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Full Paper

E-TENDERING: BENEFITS, CHALLENGES AND RECOMMENDATIONS FOR PRACTICE

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ABSTRACT

The construction industry is categorised as being an information-intensive industry and described as one of the most important industries in any developed country, facing a period of rapid and unparalleled change (Industry Science Resources 1999) (Love P.E.D., Tucker S.N. et al. 1996). Project communications are becoming increasingly complex, with a growing need and fundamental drive to collaborate electronically at project level and beyond (Olesen K. and Myers M.D. 1999; Thorpe T. and Mead S. 2001; CITE 2003). Yet, the industry is also identified as having a considerable lack of knowledge and awareness about innovative information and communication technology (ICT) and web-based communication processes, systems and solutions which may prove beneficial in the procurement, delivery and life cycle of projects (NSW Government 1998; Kajewski S. and Weippert A. 2000).

The Internet has debatably revolutionised the way in which information is stored, exchanged and viewed, opening new avenues for business, which only a decade ago were deemed almost inconceivable (DCITA 1998; IIB 2002). In an attempt to put these 'new avenues of business' into perspective, this paper provides an overall 'snapshot' of current public and private construction industry sector opportunities and practices in the implementation and application of e-Tendering. This paper identifies the benefits and challenges to the adoption of e-Tender systems and considers future industry trends and recommendations.

Keywords: construction, e-tender, information and communication technology, e-business, e-commerce

1. INTRODUCTION

The construction industry is categorised as being an information-intensive industry and described as one of the most important industries in any developed country, facing a period of rapid and unparalleled change (Industry Science Resources 1999) (Love P.E.D., Tucker S.N. et al. 1996). Efficient information processing is continuously being challenged by the extreme fragmentation of the industry's demand and supply chain - that is, construction work being undertaken by a wide variety of organisations, utilising many different skill sets, processes, and technologies; whilst enduring low profit margins and fierce competition (Pietroforte R. 2003).

Towards the end of the 1980's most disciplines within the industry had access to basic software to assist in carrying out relatively complex designs and calculations. During the 1990's the use of e-mail (as an electronic communication device) and the World Wide Web (as an electronic communication device and source of knowledge) was introduced to the industry. Today's construction industry sectors (both public and private) are following a definite and increasing trend towards adapting traditional business methods and processes to the 'new' electronic ways of doing business (e-Business), resulting in many 'divides' being created: paper to electronic media; local to global commerce; management to a leadership focus; and reactive to a more proactive state (Russell J.S. 2000; NOIE 2002; Murray M. 2003).

International predictions, relating to the amount of business conducted electronically have reached hundreds of billions of dollars, with little doubt that the emergence of the Internet is 'revolutionising' business access to communication and information. Web-based business activities within Australia, for example, are envisaged to increase significantly throughout the decade (NSW Government 2001; Anumba C.J. and Ruikar K. 2002). These 'e-activities' can generally be described as being about eliminating inefficiencies in traditional processes, communications, etc. and finding 'smarter' ways of undertaking these activities in an electronic environment, and generally requires industry organisational commitment, change and investment (NSW Government 2002). Unfortunately, there still exists within today's construction industry a considerable lack of knowledge and awareness about innovative information and communication technology (ICT) and web-based communication processes, systems and solutions, which may prove beneficial in the procurement, delivery and life cycle of projects (NSW Government 1998; Kajewski S. and Weippert A. 2000).

Consequently, through increased knowledge, awareness and successful implementation of innovative systems and processes - such as electronic / internet-based tendering (e-Tendering) - raises great expectations regarding their contribution towards 'stimulating' the globalisation of electronic procurement activities, and improving overall business and project performances throughout the construction industry sectors and overall marketplace (NSW Government 2002; Harty C. 2003; Murray M. 2003; Pietroforte R. 2003). This paper identifies the benefits and challenges to the adoption of e-Tender systems and considers future industry trends and recommendations.

2. E-UPTAKE

The Internet has debatably revolutionised the way in which information is stored, exchanged and viewed, opening new avenues for business, which only a decade ago were deemed almost inconceivable (DCITA 1998) and (IIB 2002). In an attempt to put these 'new avenues of business' into perspective, the following section provides an overall 'snapshot' of current public and private construction industry sector opportunities and practices in the implementation and application of web-based ICT tools, systems and processes (e-Uptake).

2.1 E-COMMERCE

According to 'Information Technology in Construction Best Practice' (ITCBP 2003), online trading (e-Commerce) is forecast to grow rapidly, with the undertaking of business electronically leading to significant improvements in cost, time and quality of business products and services. Rapid developments in ICT, its uptake, and increase in computer-literate customers' expectations, reinforces the need for companies to reconsider their strategy with respect to e-Commerce and e-Business. e-Commerce can be defined as: *'Any value adding business exchange conducted electronically within or between businesses, or between businesses and consumers. It covers all forms of electronic trading including electronic data interchange, electronic banking, electronic mail (email) and other online service and communication tools'* (NSW Government 2002).

The Queensland Government expects the benefits of e-Commerce and its e-Commerce strategies to include lower costs and wider markets for business, cheaper prices and greater choice for consumers, higher productivity for the economy as a whole and greater effectiveness of Government programs (Queensland Government 2001). The (Victoria Government 2000) states that e-Commerce is profoundly transforming the way people and businesses interact, with worldwide predictions of its potential to reach around US\$300 billion in 2003. (Foresight 2000) indicates that the construction industry and its participants need to start realising that:

- e-Commerce is here to stay and that the 'open 'availability of essential information and data is important to facilitate on-line decision-making.
- Technology can bridge the traditional gap between design and production.
- Joined-up manufacturers, suppliers and off-site production can lead to greater resources for research and development into new products and processes.
- Industry standard models may enable automated information sharing across the entire value chain - from products to projects.
- It is essential for the construction industry to play an active part in setting the world standards that everyone will eventually need to use.
- Specialist contractors, suppliers, contractors and the design team will use web-based project portals to manage the project and its associated information.
- For an industry susceptible to adversarial approaches, the issue of trust in the supply chain will be critical.
- Greater operating effectiveness and supply-chain efficiency needs new skills and talent - attracted through better prospects and changed perceptions.

2.2 E-PROCUREMENT

e-Procurement covers a wide range of web-based methods and tools (for obtaining prices, awarding and managing contracts, etc) spanning every stage of the purchase of goods or services. This includes e-Tender (Anumba C.J. and Ruikar K. 2002; ITCBP 2003). e-Procurement can therefore be described as using e-Commerce for procurement: *'A business tool and enabler, involving the use of electronic technologies to automate and streamline the procurement processes of an organisation, improving efficiencies and transparency, and thereby reducing the costs of those processes within and between businesses'* (NSW Government 2002).

The New South Wales (NSW) Department of Public Works and Services, for example, through their '*NSW Government Electronic Procurement Implementation Strategy*', states a key outcome of the strategy is to maximise consistency in approach in implementing e-Procurement and ICT across government agencies and the construction industry (NSW Government 2003). The primary benefit that government agencies, service providers and industry seek to achieve from implementing e-Procurement is to reduce the cost of doing business. As a result, the key objectives of one of its strategies includes providing better

access to tendering information and streamlining the whole tendering process, by offering electronic access to tender information (e-Tender), thereby providing greater opportunity for business (NSW Government 2002).

Current and future ICT, e-Commerce, e-Procurement and e-Business developments and their applicability and uptake within the public and private sectors of the construction industry, is causing virtually every business sector to shift away from traditional, tried and tested methods of communications, effectively revolutionising the way today's companies trade and conduct business. Even with a reserved uptake, the construction industry and its participating organisations are steadily taking up innovative forms of doing business via the internet, including e-Tendering – making it possible to manage the entire tender letting process electronically and online (Anumba C.J. and Ruikar K. 2002; ITCBP 2003). Today's Government departments / agencies for example, offer a wide range of (current and anticipated) e-facilities / services, including e-Tendering (Ecommerce 2002).

3. E-TENDER BENEFITS & CHALLENGES

3.1 E-TENDER BENEFITS

A significant number, and in many cases similar e-Tender benefits were identified during this investigation, with industry and Government participants generally stating that an e-Tendering process is cheaper and faster than the previous paper-based process (B&C Watch 2001). The primary benefit government agencies, service providers, and industry seek to achieve from implementing electronic procurement (e.g. e-Tender) is to reduce the cost of doing business and to deliver services that are more efficient to the community. e-Tendering is a key strategy in the development of various electronic procurement programs and initiatives, offering additional opportunities for industry businesses, contributing to a globally competitive economy, and helping secure a sustained economic growth.

According to the NSW Government (NSW Government 2002) and Department of Commerce (NSW Government 2003), the construction industry and government agencies / departments can achieve numerous benefits from introducing an e-Tendering system or process, including:

- General:
 - streamlines the whole tendering process;
 - provides improved and secure access to tender information;
 - brings about innovative business processes;
 - initiates greater opportunities for small and regionally based businesses;
 - allows downloading of electronically submitted tenders in a form suitable for evaluation purposes without having to manually re-enter data; and
 - makes it easier for businesses to obtain tender documentation and to submit an offer on time.
- Industry perspective:
 - provides quick and easy access to public and private tendering information;
 - increased tender opportunities;
 - improved access for geographically isolated industry organisations;
 - increased market share and competitiveness; and
 - reduces the cost of printing - saving time and resources.
- Government perspective:
 - best value for taxpayers' money;
 - increased efficiency and effectiveness;
 - consistent tendering practice across Government;
 - promotes overall e-Commerce initiative; and
 - environmentally friendly due to a predominantly 'paperless' process.

3.2 E-TENDER CHALLENGES

Whilst there are undoubtedly many barriers challenging the successful implementation and adoption of an e-Tendering system or process, researchers have identified the following range of challenges and perceptions that seem to hinder the uptake of this innovative approach to tendering electronically.

3.2.1 General

Whilst the electronic exchange of data within the construction industry is becoming increasingly more common, certain contractors and consultants see the use of an e-Tendering process as 'unfair practice' if they are not in a position to take advantage of receiving or sending tender documents electronically. This issue can easily be resolved by offering tenderers the option of receiving their tender documentation in either paper or electronic format (CITE 2003).

A further two principal barriers to tendering electronically have also been identified (CITE 2003). Firstly, certain consultants perceive e-Tendering as being of more use to contractors than to themselves. Secondly, even though increasing number of contractors are capable of, and encouraged to return their tender bids electronically (even when the initial tender documents were received in paper format) the majority of contractors and consultants have yet to adopt the e-Tendering process. Both these barriers can be overcome through increased efforts in highlighting the potential benefits and opportunities available to contractors, consultants and clients, when adopting an e-Tender process. Therefore, to help achieve this increased knowledge and awareness within the construction industry, researchers suggest the developers, owners and managers of these e-Tendering systems and processes need to hold regular public e-Tender information dissemination programs, which in turn will help fuel their uptake.

3.2.2 Employment

The perceived impact an e-Tendering process may have on existing contractor and consultant employment prospects could raise some level of concern. However, it is believed that the electronic exchange of tender documentation allows staff to use more of their valuable skills on 'profitable' tasks and less time on administration work. This in turn has the effect of 'empowering' employees, providing increased value to their employers and projects, thereby improving the overall service to their clients (CITE 2003).

3.2.3 Security

Research indicates that 43% of Australian government organisations with access to the Internet identify 'security' as a major limitation to the greater use of the Internet (ABS 1999). Yet in reality, according to CITE, the electronic exchange of information and data is probably more secure than the use of paper (CITE 2003). CITE's Legal & Security Issues Group, for example, are currently piloting and evaluating the use of electronic signatures and various data encryption technologies, in an attempt to offer maximum security to project partners when exchanging data electronically. CITE describes an 'electronic signature' as being '*derived from a human signature, which can be generated using data capture via a digitiser or tablet (also known as a biometric token)*'. This electronic signature is then '*embedded into a document*', thereby confirming the 'originator' signed the document and that the content of the document has not altered in any way.

3.2.4 Legal

There also seems to be a growing concern regarding certain formal contracts not making explicit reference to future / ongoing use of electronic data exchange. This is because project

participants (contractors, consultants and clients, etc) still perceive 'important' communications taking place 'in writing', and not having a clear understanding as to whether electronic communications (eg using an e-Tendering system) will 'legally' suffice (CITE 2003).

To help overcome these important legal and contractual issues, the Australian (and Queensland) Electronic Transactions Act's main objective, for example, is to provide a regulatory framework that:

- recognises the importance of the information economy to the future economic and social prosperity of Australia;
- facilitates the use of electronic transactions;
- promotes business and community confidence in the use of electronic transactions; and
- enables business and the community to use electronic communications in their dealings with government (Commonwealth Government 2001; Queensland Government 2001).

Similarly, CITE aims to define a framework for legal conditions and contracts, regarding the use of electronic exchange of information in construction-based e-business. Their goal is to provide a legal framework to regulate the new electronic ways of working for all parties involved in a project (CITE 2003).

3.3 SUMMARY

The efficiency of an e-Tender process seems well supported internationally, with a significant number, yet similar, e-Tender benefits identified during this investigation. Recognised as being in the forefront of e-tender adoption in the UK construction industry, CITE verifies the annual costs to clients, having to produce, copy and distribute tender documents the old fashioned way (that is, on paper), can be cut by as much as 90% using an e-Tender process. Australian construction companies like Thiess have now joined other major contractors and project developers in supporting CITE's e-Commerce initiatives, to help extend the operational use of electronic business and development of electronic structured data standards (including e-Tendering) across the entire construction industry (Thiess 2003).

Both construction industry and Government participants generally agree that the implementation of an automated e-Tendering process or system enhances the overall quality, timeliness and cost-effectiveness of a tender process, and provides a more streamlined method of receiving, managing, and submitting tender documents than the traditional paper-based process.

4. E-TENDER TRENDS AND RECOMMENDATIONS

4.1 RISK

When it comes to industry professionals choosing electronic communications via an e-Tender process or system, the potential legal risks in using such a system or process are directly proportional to the increasing levels of electronic interaction. Three e-Tender risk categories have been identified by (Worthington R. C. 2002), namely:

- Category 1: Where tender information is simply posted on the internet as 'pure information'.
 - Recommendation: Although exposed to minimum levels of risk, attention must be given to its contents – that is, truth, accuracy, not misleading or defamatory, etc.
- Category 2: Where the e-Tender web site claims to have tender related information that tenderers need to rely on and perhaps download.

- Recommendation: Owners or managers of the e-Tender system are to spend more time ensuring that what is on their site is complete, accurate and true. The inclusion of a 'non-reliance' exclusion clause may also be necessary. Ensure the tender documentation can in fact be successfully downloaded (in its entirety), especially if tenderers are asked to reply in hard copy format.
- Category 3: This is at the top end of the 'risk scale', having a fully interactive internet-based e-Tender system, where tenderers both receive an invitation to tender, and reply with a tender bid electronically – that is, with no option of obtaining a paper copy of the tender documentation (except by printing out the contents of the web site).
 - Recommendation: Security of information and integrity of the e-Tender system is of paramount importance. Here, legally binding and enforceable contracts are being formed electronically, leaving little room for error in receiving, sending, or storing the information. Furthermore, as owners or managers of the e-Tender system, they are unable to simply exclude all liability for what could happen during an electronic e-Tender process, and will likely have to assume some of the unforeseen risks (especially when an electronic reply is the only option).

4.2 TRAINING & EDUCATION

Whilst this paper is written in 'plain English' and without the use of too many technical terms and phrases, many have become 'buzz-words' in certain industry circles over the past decade (The Construction Confederation 2001). The term e-Tendering, for example, is one of many technical jargons that could act as a deterrent for many when given the opportunity to adopt an electronic tender process, simply due to lack of understanding or misconception.

In an attempt to help increase today's construction industry participant's uptake of innovative technologies, systems and processes (such as e-Tendering), it is strongly recommended that construction organisations become learning organisations. Due to the increasing 'electronic integration' of construction processes, industry participants have no choice but to acquire themselves a complete range of new skill sets, and to 're-think' the way current construction education is organised in delivering these skills, thereby implying a need for 'cross-disciplinary education' (Foresight 2000).

There is also a significant role for tertiary education to develop and support the understanding of how to accept, evaluate and implement technological change and innovation. This provision is required both in undergraduate / postgraduate courses to create a more receptive and able cadre of construction professionals (including the creation of a more common understanding) (CRISP 2000).

4.3 IMPROVED IMPLEMENTATION

When it comes to the implementation of an e-Tender system, 'Information Technology Best Practice' identifies a number of basic recommendations, including:

- Having an extremely robust and secure e-Tender system - by having an enhanced security policy in place and by carrying out regular security 'health checks' on the system itself and its users
- Ensuring confidential information cannot get into the wrong hands – for instance:
 - Whilst many aspects of an e-Tender process are similar to traditional tender arrangements, there are certain legal issues (possibly contractually binding issues) that need special consideration - for instance, people often let work colleagues check their email inbox, allowing 'unrestricted' access to dedicated e-Tender system usernames and passwords.
- Clarification of certain 'grey areas' regarding timing of electronic tender documents – that is, the need for an e-Tender system to automatically generate and archive dispatch and receipt times of electronically distributed/submitted tender documents.

- Providing accesses to advanced capabilities within the system - for instance, allowing one to compare data from project to project in order to view relative prices and timely decision-making.
- Allowing the reuse of standard information of regular tenderers - for instance, storing the pre-qualification documents and information of a regular pool of tenderers.
- Tender terms, conditions, application forms, and software installation procedures (if applicable) are to be uncomplicated to help 'persuade' certain contractors, consultants, suppliers, etc. to participate in an e-Tendering process.
- Additional e-Tender implementation issues that require consideration include:
 - liability for lost or corrupted data;
 - ensuring that the servers are well protected – that is, having 'fallback' plans/procedures in place for when the e-Tender service were unavailable (off-line);
 - ensuring that firewalls do not restrict the dissemination of supporting tender related documentation (ITCBP 2003).

4.4 LEGAL

Legislatures are identified as typically 'lagging' behind technical innovation and social change (Woulds J. 1997). The successful implementation of an e-Tendering process within the industry, for example, is susceptible to the current legal status regarding electronic transmissions, use of electronic signatures, etc. Furthermore, commitment by both government and industry sectors is required to help develop more innovative strategies to build a stronger and more competitive construction industry. Ongoing legal investigations, aimed at strengthening organisational and individual use of electronic communications on projects must continue, by providing better management of communication risks such as:

- Authenticity: This concerns the source of the communication - does it come from the apparent author?
- Integrity: Whether or not the communication received is the same as that sent - has it been altered either in transmission or in storage?
- Confidentiality: Controlling the disclosure of and access to the information contained in the communication.
- Matters of evidence: This concerns e-communications meeting current evidentiary requirements in a court of law, for example, a handwritten signature.
- Matters of jurisdiction: The electronic environment has no physical boundaries, unlike the physical or geographical boundaries of an individual state or country. This means that it may be uncertain which State's or country's laws will govern legal disputes about information placed on the Internet, or about commercial transactions made over the Internet (Electronic Transactions Act 2001).

5. CONCLUSION

In this uncertain and ever changing world, the construction industry and its participants need to be creative, alert to opportunities, responsive to external stimulus, have a good grasp of the changing environment, and increase existing levels of confidence in its ability to adapt (Banks E. 1999). It is been over 40 years since the introduction of ICT tools and systems into the construction industry, yet organisations are still unable to obtain the many potential benefits of ICT investment - many years after the initial expenditures have been incurred. Furthermore, the industry has been identified as 'slow' in embracing innovative ICT tools and systems such as eCommerce, e-Tendering, etc (Stewart R.A., Mohamed S. et al. 2002). These e-Activities will underpin further growth in the Australian economy, enabling innovation and significant advances in productivity and efficiency within and across industry sectors (APCC 2001).

Sharing project information electronically - from inception, design, through construction, and into building operation – can lead to large efficiency gains for all parties involved. Research suggests the eventual goal of the construction industry should be to better integrate the supply chain and all other business functions, allowing new, more efficient ways of working. The extent to which a construction company adopt these applications will depend on its specific circumstances and decisions made according to normal, sound business and strategic objectives (ITCBP 2003).

Finally, if Australian organisations continue to explore the competitive ‘dynamics’ of the construction industry, without realising the current and future, trends and benefits of adopting innovative processes, such as e-Tendering, it will limit their globalising opportunities to expand into overseas markets and allow the continuation of international firms successfully entering local markets. The construction industry must take into account that the successful implementation of any electronic tendering system often directly depends on the successful integration of innovative ICT / internet solutions, with traditional and frequently archaic processes. Achieving this integration can be a complex process, and if not done correctly, could lead to failure (Bourn J. 2002).

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