

## **Optimising Tender Process Outcomes Through Effective and Efficient Organisational and Project Knowledge Identification and Capture**

**Andrew J. Wilson**

*Research Fellow, Research Development Unit, RMIT University, Melbourne, Australia.*

### **Abstract**

The Australian construction industry typically utilises the practice of competitive tendering to facilitate its procurement process. To improve competitive tendering outcomes, a systematic approach to the use of knowledge should be undertaken that effectively identifies, captures, and uses relevant project and organisational knowledge.

Effective knowledge identification and capture within an appropriate knowledge management system should utilise suitable knowledge mapping methodologies and project history formats. Knowledge mapping procedures would determine the level of tacit knowledge imbedded in project and organisational activities associated with the tender process, particularly the key, tacit-rich, activities of project cost and duration estimation. To effectively capture this tacit knowledge in a useable format, document-based project history processes must be undertaken that gather information dynamically in a real-time environment and that are enabled through dedicated organisational resources and appropriate Information and Communication Technologies (ICT)

The effective and efficient identification and capture of organisational and project knowledge utilising dedicated knowledge management processes and infrastructure, and appropriate ICT, will enable the optimisation of tender process outcomes through the compilation of more accurate estimates of project cost and duration.

### **Key Words**

Knowledge Management, Knowledge Mapping, Project Histories, Tender Process, Project Cost and Duration Estimates

### **1. Introduction**

The Australian construction industry is highly price-competitive, which is facilitated and exacerbated through the use of competitive tendering as the predominant and preferred method of project procurement (Runeson 2000).

Competitive tendering is problematic as a result of the highly competitive nature of the industry, and the time and resource allocation constraints associated with this process. These resource constraints exacerbate

tender process deficiencies and outcome difficulties that result from the inherent uncertainties associated with project cost and duration estimation.

To improve the process and outcomes associated with competitive tendering, a systematic approach to the use of knowledge should be undertaken by participants. An appropriate knowledge management system must effectively and efficiently identify, capture, and utilise the project and organisational knowledge required to optimise project cost and duration estimates

This paper examines the identification and capture of project knowledge within such an appropriate knowledge management system utilising suitable knowledge mapping methodologies and project history formats. It is contended that to optimise tendering outcomes, project cost and duration estimation processes must initially be systematically and comprehensively analysed to determine the nature of the knowledge resources required for their optimisation. Such a process would entail a knowledge mapping procedure to identify the level of tacit knowledge imbedded in project and organisational activities.

To facilitate the effective transfer of this tacit knowledge into a useable, contextualised explicit format, an efficient process of capturing project and organisational knowledge through project histories must be undertaken. To enable effective tender process outcomes, project histories must be document-based to ensure that organization and project knowledge is captured dynamically to facilitate informational optimisation for project cost and duration estimates. To be effective, such gathering of information must occur within a real-time environment and be enabled through dedicated organisational resources and appropriate Information and Communication Technologies (ICT).

The systematic, effective and efficient identification and capture of organisational and project knowledge utilising dedicated knowledge management processes and infrastructure, and appropriate ICT, will enable the optimisation of tender process outcomes through more accurate estimates of project cost and duration.

## **2. Project Cost and Duration Estimates**

In construction tenders, project cost is estimated in advance and typically there is a difference between the estimated and the actual cost of the project. The correlation of tender estimates with actual cost - or the accuracy of estimates - is problematic given the nature of the industry's production process with its array of random and probalistic influences and the resource constrained environment of the tender process itself. Park and Chapin (1992) determined that, although estimates should be accurate within 5% of project cost, on average estimated costs may vary as much as 20% from actual costs.

The risk to clients from contracting uncertainty arising from estimating errors or deliberate submission of an unrealistically low bid is that the contractor may collapse leaving an unfinished product and requiring the client to engage a new contractor (Holt et al 1995). The difficulties and expense associated with this can lead contractors to undertake opportunistic behaviour such as cost overruns, post-contract claims and the use of changes in project price specifications to exact high prices for extras (Crowley and Hancher 1995).

A 2004 Victorian state parliamentary report found that cost overruns, project delays and poor tender processes on a number of government infrastructure projects had cost hundreds of millions of dollars over a period of one year (Baker 2004).

Tenders are a costly and time-consuming exercise for both clients and bidders, and utilise significant organisational resources. Contractors may participate in numerous tenders without success with the costs of participation eventually being absorbed through the price structure of successful bids with the costs

ultimately being borne by the client and the eventual consumer (Hinds 1993). Pre-tender feasibility studies, document preparation and bidder selection processes are also costly and time-consuming activities for the client, and add to the resource consuming nature of the tender process. Bidders rely on the integrity of the client's tender preparation processes, and the quality and quantity of project documentation and specifications to engage in the tender process and compile an appropriate bid.

Tender bids reflect market price evaluations and risk assessments rather than the actual cost of a project and are inherently problematic given the complex, uncertain and lengthy nature of the construction industry's production process (Runeson 2000). Tender bids, inclusive of project cost and duration estimates, can however be optimised through systematic approaches to knowledge management.

### **3. Knowledge Identification**

The underlying imperative for a knowledge management system is to efficiently and effectively identify, capture and utilise the knowledge resources required to undertake and successfully complete organisational processes or tasks. To optimise project cost and duration estimation as undertaken during the tender process, an appropriate knowledge management system would implement structures, utilise methodologies and concepts, and undertake activities and processes designed to achieve these underlying imperatives.

Systems analysis of the project cost and duration estimation process should be undertaken to identify and detail key activities and tasks. From this a process map or work breakdown structure would be compiled. A knowledge mapping exercise would then be conducted with reference to this process map to determine the source and nature of the knowledge required to undertake the tasks and activities. Detailed insights into complex and underlying systems processes and the nature of knowledge resources can be gained through utilisation of specific analytical methodologies and models such as Soft Systems methodology (Walker et al 2003) and the Dixon model of knowledge creation (Dixon 2000).

A key parameter of the knowledge mapping activity is the identification and classification of knowledge resources into tacit and explicit knowledge. Tacit knowledge can be described as perceptions, feelings and opinions reflecting personal experiences whereas explicit knowledge reflects openly available so-called factual information (Walker et al 2003).

The process of cost estimation can be considered to require the following key inputs: a work breakdown structure used to organise the cost estimates and to ensure that all identified work has been estimated; details of the types of resources required and in what quantities for each element of the work breakdown structure; details of the unit rates for each of the resources; details of the estimated duration of the project activities; and historical information on resource costs derived from project files, commercial cost estimating databases or project team knowledge (Project Management Institute 1996).

Cost estimating may be undertaken utilising analogous estimating that uses the actual cost of a previous similar project as a guide; parametric modelling utilising project characteristics in a mathematical model; or bottom-up estimating that involves estimating the cost of individual work items and then summarising the individual estimates to get a project total (Project Management Institute 1996).

All these estimating inputs and processes rely on knowledge resources, which as result of the nature of the construction industry and the constraints of the tender process are largely tacit in nature. This reliance on largely tacit-based historical information and expert judgement can impede the accuracy of project cost estimates.

Tacit knowledge is more difficult than explicit knowledge to create, capture, codify, communicate and transfer because it is highly intellectually energy-intensive. Explicit knowledge however, although openly available, often does not have an accompanying explanation of the context of that knowledge so, while being conveniently available, is of less value than sound tacit knowledge because tacit knowledge embeds context (Maqsood et al 2004). The essence of knowledge management is to devise and implement strategies that capture organisational tacit knowledge, make it contextually explicit and share it throughout the organization.

To be effective, a knowledge management system should therefore be designed to identify and capture the tacit knowledge required to undertake and complete a task, activity or process and convert this tacit knowledge into contextualised explicit knowledge. The conversion of tacit knowledge into explicit knowledge is imperative as only explicit knowledge can be effectively and efficiently secured, utilised and stored within a knowledge management system.

For project cost and duration estimation as undertaken within the tender process, this conversion process is critical to optimisation due to the high levels of tacit knowledge inherent in this activity. This tacit knowledge is a response to the resource and time constraints typically associated with the tender process, and the uncertainty of outcomes that result from the complexity and length of the production process. Strategies need to be designed and implemented to convert the tacit knowledge identified into contextualised explicit knowledge. Systems would then be designed and implemented to effectively and efficiently utilise this knowledge on a dynamic basis.

#### **4. Knowledge Capture**

To optimise project cost and duration estimate outcomes, the knowledge resources required for the estimating process inputs and processes must be converted to contextualised explicit knowledge. A key element in this conversion is the systematic and comprehensive documentation of project histories designed to consistently capture and explicate contextually all the knowledge required to optimise tender cost and duration estimates.

The creation of project histories must be undertaken within the framework of an organisational knowledge management system that includes an appropriate ICT Infrastructure. ICT within this context will enable the effective and efficient capture, storage and utilisation of the knowledge required to create a systematic approach to project histories utilising digital technologies and associated applications such as portable wireless data recorders with direct network access to organisational databases.

Project histories contain important data from previous projects that can be used to develop refined and realistic estimates. Project histories can be compiled utilising process-based methods that gather lessons-learned from completed projects and include Project Review/Project Audits, Post-Control, Post-Project Appraisal, and After Action Review. Documentation-based methods collect project experiences as soon as they occur and include Micro Articles, Learning Histories, and RECALL techniques (Maqsood et al 2004). To optimise tender outcomes through improved estimating processes, project histories need to dynamically facilitate effective knowledge creation by expeditiously converting tacit knowledge into contextualised explicit knowledge utilising a real-time document-based methodology.

The optimisation of cost and duration estimates utilising the knowledge identification and conversion processes described above must be supported by an overarching systematic approach to knowledge management. Such a system would ensure that all organisational processes and activities are optimised through rigorous system process modelling and the effective and efficient creation, identification, capture, conversion, use and storage of the knowledge resources required to undertake organisational tasks. This

outcome will facilitate cost and duration estimate optimisation and the subsequent competitiveness of bids by ensuring optimal allocation of profit and organisational infrastructure costs, and associated capacity utilisation.

Knowledge management through strategic activities and subsequent effective workforce engagement must be enabled through an efficient ICT infrastructure. An effective knowledge management system would utilise specific processes, methodologies and activities as described above to refine organisational processes and identify, utilise and conserve knowledge resources. The system will also undertake systematic processes to provide ongoing and dynamic monitoring, review and measures of system implementation, performance and maturity (Walker and Wilson 2004).

The processes described above enable optimal estimates of direct or project-specific costs and indirect or organisational infrastructure costs. Project cost and duration estimates as compiled in the tender process also rely upon cost and duration estimates and prices provided independently from prospective subcontractors and suppliers. To optimise the overall tender cost estimate, the prices and estimates provided by these third parties would also have to be similarly optimised to those of the direct and indirect costs described above.

## **5. Conclusions**

The competitive tendering process as undertaken for construction project procurement is inefficient as a consequence of significant inaccuracies in project cost and duration estimates. This paper has proposed that a systematic approach to the identification and capture of project and organisational knowledge resources can address tender process deficiencies by optimising project cost and duration estimate accuracy.

An appropriate knowledge management system would utilise a knowledge mapping process to determine the source and nature of the knowledge required to undertake the tasks and activities associated with project cost and duration estimating. To capture identified tacit knowledge in a contextualised explicit format, the system would utilise knowledge creation processes and document-based project history methodologies, within a real-time, dynamic environment enabled by dedicated ICT infrastructure. The optimisation of cost and duration estimates utilising the knowledge identification and conversion processes would be supported by an overarching systematic approach to organisational knowledge management.

This systematic knowledge management approach to project cost and duration estimating processes would improve tender process outcomes for contractors by ensuring competitive tender bidding and a minimisation of project cost overruns. For clients an improved tender process would reflect effective feasibility evaluations, greater price surety and a minimisation of defaulting contractors. These outcomes would provide ongoing benefits for all construction procurement stakeholders.

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