Construction Project Information Management

'Electronic tender procurement within the construction industry'

By

Michael J Wolstenholme

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1. Introduction

Construction projects contain complex networks of information and instructions which need to be compiled, amended, shared, amended and executed in order to facilitate its successful completion.

In his report Latham (1994) highlighted the fact that the communication of information within the construction industry was highly inefficient . This poor management of information can have serious implications on the running of construction projects according to Gyampoh-Vidogah, Moreton, and Proverbs (2003), while Finch, Flanagan, and Marsh (1996) specify that incomplete information often leads to longer procurement times and inaccurate cost estimations.

The industry in general is currently at the later stages of its transformation into the digital age and has already adopted electronic systems for such related disciplines as:

- Building Information Modelling (BIM)
- Electronic Document Management (EDM) (RICS, 2005)
- Electronic Data Interchange (EDI)

The process of electronic tender procurement will essentially be a process of EDI that will facilitate principles of EDM and with the possible aim for the inclusion of BIM at some stage.

According to Björk (2006), '*the rapid proliferation of the internet has also made possible the introduction of tools which facilitate e-collaboration between geographically dispersed teams, either in single organisations or in project organisations'*. These electronic data sharing facilities are used more at the initial stages of projects and their use slows down as the job progresses (Andresen, Christensen, & Howard, 2003). With this in mind, the tender procurement stage of contracting could well benefit greatly from this type of management approach.

The aim of this report is to prove the value of electronic methods in facilitating efficient and effective running of the tender procurement phase while at the same time identifying currently available solutions. After evaluating the available options against the defined problems, a plan will be formulated for the successful implementation of an electronic procedure for tendering contracts through electronic means.

2. Methodology

In order to provide an understanding of the problems which affect the tender procurement process, an evaluation of current and relevant literature must be accomplished. From this, a picture of the factors which could best benefit from a change in procedure from traditional to electronic methods can be draw. In doing so it should also be noted that potential barriers preventing the facilitation of new electronic systems should also be highlighted. This will help to formulate implementation.

From here an investigation of the current solutions which are available shall be addressed and options critically evaluated against current opinion so that recommendations can be offered against the identified problems and a plan drawn up for the introduction of the e-tendering procedure.

3. E-tendering

Technological advances of recent years has led to a greater reliance of construction based practices, on the use of computer aided procedures. The design and execution of the building process is already heavily involved through BIM practices but the procurement aspect has not been as quick to adopt IT approaches in its routine. In order to assess this new implementation, the subject past and present, should be scrutinised.

3.1. Traditional practices

According to McDermott and Rowlinson (1999) procurement in the construction environment is "the acquisition of project resources for the realisation of a constructed facility".

Traditionally this process involves the exchanging of hard paper format details from client, down the chain to contractor and back again. The procedure is fraught with waste (physical resources) and is highly prone to error through misinterpretation.

In addition, EIU (2001) inform us that last year local governments within the European Union bought €400bn of goods and services from the private sector and less than 10% of purchases were made from other countries. It seems that the process of tender procurement system is not only restrictive but highly inefficient.

Electronic based collaboration technology such as EDM and EDI systems have been extensively developed in recent years to provide a 'project web' through which different companies working on the same project may exchange information with each other. The transfer of data in most situations can be of a two way nature, however with the costing and competitive tender phase, anonymity and discretion are paramount. This requires a controlled flow of information.

Competitive tendering requires 'sealed envelope' type security and fixed deadline timeframes in order to facilitate fairness amongst bidders. Traditional methods rely on transparent 'opening' appointments to accredit this fairness to the procedure.

3.2. Problems and criteria

The traditional tender procurement process requires a great deal of man-hours to prepare and execute, as well as vast amounts of physical resources to facilitate delivery of the documentation. In addition, the procedure requires certain criteria in order to provide fairness and reduce risk.

Procurement often requires an initial prequalification process after which all prequalified parties are entitled to continue through the next phase of tendering. This can often require the exchange of confidential information between prospective contractor and client.

Any changes to the tender itinerary must be passed on to each of the prequalified parties. As do the details of any queries made concerning the tender. In order for this process to be facilitated with a high degree of accuracy, a standard formula of procedure needs to be followed requiring documented query and response which is passed to each and every bidding party. Verbal queries are often answered verbally, and then miscommunicated to third parties through document updates.

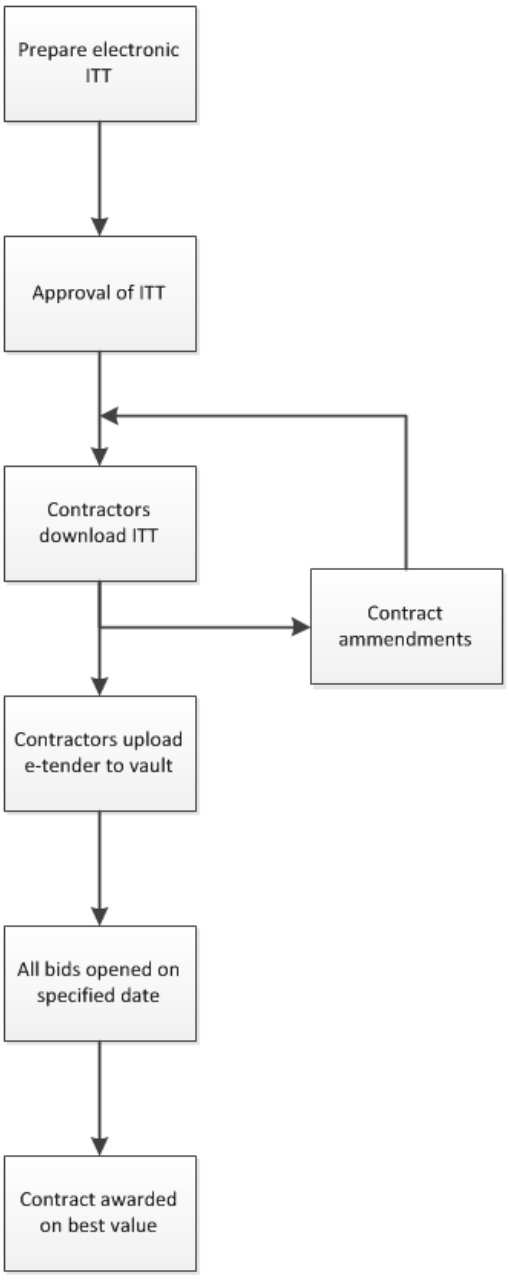
Competitive bids must remain secret until after submission deadlines to prevent corruption and unfair advantage. The traditional system of handing in sealed envelopes which are publicly opened in a meeting attended by all concerned parties.
Setup meetings need to be held in order to help provide thorough understanding of what is needed from the contract bids. These meetings often highlight more problems than solutions and can be critical in establishing the required tender.

3.3. Electronic Solutions

"An electronic tendering solution facilitates the complete tendering process from the advertising of the requirement through to the placing of the contract. This includes the exchange of all relevant documents in electronic format. **"** (LGID, 2006)
According to software provider Sarcophagus (2012) electronic procurement can reduce tender document preparation costs, error and revision notification costs, and meeting overheads.
So what options are available to the construction market?
Several services are available on the UK market, and standards are being draw up for a universally acceptable protocol such as the RICS model (RICS, 2005). This system is aimed at establishing standards for aspects such as data transfer formats, communication methods, technology, security, filing structure and assessment.
Other standards are aimed at national guidelines for tender procedures though there have been a collaboration between online marketing specialists CITE and the UN/CEFACT to produce an international standard.
The tender procurement procedure should include several key features including tender document preparation, complete understanding, error and revision notification, confidentiality and fairness (Brown, 2005; Lavelle & Bardon, 2009).
As indicated in Fig.1 the process should include seven key stages staring with the preparation of the tender documents. These should be supplied in a format which is compatible with the recipient parties. When approval is given qualified contractors can be granted access to the invitation to tender files at which point ambiguities and discrepancies may bring about amendments and updates. Completed bids are uploaded before scheduled deadlines and then viewed upon the agreed deadline date, after which point the contract may be awarded to the most competitive bid. The process flow is in essence, the same as the traditional method.
In the UK construction market there is still a good deal of competition amongst vendors of e-tendering solutions, though much progress has been made by way of standardising options. Guidelines set out by the Royal institute of Chartered Surveyors (RICS) have been adopted by many of the market leaders as their standard (RICS, 2005).
Typically system developers are third parties, selling their EDM products as 'application service provider' (ASP) services.
Upon examination of the existing services on offer in the European markets it appears that within Scandinavia, competition as well as low profit margins has resulted in mergers and acquisitions of rival companies to from singular vendors. Björk (2006) believes this creation of a *de facto* standard is in the best interest of the end user in preference to market segmentation.
Below are listed the some of the market leaders by country:

- Asite in the UK, tender manager http://www.asite.com/index.php
- eTenderer in the UK http://www.etenderer.com/
- Byggeweb in Denmark, Docia http://www.byggeweb.dk/cms/uk/about_docia/
- Buildercom in Finland http://www.buildercom.fi
- Byggnet in Sweden & Norway http://www.byggnet.se

On a European wide level, one service provider has emerged as leader, the Single European e-Tendering Service (SETS). Problems with the compatibility of legal frameworks can be an issue when dealing with cross-border contracting as discussed in chapter 3.5 (Westcott & Mayer, 2002).



Stage 1: Invitation to tender and associated documents can be prepared as a collaboration of several employees. Work is done online

Stage 2: Approval is made by direct access to e-tendering system by appropriate departments i.e. Legal department

Stage 3: The documents are published through the system to all interested parties. Online access allows for instant updates.

Stage 4: Amendments can be made to all parties simultaneously.

Stage 5: Contractors upload their bids to the secure storage vault prior to the deadline. Documents here cannot be viewed by client at this time.

Stage 6: Bids are viewed and assessed against the award criteria.

Stage 7: Contracts are awarded to successful bidder.

Fig 1. E-tender procurement flow chart

3.4. Drivers

"*The theory behind electronic procurement is provision of a system of transmitting electronic input from the contractor's tender to contract management and final account*." (Eadie, Perera, & Heaney, 2011)

According to The Economist Intelligence Unit (EIU) (2001) what is needed in procurement is a single document repository. They offer the bureaucracy surrounding expensive document distribution and updating as being key to inefficiency in the process, and therefore an important driver. Eadie et al. (2011) go on to identify other leading drivers for implementation of electronic systems to include process cost savings, product/service cost savings, shortened procurement cycle times, increased quality through competition, convenience for archiving work and improved communication, claims supported by Lavelle and Bardon (2009) and Preston (2001).

3.5. Potential problems with e-tendering

In 2003 a pilot scheme in Gateshead, England was run to trial e-tendering as a total solution to local government procurement. (Due North system, chosen from six systems contenders). The initiative was deemed a huge success, however its scope of the initiative focused on resource acquisition and did not include project tendering.

Hadaya and Pellerin (2010) identify fragmentation, unsupportive hierarchical structuring, and bad planning and evaluation as being major contributors to the late adoption of information technologies (ITs) in the construction sector.

According to Eadie et al. (2011) inefficiencies are a contribution of delays and costs brought through manually processing any contract management activity. They add that the leading barriers for the implementation of electronic information management systems include, the reluctance to 'buy into' one off systems, confidentiality issues, partial data display, data delivery mistrust, complicated procedures, bureaucratic dysfunctionalities and security. In addition Lavelle and Bardon (2009) highlight age and experience of personnel, as well as available technology as major governing factors to the adoption of e-tendering.

Björk (2006) identifies what he calls a paradox, when he describes the failure of EDM systems to reduce the volume of paper copies being produced. The gives reasons for this as being:

a) The procedure for paper copy distribution is facilitated by automatic upload.
b) The refusal of participants to trust the system, instead preferring to back-up with hard copies in case of failure.

In addition to this, service providers realised that the core challenges in the introduction of these systems are '*behavioural rather than technical'*, and therefore the focus has recently been on getting market acceptance for less comprehensive systems (Björk, 2006). Westcott and Mayer (2002) compare differing approaches to tendering between those of foreign nations, giving the example of limiting the number of tender invitations in the UK to six parties, whereas in Germany it is normal for bidding to be offered on an open tender basis, a practice which is mandatory in larger public sector contracts. Other legislated differences include the ability to divide tenders into separate trade packages and the allowance of post tender negotiations.

'Typically the EDM systems used in the construction industry have been developed by third parties and are sold as ASP-services, rather than as licences' (Björk, 2006)

3.6. Solutions

At present the e-tendering packages available come in three formats, cloud based, licenced user installations and dedicated server specific.

3.6.1. Cloud based solutions (subscription)

Cloud based solutions are hosted on internet based servers by the service providers. They can facilitate use by most devices that are compatible with the internet, such as laptop computers, netbooks, smart phones, ipads and e-readers.
They work on the simple format as illustrated in *Fig.3* below.

Fig.2 simplified tender procedure

Projects are created and uploaded to the cloud. Interested parties are then granted access to the same set of information from which to calculate their bids. Once an offer has been produced, tenderers then upload them to the same cloud facility where they will be stored in a secure 'vault' until the submission deadline. Once opened the bids are evaluated and compared. This can be automated as part of the product or can be done manually in a qualitative manner.
Less dedicated hardware needed using this method and some risk can be transferred to the third parties.

3.6.2. Licenced software

Products such as CATO E-Tendering software works by providing a structured file system into which all the necessary tender documents are inserted. The software then creates CD-ROMs to be distributed to tenderers. Prospective bidders then perform the calculation process in the traditional manner, returning their 'sealed envelope' bids either by hard copy or digital format.

3.6.3. Dedicated Server

Dedicated server technology utilises either individual computers or servers to host the application. Access is granted by permission of the client administrator, usually on a single contract basis. As with all applications of a dedicated server format there are pros and cons over cloud based alternatives. A higher degree of client control is possible and software can be customised to suit individual clients. Third party risk is incorporated through technical support services and security is governed by clients own initiatives. Speed can also be an

issue, with server based solutions performing to the clients own dedicated hardware capabilities. Third party risk is eliminated but more risk is adopted by the client as the need for dedicated support through client administration.

3.7. Pricing

Pricing is usually based on periodical or piece-work subscription though Björk (2006) offers a range of possible options due to the internet based nature of the service. He highlights combinations can be customised to suit individual users needs and are often comparable to existing software licencing trends. Options can include:

- One off fee for entire project
- Periodical fee for entire project
- Individual participant company fee
- Individual user fee
- Web storage tariff
- Individual transaction fee (upload/downloads)
- Individual licence fee
- Bundling into multiple service package

It is also apparent that cultural trends can affect the type of options which are adopted. Scandinavian companies prefer monthly service charges as they are easier to budget and transfer costs for (Björk, 2006).

3.8. Other potential

As Eadie et al. (2011) have already pointed out, e-tendering has the potential to remove many of the inefficiencies, delays and cost associated with manually completing the tender process but what more could it offer?

EDM solutions are already providing subscribed databases of projects which are available for tender. Prequalification can be automated to give members a filtered resource suited to their capabilities through EDI applications.

- http://www.europeantenders.com/
- http://www.government-tenders.co.uk/
- http://www.globaltenders.com/

Are we about to enter a new dimension in contract procurement where accurate pricing can interact with bills of quantities to provide fully automated e-tendering?

4. Tender procurement plan

Electronic commerce is a rapidly growing environment but adoption by industry is very poorly represented (BCIS, 2009). Barriers preventing universal adoption of electronic data management and interchange need to be overcome.

Early adoption will always be fraught with opposition so therefore a soft approach needs to be adopted along with an unprecedented degree of User friendliness. Issues such as security and confidentiality should be reinforced through clear instruction.

A website inspection of five reputable service providers in order to determine the level of trust depicted to the viewer. In the occasion of all three Scandinavian providers the procedure

was not very disclosed at all, instead information is distributed upon request. At this time requests for further information have been ignored by all three. Therefore a full assessment of the outward appeal was only possible for the UK based service, though previous experience of the Danish 'Docia' system did produced some comparison suggesting a general similarity in the approach, and they offer video advertisements to overview the products they sell. Unfortunately not much information regarding the way the system operates is available
In the case of the UK based e-tenderer service, their brochure gives a detailed overview of what their services entail and fulfil all criteria mentioned below

- Anonymity from other bidders
- Ability for client to upload or remove documents at any time during the process
- Bidders may update their submitted documents up until the submission deadline
- Secure submissions vault, inaccessible to any party prior to submission deadline
- Extendable submission date facility
- Feedback facility for unsuccessful bidders
- Follows traditional tendering procedures

Asite followed a similar approach and even offer a free trail of their services. In addition to tendering facilities, most providers offer an extended range of products for managing pre-qualification, procurement, BIM, workflow and documents.
As a recommendation e-tenderer and Asite appear to tick all the boxes as far as functions are concerned. In addition the e-tender system follows all the RICS guidelines. Pricing is based on subscription, either on a periodic basis or per item, thus providing a relatively inexpensive means of trialling the product.
Care should be taken to contain the scope of tendering with this system within the bounds of the UK, unless special care is taken to scrutinise the pro0cedure from an international legal perspective.
It would be advised from these findings, that the best implementation strategy would be to trial either of the above systems over a period in order to evaluate them in practice. It is important that all involved parties are fully informed in operation of the system application. The choice of system should include a degree of consultation in order to identify and overcome barriers such as mistrust and other behavioural aspects. Application providers would usually provide this assistance.

5. Conclusions

The adoption of electronic means of document management is becoming an industry norm. By facilitating paperless approaches, companies not only improve their 'green' image but can also reduce time costs and improve quality through standardisation.
This paper has highlighted some of the options available to construction companies looking to implement e-management techniques into their tender procurement regime. The findings conclude that 'e-tenderer' and 'Asite' are both comprehensive services which offer all aspects of traditional tendering in addition to following the RICS guidelines for compliance. Advice on how to implement this type of approach into the construction process would be to trail a chosen method and implement according to consultation by the providers. Differences in

legislation provide barriers against international integration and should be given particular attention before invitation to tender is offered.
Finally, further beneficial approaches such as electronic tender sourcing have been highlighted for further investigation, such as tender searching, which offers potential tender invitations based on predetermined prequalification criteria.

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