

THE ROLE OF KNOWLEDGE MANAGEMENT IN E-PROCUREMENT INITIATIVES FOR CONSTRUCTION ORGANIZATIONS

Charles Egbu, Micah P.Vines and John Tookey

School of Built and Natural Environment, Glasgow Caledonian University, Scotland, G4 0BA, UK

In this 'new' economy, organizations are depending more on their knowledge assets or intellectual capital (IC) to remain competitive. There appears to be one pre-eminent challenge that needs to be addressed. That challenge may be expressed as how organizations can manage their knowledge assets or IC to help them successfully transfer their business processes on-line without adversely disrupting their business operations. One of these processes involves the procurement of goods and services. This paper looks at the important role of knowledge and knowledge management in facilitating e-procurement initiatives. It also discusses some of the main challenges in this regard. Some tentative findings of an on-going PhD study are also discussed. With the advent of the Internet, there are now new opportunities for organizations to transfer their business processes on-line via e-business initiatives. E-procurement can add a significant improvement to the value of construction projects. However, there remains a paucity of empirical research in this area.

Keywords: e-procurement, knowledge, knowledge management.

INTRODUCTION

It is apparent that knowledge and knowledge management (KM) now plays a vital role in organizations and global economies as a means of ensuring competitive advantage (Amidon, 1998; Nonaka and Takeuchi, 1995). Within this context, the construction industry is similarly composed of knowledge intensive organizations, procuring its knowledge in the form of products and services (Skyrme, 2001). However, how this very important asset can be assembled (or 'packaged') in order that an organization can make best use of knowledge as a factor of production is a moot point. This paper attempts to highlight the key role that KM is perceived to play in assisting construction organizations to use the Internet to carry out their procurement activities.

Procurement in a construction context is a very complex issue. Predominantly procurement is considered to be the range of activities associated with the identification and management of key stakeholders (architect, construction manager, quantity surveyor, etc.) in the construction process. Procurement in a construction context is therefore a strategic decision-making activity; the structure of the procurement system adopted also defines closely the nature and type of communications that take place between those key stakeholders (Tookey *et al.*, 2001). Consequently procurement is differentiated substantially from the issue of 'purchasing' – i.e. the simple task of identifying products and paying for them. The term 'procurement' in this paper is used to specifically look at buying and selling of goods and services in the construction industry. The particular emphasis will be on the use of Internet related technologies, i.e. e-procurement.

E-procurement can be grouped into two distinct categories; firstly, procurement of goods and secondly the procurement of services. The former applies predominantly to contractors and sub-contractors procuring materials from suppliers for delivery to and inclusion in the project. This is what could be thought of as 'purchasing' as previously discussed. The latter type of e-procurement largely applies to clients procuring design and consultancy services from the key stakeholders in the construction process. This is the higher level strategic aspect of procurement, and what most traditional authors in the area of procurement systems think of as 'procurement'.

In common with many other industries, the construction industry faces extreme competition from globalization, which has the effect of rapidly introducing new competitors into markets that were once protected and monopolized. Also with advances in technology, the processes involved in producing goods and services have become highly specialized and increasingly competitive in terms of price, quality and time of reaching the customers (Chafey, 2002; Kalakota, *et al.*, 2001; Skyrme, 2001). The advent of the Internet and Internet related technologies have brought another dimension to procurement processes. These have now resulted in emerging new e-business opportunities that now enable organizations to conduct their procurement processes on-line without the traditional requirement to exchange paper documentation. Traditionally the 'paper trail' attending to the procurement process has been an Achilles heel in any economic activity. The physical exchange of paper reduces responsiveness, increases timescale and ultimately leads to errors and misinterpretations within supply chains (Chafey, 2002). All of these problems increase the transaction costs of the supply chains (Coase, 1937). It is now realized that procurement is such a strategic issue that the use of internet based technologies can help achieve significant savings through reduced transaction costs, reduced time and reduced transposition error. All of these benefits can substantially increase the performance of an organization, and consequently increases the organization's value to the customer (Chaffey, 2002, Ribeiro, 2001, Skyrme, 2001).

The Internet has led to a massive power shift from business to the consumer (B2C) (Chafey, 2002; Kalakota, *et al.*, 2001; Skyrme, 2001). With the arrival of the business-to-consumer (B2C) and business-to-business (B2B) e-commerce, the customer should be able to significantly enhance his purchasing power. The theory behind B2C is that e-procurement gives consumers access to all the possible products that fulfil their purchase requirements. This can be thought of as wider market knowledge. Given that the customer has an immediate access to wider market knowledge, this implies that the customer will have an "automatic and better" understanding of different costs of purchase. Given that identical products may be offered at different prices throughout a market place, the customer can then purchase on the basis of lowest cost without compromising on other factors such as quality. The Internet connects the buyers and the manufacturers to negotiate directly thus removing a significant cost of the products which could have been charged by the middle-men. The Internet provides the platform to pass this power onto the buyers (Kalakota, 2001).

RESEARCH METHOD

This paper is based on an on-going PhD research project which is at a relatively early stage. The project focuses on an investigation of "how organizations can capitalize on their knowledge assets through e-business initiatives". This paper, however is based on two main elements of the preliminary research. Firstly, pilot interviews conducted

in order to gauge the views of organizations on how they see e-procurement and how it relates to changing business processes. Also addressed within these initial interviews was an assessment of which key knowledge assets and KM initiatives are likely to underpin the success of their e-procurement initiatives. Secondly a wide ranging literature survey has also been undertaken, the results of which are interspersed throughout this paper. In the main therefore, thirteen pilot interviews and a review of relevant literature provided much of the data for this paper.

The research method employed for this paper involved literature reviews and semi-structured pilot interviews, designed to engage senior management of selected organizations involved in e-business initiatives. In general these interviews have followed the pattern of 'Elite Interviewing' as described in various methodological texts including Easterby-Smith (1996). Some of the interviews were carried out in person and some with the use of tele-conferencing facility. Interview intervals range from twenty (20) minutes to ninety (90) minutes. The interview questions were designed to identify the challenges facing organizations that are associated with organizational culture, and structure in exploiting e-business initiatives. The questionnaire also tried to identify the benefits that organizations are reaping from e-business initiatives which include e-procurement processes, i.e. the purchase of good and services using the Internet.

UNDERSTANDING THE PROCUREMENT PROCESS

In the traditional procurement system, the customer selects the product by searching manually through catalogues, phone calls and facsimile to a number of suppliers. He then compares the prices and the terms and conditions of purchase and delivery. Usually the price and availability to deliver on time are major factors that affect the selection of the products. This process is time consuming and is very tedious. Once the product is selected, the customer fills out a paper requisition form that is sent to the buyer within the purchasing department of the organization. This is usually authorized by the department manager. The buyer would then fill out a purchasing order and dispatch it to the supplier. At the time of item delivery, the supplier will include an invoice and a delivery note. This is usually attached to reconcile with the original order form. Once the order is reconciled the payment can then be processed. Apart from the actual buying and selling the procurement process includes inbound logistics which comprises transport, storage and distribution of the goods received (Chaffey, 2002). This process involves delay occurring at every stage of processing the material order. Chaffey (2002) calculated that the typical cycle time taken for procurement of an item to be consummated is 5.5 days per material. This is a significant cost especially if the project has to be halted due to the delay products arriving on site. This will cost significant loss in man hours and machine hire etc, and other associated costs. The construction industry deals with large quantities and categories of materials which makes it very tedious and difficult a task to undertake. The time spent in procuring these materials are also very long. The material procurement process can be automated using e-procurement process to significantly save time that can be utilized elsewhere to speed the construction process (McIntosh and Sloan, 2001).

THE KEY ROLE OF KNOWLEDGE MANAGEMENT IN E-PROCUREMENT.

It cannot be ignored that KM plays a vital role in mobilizing of organizational knowledge assets and can help facilitate the effective deployment of organizational skills and competencies (Egbu, *et al.*, 2001) through e-procurement initiatives. Knowledge management can help to address issues of culture and organizational structure that are seen to be possible obstacles to effective adoption and implementation of e-procurement processes in construction organizations. The critical need for KM in construction organization is very important because the industry in general is known to resist change. The adoption of new working processes like e-procurement systems will always face internal resistance by the workers. Furthermore, if employees do not understand the benefits associated with automating procurement processes there will be a lack of confidence and security in executing this new technology. This in turn will cause delays and even reluctance to use the e-procurement system. Knowledge management processes help to identify these softer non-technical concerns and can help to design training and awareness programmes for the organization. Such an approach also helps to encourage the development of a more conducive environment for learning for organizational employees in meeting the needs of the organization. Knowledge management can facilitate the creation of an environment where employees are committed and motivated to share knowledge to benefit the organization (Malholtra and Galletta, 2003).

Knowledge management can also play a vital role in identifying knowledge gaps in existing business processes and integrate any organizational processes, knowledge databases or repositories that can be utilized to improve these business processes to complement any e-procurement initiatives. This knowledge gap identification process plays an important role in helping to map out the capability of the organization before any e-procurement initiatives are considered. It also can help to identify appropriate technical infrastructure that complements the existing business needs and identify emerging business needs that may face the organization with the introduction of e-procurement initiatives. Knowledge management can play a significant role in making sure there is a seamless integration of the people, and processes with the appropriate technical infrastructure for e-procurement initiatives. Without this integration and on-going support, it will be difficult to operate a successful e-procurement initiative.

OBSERVATIONS FROM PILOT STUDY ON THE ROLE OF KM

Knowledge management plays a vital role in designing 'mechanisms' that will help capture, store, codify, access, share and implement the knowledge of its internal operating processes and that of the external partners of the supply chain and using this to improve the e-procurement system. The complex make-up of the supply chain will require consideration to be given to all parties in integrating the entire e-procurement infrastructure. This infrastructure refers to both the technical compatibility of the system (software and hardware) and the human resource and organizational environment involved in executing and maintaining these systems. This is very important because if the human aspect, comprising skills and competencies, are not integrated well across the supply chain, and the work environment is not conducive, no amount of technical sophistication can bring about a good return on investments (ROI). This was highlighted in four (4) pilot interviews where two big UK contractors, a major UK concrete products manufacturer and a major reinforcement steel supplier highlighted, that their e-procurement systems were not as effective as

expected because majority of the supply chain members did not have both the technical and human capabilities to implement an e-procurement system. The organizations interviewed see KM playing an important role in identifying knowledge and skills deficiencies within organizations and for implementing training programmes in updating knowledge, skills and competencies of employees in the organizations for e-procurement initiatives.

E-PROCUREMENT- BENEFITS FOR CONSTRUCTION ORGANIZATIONS.

Knowledge management can effectively facilitate e-procurement initiatives. It also allows real time knowledge to be captured, shared, exchanged and implemented through a common global network through the Internet in an efficient and relatively low cost environment (Kong, *et al.*, 2001; McIntosh and Sloan, 2001). E-procurement initiatives would help construction organizations to access appropriate technical information via the Internet from supply chain partners' "knowledge repositories" regarding goods and services, and enable organizations to get in touch with appropriate suppliers in the global environment (McIntosh and Sloan, 2001; Kalakota *et al.*, 2001). This is particularly useful if there is a substitute good or service to be effected that have a better value in terms of quality, price and time for delivery. The up-take of e-procurement in construction can provide a win-win situation for both the suppliers and buyers (Kong, *et al.*, 2001), as it provides an expanded market place (McIntosh and Sloan, 2001) within which buyers and suppliers can communicate directly with each other (Cheng *et al.*, 2001), thus eliminating the multiple middle-men that often exist (Kalakota, *et al.*, 2001). This can significantly affect the profitability of construction organizations.

E-procurement initiatives can help with real time maintenance of an efficient and effective material procurement system as well as procuring materials at the right price, quality and time (McIntosh and Sloan, 2001; Ribeiro, *et al.*, 2001). E-procurement also allows organizations that previously conducted business activities during traditional hours to conduct their procurement activities on-line 24 hours a day, 7 days a week, 365 days a year (Kalakota, *et al.*, 2001; Turban, *et al.*, 2000). This is very important for construction based organizations that are usually hard pressed with budget constraints and time on projects (Kong, *et al.*, 2001). E-procurement initiatives can help with the formation of new alliances with new product and service suppliers who can add to the value of the organization's product and service delivery. One major steel reinforcement supplier (in UK) involved in the pilot interviews responded that 'since implementing an e-procurement system in 2000, the current staff handling a multi-million pound project is only using 20 % of the staff it would have used if it did not implement an e-procurement system. This has significantly affected the efficiency and price of the materials supplied. Also there is control of information flow and good communication between the parties involved. This organization is convinced that all parties along the supply chain must be integrated to benefit from the system and is putting training as a high priority in the next two years for its supply chain members to use the system. From the tentative results of the pilot interviews, there were significant time and cost savings where e-procurement systems were implemented.

Some of the gains of implementing e-procurement initiatives include the increase in the quality of documents, increase in the speed of work, a better financial control, better communications (DLC, 2002), simpler and faster access to common data and

information as well as a decrease in the number of mistakes in documentation (quotation and invoicing) (Ribeiro *et al.*, 2001). It seems that construction companies are getting more and more eager to participate in e-procurement systems, as the pilot interviews carried out have indicated that procurement of materials is one important area which organizations are keen to explore within the next five (5) years. This will significantly improve the quality of constructions products delivered at a good price to the clients (DLC, 2002) and also impact upon the competitive advantage of the organizations.

DRIVERS OF E-PROCUREMENT IN CONSTRUCTION ORGANIZATIONS.

Typically, construction materials account for 40-45 % of the cost of all construction work (Andrew, *et al.*, 1998). This cost can be significantly reduced with the use of e-procurement initiatives. Significant proportion of that cost reduction can be in the elimination of cost associated with middle-men distributors (DLC, 2002, Kalakota, *et al.*, 2001). With e-procurement, the contractors can directly procure materials from manufacturers who meet the product specifications nominated by the clients (client's representative). This was a case highlighted in one of the pilot interviews where a contractor working on a £30 m contract after signing-on the contractor, used the Internet to procure granite from India at a lower cost. This item will significantly affect the price for the component of work priced in the initial Bills of Quantities (BOQ). This was highlighted as a practical benefit for this company, in using e-business initiatives to procure materials for construction. The other key driver would be the need to reduce of time due to e-procurement initiatives. Furthermore, one other aspect is to reduce the number of organizations participating in the supply chain to a fewer number of competent organizations. This will allow for a tighter integration of the supply chain and will provide for an effective control and deployment to meet project requirements.

With the use of Internet, there is an opportunity to increase market share. The pool of possible suppliers and buyers that can match the specifications and asking price can be significantly high (Kalakota, *et al.*, 2001; Turban, *et al.*, 2000). This can give the buyer the opportunity to use this advantage to negotiate prices and select the appropriate prices which can significantly affect the profit margin. Obviously if this can be done during the design phase, where the contractor is engaged in the design team, there can be a significant savings transferred to the client.

CHALLENGES ASSOCIATED WITH E-PROCUREMENT IN THE CONSTRUCTION ORGANIZATIONS.

Following an analysis of the thirteen (13) preliminary pilot interviews for this research project, and a reviewing of relevant literature, a number of challenges facing construction organizations in adopting e-procurement have been identified. The challenges faced can be conveniently viewed as both technical and non-technical. These include:-

Technical Challenges:

- **Systems non-compatibility:** This is due to many players with different versions or software and hardware capability not able to communicate with each other in carrying our business transactions. This is a major huddle for any supply chain to operate effectively using e-procurement initiatives. Indeed for many

years the need for standardization of software and hardware has been apparent in other industries. As long ago as 1996, Boeing was selecting its suppliers on the basis of their ability to integrate seamlessly with their standard design software (CATIA). This is not to say that price was not an issue per se. There was simply a realization that the compatibility of software and hardware had an impact on transaction cost throughout the process that was otherwise lost in overhead charges, consequently this problem became a significant factor in procurement decisions (Tookey, 1998).

- Lack of a universal format and standard in which materials are described, displayed and specified.
- There appears also to be a lack of capability to cope with the changes in technology. It is very difficult to uniformly address ‘technology leap’ issues to meet the needs of the industry.

Non-technical Challenges:

- **Industry Fragmentation:** The industry is composed of a relatively small number of large firms and a very large number of small firms. Indeed this reinforces previous research in which it was estimated that about 95 % of the construction firms employ fewer than eight people (Egbu, 2002). Most small firms operate within their local business community and have personal contact with their clients and suppliers.
- There is a chronic lack of investment throughout the construction supply chain, this in turn prevents wide spread adoption of the principles of e-procurement. In order to become effective, e-procurement will require all supply chain elements to spend both money and time in upgrading their human, technical and business processes to a minimum required operational state. In essence a common base capability has to be established, from which the industry can develop. Without making this initial ‘pump-priming’ investment, it will take many years before e-procurement becomes standard operational reality.
- There is a particular reluctance amongst the smaller companies in the industry to venture in to e-business initiatives. The main factor in this pseudo-decision is that they see their geographical sphere of operations as being closely defined; thus, they utilise personal contacts and ‘tips’ as a means of identifying opportunities for new business. These small companies generally appear not to see how e-procurement can add value to their already “comfortable” business operations. This is a classic example of a comfort trap in a small company; that said it is well known that from a risk management perspective small companies are at their most exposed when undertaking significant investment with uncertain returns.
- There appears to be a lack of awareness and training in the construction industry in general. Employees feel that they need to be involved in business activities that are generating positive cash flow for the business. Consequently, it becomes both very hard for the company and the individual to justify training, such as e-procurement and internet usage, no matter how profitable it is likely to be in the longer term.
- The inability to break away from old business models is also a barrier for organizations to adopt e-procurement. It is very difficult to break away from the existing business partner relationships. The internet provides open threats and opportunities to every existing business relationships.

These barriers presented are important and need to be considered to help facilitate the effective uptake of e-procurement in any organization. Any appropriate measures needed to be taken in addressing the e-procurement issues in construction is worth taking, as this is one area where a significant cost of construction projects is embedded. Although the barriers are significantly large, however if there is collaboration amongst all the parties in the respective supply chains, these barriers can be overcome. The industry wide adoption of e-procurement initiatives could add significantly to streamlined material procurement processes and bring speed, flexibility, efficiency and increased profit margins for organizations (McIntosh and Sloan, 2001; Ribeiro, 2001). Four of the organizations involved in the pilot interviews anticipated most of their material procurement to be done on-line in the next five years. They are of the view that any supply chain member who is not e-business compatible to effect e-procurement will be removed from the supply chain. It is anticipated that this sort of measures will force organizations to consider e-procurement initiatives. It also has consequences for smaller organizations with limited capabilities in this regard. The use of e-business initiatives in procuring construction products and services is anticipated to be a normal way of conducting business within the next five (5) years as commented by four of the organizations.

CONCLUSIONS

Knowledge management is vital for organizations considering e-business initiatives. Construction organizations are increasingly embracing e-business initiatives. Similarly, e-procurement is seen as an important part of e-business initiatives. Most organizations, as evident in the pilot interviews, are beginning to see the benefits of e-procurement and are starting to address its potential. The challenges facing organizations in pursuing e-procurement initiatives involve the consideration of technical (e.g. technical infrastructure compatibility) and non-technical issues (cultural, social, organizational and human). Due to the high fragmentation of the construction industry, there are many stand-alone, off-the-self systems that are not compatible across supply chains, resulting in non-compatibility of systems. There is also a lack of a universal format and standard in which materials are described, specified and displayed.

Other challenging factors include the lack of initiatives amongst construction supply chain members to invest into upgrading and unifying the construction supply chains. There is also the lack of awareness and training in the construction industry, uncertainty of the how e-procurement will work for the industry and inability to break away from old business models and existing business partner relationships. These are contributing issues that are barriers to e-procurement initiatives in construction organizations. Some of the benefits for e-procurement initiatives include removal of middle-men along supply chains thus allowing a significant reduction of materials cost and tighter integration of supply chains. Other benefits from effective e-procurement processes include reduced time to market products, growth of market share, better quality products and associated services, automation of paper work and documentation, improved forecast of delivery dates and market transparency. In this revolutionary economic environment, it is absolutely necessary for construction organizations to reconsider their operational performance to remain competitive. E-procurement provides an opportunity to improve operational performance. Knowledge management offers opportunity for organizations to increase their performance and efficiency output in implementing e-procurement initiatives. Organizations that

previously conducted procurement activities during traditional hours can now conduct these procurement activities on-line, 24 hours a day, 7 days a week, 365 days a year. Finally there is paucity of empirical research in this area. There is therefore ample scope for more empirical work to be conducted.

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