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CRITICAL SUCCESS FACTORS FOR E-TENDERING IMPLEMENTATION IN CONSTRUCTION COLLABORATIVE ENVIRONMENTS: PEOPLE AND PROCESS ISSUES

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SUMMARY: *The construction industry is increasingly engulfed by globalisation where clients, business partners and customers are found in virtually every corner of the world. Communicating, reaching and supporting them are no longer optional but are imperative for continued business growth and success. A key component of enterprise communication reach is collaborative environments (for the construction industry) which allows customers, suppliers, partners and other project team members secure access to project information, products or services they need at any given moment. Implementation of the stated critical success factors of the project is essential to ensure optimal performance and benefits from the system to all parties involved. This paper presents critical success factors for the implementation of e-tendering in collaborative environments with particular considerations given to the people issues and process factors.*

KEYWORDS: *Collaborative Environments, E-Tendering, Construction, Information Technology (IT), People, Process, Critical Success Factors.*

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1. BACKGROUND

Information technology (IT)-based processes are taking the construction industry (CI) into new dimensions. The key element of success is accepting change and a new way of working within this traditional and fragmented industry (Blayse and Manley, 2004; Blismas *et al.*, 2004). Organisations need to adapt and explore concurrent changes in today's borderless economy, or risk losing out (Alshawi, 2007; Nitithamyong and Skibniewski, 2007). Businesses are moving away from traditional processes to modern and efficient ways of working, mainly through electronic media. Data and information are shared and distributed digitally, formulating a cheaper and more effective way of communication. Electronic processes have the potential to generate huge new wealth and to transform the way business is conducted in unprecedented ways (Amit and Sott, 2001). The continuing expansion of e-business and e-

commerce provides opportunities for improved business processes, which are more efficient and responsive, reduce the reliance on paper transactions and lead to reduced costs and time. The internet-based collaborative environment is one such opportunity.

Collaborative environments present a platform whereby various construction professionals involved in a construction project could come together and to address project needs. This environment offers a standard platform for all parties involved to communicate, exchange data and information, data storage, archiving and much more. Most of all, it initiates a drive for IT integration through data and information interchange and reuse through a common environment. This common environment (or extranet) is generally a network which uses Internet technology to link construction project team members through private wide-area networks that run on public protocols. The overarching goal is fostering collaboration and information sharing (Vlosky *et al.*, 2000; Wong, 2007).

This paper aims to examine the critical success factors in e-tendering implementation, focussing on the people and process issues in the CI. The results ought to be of interest to construction organisations interested in setting up e-tendering practices using internet-based collaborative environments.

1.1 Tendering Phase

The tendering phase in the CI is deemed to be the most critical and important throughout the lifecycle of the construction project (Vee and Skitmore, 2003). This phase will shape the contractual and legislative agreements between the client, consultant team, contractor and other members of the project. Based on traditional contracting, the tendering phase starts when the drawings and tender documents are completed. Compilation and analysis of project data is gathered through the stages of strategic briefing, outline and final proposals, production information, statutory approvals, building contracts and others. This phase is information-intensive and paperwork-heavy. Tender documents comprise of the invitation to tender, form of tender, architectural drawings, bills of quantities, health and safety agreements and others. These documents are paper intensive, not portable, expensive, tedious and troublesome to produce (Lou, 2006). Once the tender documentation is prepared, it is ready to be distributed to interested bidders. Often, problems arise during this process. Among them are human errors in document production – incomplete information or tender document, possible mix up of documents, insufficient copies, possible leakage of restricted information, problems in issuing of addendums and voluminous tender documents (Du *et al*., 2004; Egan, 1998; Pavlov and Aleksandrova, 2003; Worthington, 2002).

The introduction of electronic documentation (e-documentation) could address most of the aforementioned problems (IDeA, 2003; Nitithamyong, and Skibniewski, 2007). E-tendering is a process which replaces the traditional paper tendering system in the purchasing of products and services and is a means of electronically notifying, involving, vetting and selecting suppliers. For the seller it is a means of electronically competitively bidding for contracts. Among the major benefits of e-tendering is the reduction of costs from tender documentation production, a shortened tender period, a secured method of sending and receiving tenders and a more systematic and progressive method of working. E-tenders are also portable, inexpensive and simple to compile (Forbes-Pitt, 2006; Utvich, 2005).

1.2 People and process

Construction organisations and professionals are aware of the benefits and advantages of e-tendering and collaborative environments through many high-profile success stories (4projects, 2009; BIW Technologies, 2007). However, when new software or new processes are introduced in any organisation, it is only natural for the employees to be cautious and afraid of their jobs; employees will fear responsibility and process changes (Lou, 2006).

The main reasons for the high percentage of systems failure are rarely purely technical in origin. They are more related to the organisational "soft issues", which underpin the capability of the organisation to successfully absorb information systems (IS) and IT into its work practices; in this context one or more collaborative environments. IT is still, in many cases, being considered by the management of organisations as a cost-cutting tool (owned and managed by the IT departments). This "technology push" alone, even though to some extent still dominant in many industries like construction and engineering, will not harness the full business potential of IS/IT and will thus be unable to lead to competitive advantage (Alshawi, 2007). Although the implementation of a few advanced IT applications might

bring about *first-comer* advantage to an organisation, this will not last long as it can be easily copied by competitors. The innovation in process improvement and management, along with IT as an enabler, is the only mechanism to ensure sustainable competitive advantage. This requires an organisation to be in a state of readiness which will give it the capability to positively absorb IS/IT-enabled innovation and business improvement into its work practices.

People are the determinant force in deciding the success or failure of the uptake of e-tendering and collaborative environments. When the individual is willing to change, there will be the willingness and aspiration to explore new horizons. Top management support, the presence of an innovation *champion* among employees and a motivated manager will drive the desire to try and change from the old ways. (Neef, 2001; Retik and Langford, 2001). Employee behaviour towards collaborative environments and e-tendering could also be reflected into the Maslow's hierarchy of needs (Maslow, 1943) – the individual process; the interpersonal process; the organisational structure and dynamics.

Organisations should not implement new technology into current processes but allow technology to be absorbed into the current organisational processes. Radical process changes may break existing organisational processes, crippling the organisation. Introducing new technology will incur changes. Employees may have to change the way they work to suit technology which may lead to work inefficiency, disorganisation, low morale, no motivation, and some may be fear for their job security (Beise, 2004; Deng *et al.*, 2001).

1.3 E-tendering environments

The growth of collaborative environments, triggered by the fragmented nature of the CI, has caused various individual organisations to develop their own versions of collaborative environments and e-tendering services. This created a scene of "islands of automation". Among the larger vendors of collaborative environments for the CI are BIW Technologies, BuildOnline, 4Projects, Cadweb, Viecon, ProjectVillage, Integration, and many more.

The main driver of collaborative environments is to gain competitive advantage through improved work processes; efficient information sharing and reuse; better returns on investment; strategic partnerships ("win-win" culture); availability of project information management strategy; improving "buildability" and whole life costs with the supply chain; and public and private initiatives. (Alshawi and Ingirige, 2003; Amit and Sott, 2001; Jackson, 2004; Pavlov and Aleksandrova, 2003). Harnessing collaborative environments in the organisation can provide a competitive advantage through improved efficiency, speed, data accuracy and effectiveness in everyday business processes and management.

The largest barrier to the adoption of collaborative environments is the people as opposed to the technology. These specific barriers include lack of awareness, no quantifiable measurements or indicators of success, limited skilled workers, transparency in the CI, poor cross-disciplinary communication, fragmented supply chain and poor industry standards for information interchange (Martin, 2003; Mould and Starr, 2000; Sulankivi, 2004). Overwhelmed by their traditional mindset, industry players are reluctant to adopt or consider changes to everyday processes and therefore pay less attention to the advantages and benefits of IT. To date there are no recognised quantifiable methods to measure and quantify the benefits of IT systems in organisations which reflects the perception that IT is complicated and high risk (Alshawi, 2007). Transparency of work processes in the CI remains questionable; project information is not being shared, resulting in a waste of knowledge, resources and intelligence. Poor communication has also often been identified as a bottleneck for performance improvement and re-enforces a confrontational and blaming culture. Poor data and information exchange standards derived from different developing standards prevents computer systems from talking to each other and the exchange of information and data is virtually impossible. This issue is being widely discussed across all industries, the CI included.

Project failure in IT has long been of interest of the public. One of the primary explanations for the extent of project failures and the size of ultimate write-offs is the presence of agency problems (Mahaney and Lederer, 2003) and especially escalation of commitment on the part of the managers (Keil, 1995). Escalation is generally defined as continued commitment of resources after receiving negative feedback about a project.

2. KEY SUCCESS FACTORS FOR E-TENDERING

Critical success factors (CSFs) for the implementation of e-tendering can be classified into four major characteristics – construction project; project team; collaborative environments service provider; collaborative environments software – as listed in Table 1. This paper examines these four classes of factors. The traditional tendering process will be the basis of comparison, similar to the evaluation of process changes.

Alshawi and Ingirige (2003) discuss the importance of project characteristics, project team and service providers where collaborative environments could be successfully implemented. These factors include project duration, size and cost, type of contract, type of collaborative environments used, internet facilities and more. The construction project itself is important; the complexity of construction, design and engineering works is decisive in making the system successful (Deng *et al.*, 2001; NCCTP, 2006). Qualitative benefits and quantifiable benefits of a centralised digital information management system are discussed by Sulankvi (2004), providing evidence of the impact on project and document management to benefit various parties; in addition to monetary benefits, work time savings, reduction in the time delays for information distribution, fewer field errors, slightly fewer disputes because of documented information exchange and less paper to be filed. Security is also a major issue, for both the collaborative environment service providers and the end-users (Eriksson and Laan, 2007; Vlosky, Fontenot and Blalock, 2000). The timely and efficient distribution of key information is another reason companies participate in a common environment as this creates a secure environment for the interchange of critical data with business partners, customers and suppliers (Business Wire, 1998). Vlosky, Fontenot, and Blalock (2000) added that the champion, initiator and paymaster of the collaborative environment are all essential for successful implementation.

Users, or project team members, are essentially the core to the construction team. The team's IT skills, enthusiasm and prior experience are the forefront for success. This could be further strengthened through training and additional resources for the collaborative environment. The involvement of project members from initiation stage provides the insights towards the project from the start, conversely better understanding of the project equates to the higher usage of collaborative environment for implementation (Hedelin and Allwood, 2002; Keil *et al.*, 1994; NCCTP, 2006; Lou, 2006). Brockway and Hurley (1998) also illustrate that support from top management and the ability of the project manager has a positive effect on implementation. A strategic approach in aligning collaborative environments into the project team and their integration among the collaborative environment's features is imperative in providing a smooth transaction in data interchange and maintenance (Neef, 2001).

There are technology issues that may impact on the operation of the collaborative environment and extranets. The software must be tested and reliable and have simple-to-use interfaces. Complex and disorganised interfaces will only put-off users. (Chulkov and Desai, 2005; Lou, 2006). The exchange of data with other systems, within the organisation or external software, must be seamless to provide smooth data integration. In terms of the collaborative environment the provider should be able to provide technical competency when needed by users, and be well versed in knowledge and understanding of the construction business (Blismas *et al.*, 2004). The provider must ensure that the software is running optimally at all times and provide prompt responses when needed. From crucial literature as discussed above, key success factors for the implementation collaborative environments for the CI are identified as in Table 1.

TABLE 1: Critical success factors for the implementation collaborative environments for the CI.

Project characteristics	Project location.
	Project cost.
	Project duration.
	Project size.
	Project phase when collaborative environments are introduced.
	Type of owner.
	Type of contract.
	Type of project.
	Complexity to construction tasks.
	Complexity to design and engineering.
Project team characteristics	Presence of a champion.
	Ability of project manager.
	Prior experience with collaborative environments.
	Involvement of team members during planning process.
	Team attitude towards collaborative environments.
	Team attitude towards IT.
	Type of internet service.
	Frequency of collaborative environments features / functions in-use.
	Party decides to use collaborative environments.
	Party who pays for the collaborative environments.
	Internet access availability.
	Alignment of collaborative environments implementation strategy to project team strategy.
	Level of top management support.
	Adequacy of training.
	Adequacy of resources.
	Computer experience of project team.
Service provider characteristics	Contact facilities.
	Promptness of responses.
	Technical competency.
	Attitude of staff.
	Knowledge in construction business and problems.
System characteristics	Ease of use.
	Output quality (reporting).
	Frequency of software updates.
	System reliability.
	Data quality and reliability.
	Data security.
	Type of services.
	Integration among collaborative environment features.
	Integration with teams' internal systems/functions.
	Integration with external software programme.
	Number of team members having access to collaborative environments.

3. CASE STUDIES

These case studies will be based on qualitative research methods where the perception of individuals will be the focus of the study, in naturally occurring situations. Case study research method as an empirical inquiry investigates a contemporary phenomenon within its real-life context, particularly when the boundaries between phenomenon and context are not clearly evident and when multiple sources of evidence are used (Yin, 1984). Archival analyses are made though past literature about collaborative environments and e-tendering topics.

The identified key success factors for the implementation collaborative environments for the CI (Table 1) will be used as a benchmark in the case studies to identify key success factors for e-tendering implementations within collaborative environments. Through the case study approach, all the outlined critical success factors were discussed with decision-makers and users to distil the importance and impact of each and every factor. This study also unearthed the potential of other factors that may have been left out in the literature. This is critical step in the validation process. All meetings with seminal decision-makers and users were conducted as a semi-structured interview in order to give the interviewees the opportunity to elaborate and pinpoint the importance and impact of each factor.

The three case studies are construction projects undertaken in the United Kingdom (UK). All the three organisations used the same collaborative environment e-tendering software. Case study 1 is conducted with a building contractor, using collaborative environments for tendering and project management. This organisation is among the earlier adopters of e-tendering in collaborative environments. Case study 2 is a building contractor and consultant and Case study 3 is a construction consultant team, both only just beginning to adopt e-tendering within their collaborative environment tool.

The traditional tendering process is used to compare the issues related to the people and process. The RIBA Plan of Work is used as the benchmark for comparison purposes. The focus is on the use of e-tendering in collaborative environments, examining the changes in people and process.

3.1 Case Study 1

This study is focussed on a building contractor (currently employing over 1000 employees) based on a £1.5 million building construction project. This organisation was among the earlier adopters of e-tendering in collaborative environments. Interviews were conducted with the Project Manager, Project Quantity Surveyor and several clerks; an observation of the organisation's work progress was also carried out.

Resistance from employees was visible during the first three months of implementation, but they soon became familiarised and accepted the process as part of their daily responsibility. From the beginning, the organisation provided ample training, support and resources as part of the introduction scheme. The e-tendering system managed to cut down the number of manpower hours involved in the stages of estimating, tender enquiries and pre-contract negotiations. Accordingly, the overall work motivation and satisfaction improved as a result of having to do less tedious paper-based work.

The work process remained similar with the major difference replacing paper-based documents with softcopy documents, with the later providing better efficiency, higher quality of work and completion in a shorter time. The correspondence among project members shifted from traditional "snail" mail to e-mails and the collaborative environment system. The main advantage of the system is the availability of audit trails for all documents both to and from the project team members.

On the whole, the organisation reported positive responses since the collaborative environment commenced. The system manages to improve work efficiency, produce higher quality of work, makes fewer mistakes, allows for faster completion and incurs lower costs with no major changes in daily processes and workflow. Employee resistance was expected but quickly resolved when the benefits of the system became apparent.

3.2 Case Study 2

Case 2 spotlights a £2.2 million building construction project by a building contractor and consultant. This case was conducted with assistance from the IT Manager, Project Quantity Surveyor and Assistant Project Manager. The organisation have just adopted the use of e-tendering, therefore it is using it on a project-by-project basis.

The major change was the reduction of personnel throughout the project – tasks which previously took four persons to complete, now only required two. This resulted in a significant reduction in cost, personnel management and work efficiency. People skill sets remain similar, only with the additional requirement of IT competence. Work satisfaction

and motivation improved with the use of e-tendering. Resistance was minimal as the personnel involved were relatively young.

The changes to the work process remained minimal. Electronic communication through the e-tendering system (e-mails, electronic media, etc.) replaced traditional correspondence ("snail" mail, tender queries, etc.). The system also provided audit trails and database back-ups for easy search and filing capabilities.

This case study presents a scenario where the younger generation of construction professionals is dominant in an organisation. Younger employees are more IT savvy. There are various processes which will never change – face-to-face contact between project team members is important and is not replaced with the computer, such as contract negotiations and awards.

3.3 Case Study 3

This organisation is construction consultancy and owes it success to over 7000 expert employees. This organisation has not fully implemented e-tendering; it is only being rolled out on a project-by-project basis. The case study is based on an estimated £700,000 construction project using e-tendering in collaborative environments. Work process observation and interviews were conducted with the Project Manager, Project IT Manager, Assistant Quantity Surveyor and several administrative personnel.

The organisation does not have to endure large-scale people or process changes for rollout; being a consultancy organisation, employees do not require extensive use of the e-tendering system. Therefore, uptake of the system was easy. Resistance from the employees was minimal as consultants will have to follow their client's needs and requests. The results of implementing the system are a slight reduction in manpower requirements, less tedious paper work, higher work satisfaction, shorter working time and increased motivation.

In summary, the organisation did not endure any major changes to employee practice or work processes. There was also no significant reduction in cost. It is also noted that the system did not yield a good return on investment for the organisation.

4. ANALYSIS

The case studies show that the e-tendering solution is welcomed by most employees in the selected organisations. Employees welcome the changes as they improve productivity, ensure work efficiency and less repetitive work through data and information reuse. Employers have the perception that e-tendering made the tendering process less tedious and less costly as well as ensuring better control and management over the tender process. This enabled organisations to handle more jobs in a single timeframe when compared to the traditional method of tendering.

One of the many good responses from users is attributed to the software itself, i.e. that it is designed with user-friendly features and demands very little computing knowledge to use the system efficiently. The basic set-up only needs internet access and a web browser. The simplicity of the interface and functionalities made acceptance of the system easy for all users, particularly when combined with the training provided to all participants.

The overall impact of introducing e-tendering in collaborative environments is significant. Organisations using e-tendering enjoy better efficiency, accuracy and productivity in their tendering activities. Resistance from the employees was apparent when e-tendering was initially introduced in the organisation. Steps taken to resolve this issue include the introduction of free training to employees, readily available resources and top management support in ensuring job security. In one instance, the organisation employed specific personnel to act as the implementation champion to other employees, to raise employee motivation and encourage interest in IT. The case studies show that the tender process was not changed to embrace the power of technology, but rather technology was used as a tool to record and accelerate the communication process. Through the RIBA Plan of Work (RIBA, 2004), every stage is distilled and discussed in the section below.

Preparation of tender
The people factor varies little between the traditional and the new system, i.e. manpower, career background, qualifications and responsibilities of employees. The process of preparing the tender remains virtually the same in both the traditional and e-tendering process. Tender documents also remain the same, whereby the documents are prepared using word-processors and spread sheets, enabling users to edit and change items easily. Tender documents are prepared and checked manually.

E-tendering will gather all documents and drawings to be compiled in a softcopy format and ready for upload to the system, replacing the traditional and tedious paper-based system. Employees at this stage show increased motivation and better attitudes to their duties.

Tender out
The traditional process does not involve internal staff but requires help from the couriering services, where documents are accepted manually and stay unrecorded by the bidder. This system is inefficient, slow, unreliable and incurs a high cost. E-tendering requires an employee, with access rights, to upload the documents and drawings into the system. Tender documents and drawings can be downloaded by interested bidders and the audit trail will record it.

Estimating task
Traditionally, bidders start estimating and measurement works manually when the tender documents received. The e-tendering system allows the bidders to view the documents in softcopies or print as they like which allows bidders to access the system at anytime, regardless of location. However, the e-tendering system requires fewer personnel than the traditional system. Unlike tendering, the estimating process still follows the traditional method. E-tendering did not include provisions for estimating, therefore, estimating work continues to be tedious and costly.

Tender enquiries
Tender enquiries involve both the consultant and the bidder. The new e-tendering system provides a quick and systematic approach to responses to tender enquiries, correction and replacement of tenders. Responses are sent by e-mails within the e-tendering system, which is fully audited and managed. In addition, response times are extremely fast and accurate. The e-tendering system archives, manages and audit trails all mail, documents, drawings and queries completed during the tendering stage, something the traditional process never does. Although the work process is the same, work efficiency and quality is vastly improved. The management views that the manpower involved, experience, background, qualification and responsibility of the employee remain the same as the traditional process.

Tender in
Similar to the tender out stage, bidders can upload completed tender documents online. The date and time of documents uploaded by bidders are recorded and audit trailed by the e-tender system. The system also ensures all tenders are submitted on time and late tenders are rejected automatically. This proves to be efficient, fast and cheap, compared to the traditional methods, which uses external help in delivering the tenders.

Tender analysis
Tender analysis is completed manually and the process remains similar to the traditional method. The only clear difference is that the traditional method refers directly to the paper-based tender documents, while e-tenders can be printed in hardcopy or viewed in softcopy format. As for the people factor, manpower, background, qualification and responsibility of the personnel involved are similar for both the traditional and e-tendering systems.

4.1 Process

All case studies show that e-tendering did not incur many process changes from the traditional construction tendering process. Much of the traditional processes were retained and technology was used to control and manage processes for the various parties involved. This mainly ensures that such processes are more effective, efficient, less costly and accurate.

Top management are aware that maximising benefits can be attained when change is process-led and not technology-led. However, achieving *process-led* is often more difficult in practice. The case study shows that e-tendering implementation strategies are aligned to the project team strategies; this is to ensure common aims and objectives. Implementation of a new software or technology must evaluate and consider the current processes and work flow conducted within the organisation. Work processes did not entirely changed to fit into technology or software, but to harness the power of technology to automate, simply and secure work processes. Where change is necessary, strategies are in place. This is achieved through business process reengineering and change management, just to name a few. Self evaluation within the organisation is conducted before the implementation of e-tendering; this ensures that employees and management have a clear picture of the benefits and roadmap that could be achieved from the implementation of e-tendering and the level of process and people change required to successfully meet the challenges. Potential critical success factors for the process issue in the implementation of e-tendering in collaborative environments are given in Table 2.

TABLE 2: Potential critical success factors for the process issues in the implementation of e-tendering in collaborative environments for the CI.

Potential critical success factors for the process issue
Changes must be process-led, not technology-led.
Alignment of collaborative environments implementation strategy to project team strategy.
Never change the entire work process to suite technology or software solutions.
Conduct self-evaluations before change.
Conduct change through change strategies – business process reengineering, change management, etc.
Alert to current research and development methods for better business processes.

4.2 People

People are the core element in all organisations, no matter how big or small. The case studies have shown similar critical success factors between collaborative environment implementation (Table 1) and people issues in the implementation of e-tendering in collaborative environments. It is clear that employees' level of motivation and work satisfaction is essential in e-tendering implementation. In the initial stage, employees were "afraid to lose their jobs to computers". Here is where top management needs to pledge their support and ensure that technology is implemented to ensure higher productivity and efficiency. When the employees are satisfied, IT interest and attitude will change for the better. The interface and simplicity of the e-tendering system also plays a significant role in providing a simple-to-use system, making work practices more efficient and accurate. This aspect could also be enhanced with the provision of training and availability of resources to employees. Specialised training could also be provided to those whom are interested. Employees with prior experience in collaborative environments found the change easier when e-tendering was implemented – and this leads to the presence of a champion among the users. This champion then becomes the inspiration to other employees. These factors are reflected in the project team characteristics in collaborative environments implementation.

Project characteristics do not have a significance influence when examining the people issue. Every construction project is embodied as a "job" and therefore the project size, cost, location, duration, owner, complexity of construction, design and engineering provide little influence. Irrespective of the contract employees will simply automate from the existing contract process with the help of the e-tendering system.

From the management perspective, proven technologies and collaborative environment systems must be in place to boost confidence and ensure optimum productivity of employees which also forms part of the critical success factors in collaborative environments implementation. However, one of the more interesting finding is the preference of employment of the younger generation who are deemed to have better training and attitude towards IT. Potential critical success factors for the people issue in the implementation of e-tendering in collaborative environments for the construction industry are given in Table 3.

TABLE 3: Potential critical success factors for the people issues in the implementation of e-tendering in collaborative environments for the CI.

Potential critical success factors for the people issue
Motivation of employees.
Interest in IT of employees.
Work satisfaction of employees.
Prior experience with collaborative environments.
Employee attitude towards collaborative environments.
Presence of a champion.
Level of top management support.
Security of job – technology does not replace human processes.
Internet access and type of availability.
Adequacy of training.
Adequacy of resources.
Employment of the younger generation – more interest, training and focus on IT.
Proven computing technology and capabilities of the collaborative environment solution.
Proven to improve efficiency and productivity in work of the collaborative environment solution.

5. CONCLUSIONS

This study investigates the people and process critical success factors to successfully implement e-tendering in collaborative environments, with a specific focus on the construction industry (CI). Technology today is revolutionising businesses, transforming organisations and forcing changes to improve productivity.

The results of this study show that the traditional construction tendering process did not change much in terms of people and process issues, through the introduction of e-tendering in a collaborative environment.
In implementing e-tendering, perhaps the most important critical success factor is that all changes in the organisation must be process-led, and not technology-led.

The survey showed that were no massive changes through the automation of the traditionally paper-intensive construction tendering process into electronic tendering. Technology is mainly used to automate, simplify and secure the communication process among parties, in turn making the tendering process more efficient, less costly and more accurate. To achieve maximum benefit from e-tendering, organisations must be ready to adopt change, through self-evaluation and incorporating change management strategies. Organisations must also align their e-tendering implementation strategy with the project team strategy.

People are the fundamental basis for successful e-tendering implementation. Technology is no longer a barrier. Potential critical success factors in implementing e-tendering for the industry include employee motivation, interest in IT, attitude and prior experience within collaborative environments. Supporting these factors will encourage the use and adaptation of the system and remove the fear of losing jobs. Support from the top management is indispensable to boost confidence among employees. In addition, adequate training and resources must be provided to employees to efficiently integrate IT into their new learning experience. The presence of a champion among the employees is important to provide a role-model and mentor for others. It is also important to provide and communicate proven collaborative environment solutions in terms of technologies, capabilities, efficiency and productivity in order to provide assurance that the collaborative environment will ensure better efficiency, accuracy and transparency in the tendering process.

Further to this study, there is a strong argument that construction organisations need to be ready to embrace change, in both the “hard” and “soft” issues associated with people, technology, and process. These are however often highly interrelated, such that developing competence in one element must (by default) be accompanied by improvement in the others. Organisations could adopt a “measured approach” in order to help them be “e-ready”; the rubrics of which could be augmented through some form of a practical framework which allows them to measure their e-readiness. However, the real question is: “How ready is my organisation to adopt IT?”

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The authors regret omitting the above references previously.”