building methodologies and studies based on detailed and long term observations of the project environments'. The Phelps and Horman (2010, p58) paper identifies a critical need for theory building methods and methodological challenges. 'What has changed is the interpretation of the ideas and problems that confront the construction sector globally and the methodological pluralism approaches available to resolving them' (Hughes, 2007 piii). This research takes a pluralist methodology (Kellert, Longino, and Waters, 2006) through the development of an artefact in the form of a construct, model or method and test case using a fine grained approach over a lengthy period. From this some general conclusions, insights and frames may evolve which contribute to theory, and in doing so gather empirical data that is replicable.

Method

Cooke-Davies and Arzymanow (2002 p 471) found that 'the most highly developed project management models are in the petrochemical and defence industries'. Representative of this is the Australian defence customer. Its pre-tender process begins with new project entry into the defence ten year capability plan (Australian Government, 2006), that is the defence 'project portfolio' (Jonas 2010, p818) which comprises over 200 significant projects. This customer process begins with identifying the need to address the government's defence vision and related capability gaps and performance needs. These needs are progressively deepened into capability briefs and business case options derived from strategic guidance, current and future operational concepts and technology, emerging environmental issues, and already identified capability requirements. Drafts of the capability briefs and business case options are circulated for comment and transformed progressively into detailed, costed, defined requirements with business case options to be considered by the appropriate executives and defence boards. The preferred capability brief/business case option will be identified, a project design brief developed and given a schedule for procurement and budgetary provision for acquisition and through life costs (Australian Government, 2006 pp 98-101). The period, price and scope/quality of the required capability will be well developed during this process, sometimes with the assistance of industry experts such as quantity surveyors.

Defence projects selected and data collected

The defence commercial support program exposed selected non 'core' defence support activities to competition (Industry Commission, 1994, pps 69-90). This outsourcing program offered industry the opportunity to compete for work previously delivered exclusively by military and defence civilian personnel. Critical success factors were that a lowest cost option would not always be successful, that cost effectiveness took into account the financial viability of the tenderer, the demonstrated management and technical capabilities, the capacity to provide long-term support to defence, and other value for money criteria. In this pilot study, pre-contract award transaction costs and time data were collected for eleven of these projects for which defence followed its 'traditional' pre-contract award delivery processes (Table 1).

Table 1 Eleven projects offered by defence for pre-contract award transaction resource investment

No	Project Description	Defence Base	Contract Awarded	Value of contract (AU$m)
1	F111 maintenance	Amberley, QLD	IHO	48
2	P3C Depot Level Maintenance	Amberley, QLD	De Havilland	20
3	PC9 Pearce maintenance	Pearce WA	Airflite	20
4	PC9 Maintenance	East Sale Vic	Airflite	10
5	HS748	East Sale Vic	IHO	6
6	RAAF Surface Finishing	Richmond, NSW	IHO	9
7	Fairbairn Base Support	Fairbairn ACT	IHO	4
8	RAAF Williams Base Support	Point Cook Vic	SERCO	5
9	RAAF Basic Flying Training	Point Cook Vic	BAe	4
10	Fairbairn Catering	Fairbairn ACT	AFS	12
11	RAAF Williams	Point Cook Vic	Spotless	32

Source: Industry Commission, 1994, Defence Procurement Report no 41 Appendix E, p197, Commonwealth of Australia, AGPS, Canberra

Pre-contract award transaction cost and time data was collected from each of the defence project managers of the selected projects (Table 1). This involved an initial meeting to outline the time and cost data to be provided, a return meeting after the data had been collected, and then a final meeting to ensure that the data provided was interpreted correctly. The transaction cost and time data covered direct 'search and information costs, bargaining and decision costs, policing and enforcement costs' for the defence customer (Table 2) and for the suppliers (Table 3).

Table 2 Pre contract award summary of customer transaction costs and times for the selected eleven defence projects

Pre contract award Phase	% of total cost	% of total time
Pre-tender: Concept approval to proceed to RFT issued	26.8	56.0
Tender: RFT Issued to RFT Closed	1.0	17.7
Tender: RFT closed to tenders evaluated	57.0	7.7
Evaluation: Tenders evaluated to source selected	8.9	8.2
Evaluation: Source selected to contract negotiated	4.0	6.3
Award: Contract negotiated to contract award	2.3	4.1
Total	100.0	100.0

Table 3 Pre contract award summary of supplier transaction costs and times for the selected eleven defence projects

Pre contract award Phase	% of total cost	% of total time
Pre-tender: Concept approval to proceed to RFT issued	15.6	56.0
Tender: RFT Issued to RFT Closed	41.7	17.7
Tender: RFT closed to tenders evaluated	33.8	7.7
Evaluation: Tenders evaluated to source selected	5.2	8.2
Evaluation: Source selected to contract negotiated	2.3	6.3
Award: Contract negotiated to contract award	1.4	4.1
Total	100.0	100.0

These findings (Table 2) indicate that there was significant investment (57.0%) by the customer in tender evaluation with only 26.8% investment in the concept, design and development of project performance. For a customer, most value for money is in the development of the project performance requirement. From Table 3, the cost for suppliers to retain their project teams until they knew the outcome of the customer's tender deliberations is noticeably high (33.8%), caused by the customer's complex tender evaluation process.

Using the lagging customer data (Table 2), leading transaction costs and times for future projects can be developed (Figure 4). The solid line represents the average of the eleven project's performance,

while the dotted line represents a future project, in this case, the best performing of the eleven projects.

Fig 4 Average (solid line) versus improved (dotted line) transaction costs and times

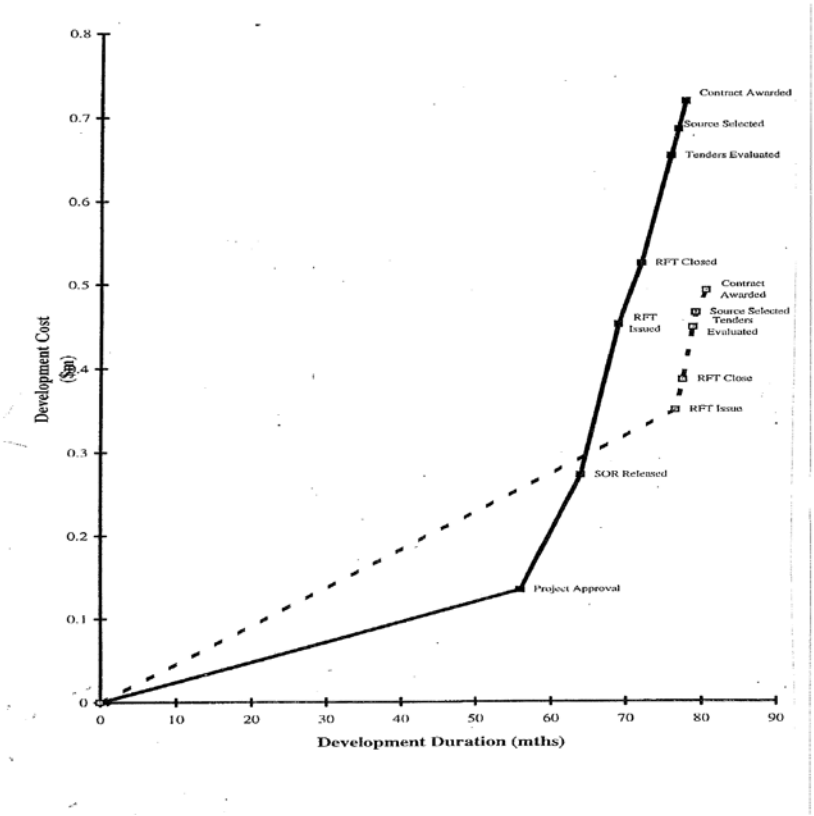


Figure 4 graphically indicates the need for a customer to make greater investment in the concept, design and development of a project, and less in tender evaluation. From this graphic, it is possible for defence to pre-determine the most desirable transaction cost and time allocation for each phase of the pre-contract award process. This could be adjusted as necessary for a particular project, and used for project management and monitoring.

Comparing 'performance' and 'traditional' project governance arrangements

'Performance' governance and risk arrangements are different from 'traditional' governance and risk arrangements. Calvert, Gavin, and Hamilton (1996) research found that the principal consequences of the use of 'performance' specifications are that there will be no owner's warranty of the sufficiency of the plans and specifications, that liability for design failures is shifted from the customer to the supplier, and that risks arising in performance, such as the risk of unforeseen conditions or necessary changes, are shifted to the supplier. This finding is based on the Supreme Court of the United States (1920) principle that: 'where one agrees to do, for a fixed sum, a thing possible to be performed, he will not be excused or become entitled to additional compensation, because unforeseen difficulties are encountered.' For such contracts, fixing the project sum is necessary. The party that drafts the specifications and designs the product normally runs the risk that those specifications will be possible to perform and that the product will be as required. In a 'performance' specification the customer provides some of the design but the supplier is required to complete contract 'performance' utilizing the supplier's own means and methods. When a contract contains

'performance' specifications it allows the supplier discretion to select the means and methods, but the supplier is not entitled to recover the cost of changing to the correct means or methods if its initial selection of the means or methods was wrong. A case study to compare such project governance arrangements was proposed and approved by defence. Such comparisons were to be based on the transaction costs and times for 'traditional' design and construct project delivery governance processes and compared to 'performance' governance arrangements.

For the test case, defence provided a fixed sum of $0.891m for a navy senior sailor's accommodation project in Victoria, Australia. The pre-contract award transaction costs and times for this project using Australia's traditional 'design and construct' process were estimated by a third party (John Holland Group) to be $133,650 and 4 months. The post contract award transaction cost and time estimates were $89,100 and 8 months. The actual use of a 'performance' contract resulted in actual pre-contract award transaction costs of $49,874 and 2 months and actual post contract award transaction costs of $50,961 and 7 months. Overall, the comparison between the two corporate governance arrangements favoured the 'performance' contract by $122,915 and three months (Table 4) (Thomson, 2012).

Table 4 Comparison of a customer's 'design and construct' versus 'performance' transaction costs and times

Pre and post contract award	Predicted customer's 'design and construct' contract transaction cost and time (estimated by third party quantity surveyors)	Actual customer's 'performance' contract transaction cost and time
Pre-contract award (concept to contract award)	$133,650 4 months	$49,874 2 months
Post-contract award (contract award to contract completion)	$89,100 8 months	$50,961 7 months
Total	$222,750 12 months	$99,835 9 months

Conclusions

This research demonstrates that effective project delivery requires traceability, as comparability and performance of project components and subsystems must be examined in detail. Transaction cost analysis enables such detailed analysis to be undertaken, where lagging performance indicators were used to develop useful leading indicators for improving project delivery performance from both the customer's and supplier's perspectives. This need not be a large operational expense if the necessary data is collected on a routine basis or is accessible from existing sources such as project accounts or reports. Data systems can now capture most of this information which can then be used to analyse the critical success factors of transaction cost and time, so using a holistic view of the process across the complete value chain. This is particularly important as the cost and time to remove defects escalate over time. While transaction cost economics holds that all complex contracts are unavoidably incomplete (Williamson 2002; 2000; 1991a,b), an incomplete contract can cause costly inefficiency. In the test case use of a 'performance' contract, there was no customer's warranty of the

sufficiency of the plans and specifications, or liability for design failures, or risks arising in performance such as the risk of unforeseen conditions or necessary changes. These risks were shifted to the supplier through the competitive tender process, while the customer retained cost and time risk, thus allocating risk to the party best able to carry the risk. In using a 'performance' contract, the customer saved the transaction costs, time and risks in developing a detailed 'design brief'. The customer was able to focus its efforts on the development of its required capability 'performance'. It did not need to extend this into the complex development of a 'design brief' and the responsibility and risk this carries as construction industry tenderers were then given the opportunity to respond competitively and innovatively to the 'performance' specification using their expertise and knowledge of their industry and its marketplace. With the time and cost fixed, tender assessment was simplified and shortened and 'value for money' (quality) became the only tender differentiator.

This research has taken a pluralist methodology and developed an artefact using a fine grained approach over a lengthy period. From this some general conclusions, insights and frames may evolve which contribute to theory, and in doing so gather empirical data that is replicable.

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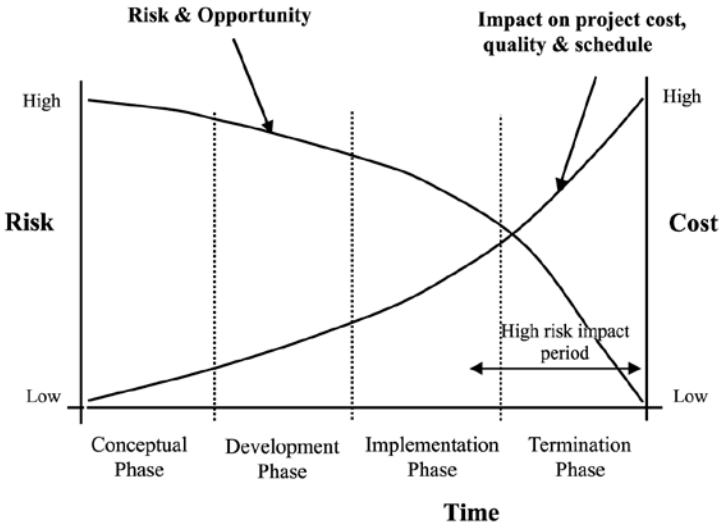
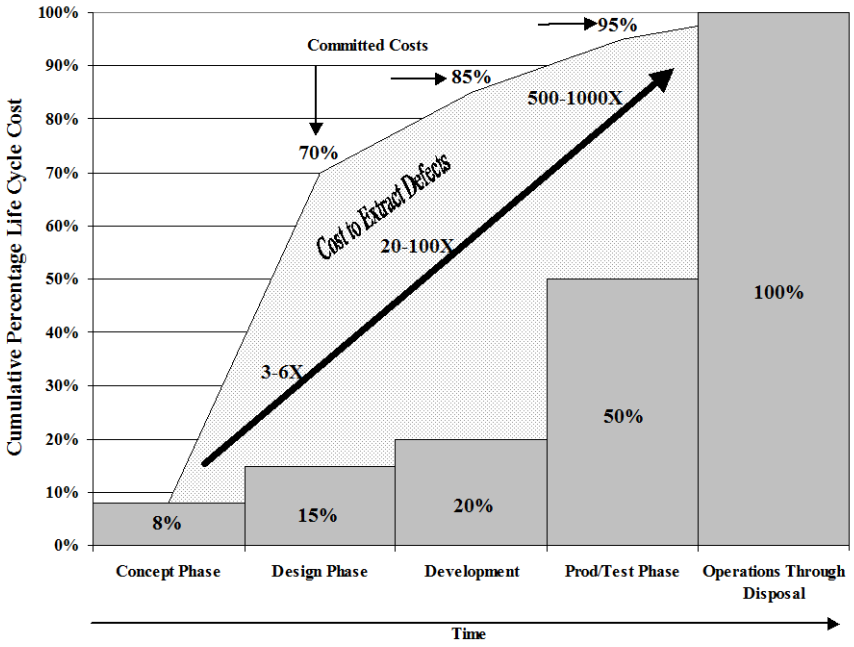
Fig 1 Customer's Ability to Influence Risk and Opportunity for Lowest Cost



Source: Project Management Institute (2004)

Source: Project Management Institute, (2008), A Guide to the Project Management Body of Knowledge (PMBOK) 4th Edition, Project Management Institute, PA, USA;

Fig 2 Cumulative Percentage Life Cycle Cost over Time and Cost to Extract Defects



Source: Artisan, 2008, Defense Systems Management College 9/93, in Model based systems engineering – opportunity to improve efficiencies with sysMI, Artisan Software Tools, p 6;

Fig 3 The stages, timing and cash flow of new project development

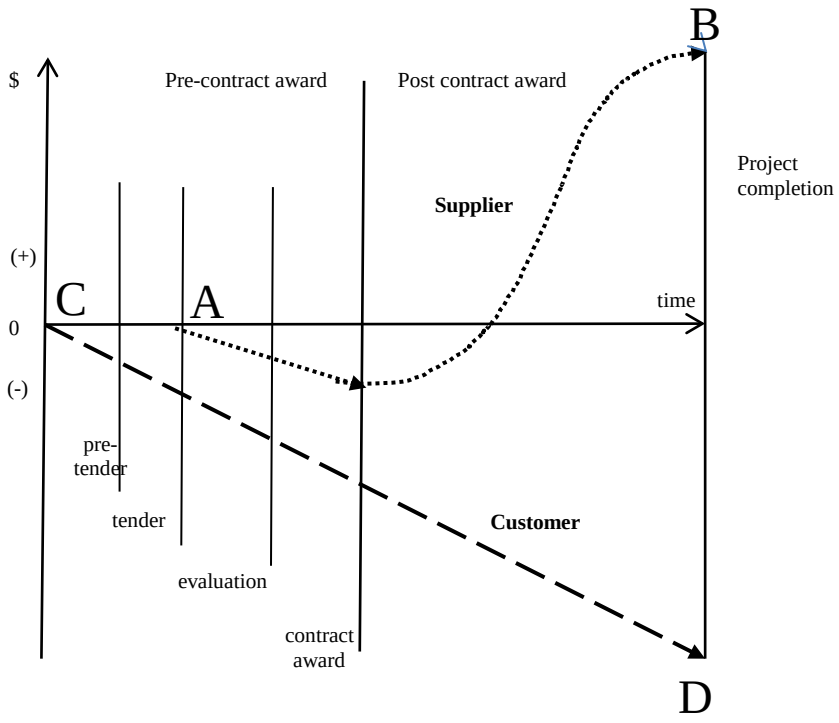


Fig 4 Average (solid line) versus improved (dotted line) transaction costs and times