

ELECTRONIC PROCUREMENT BENCHMARKING EXERCISE IN THE AEC INDUSTRY SECTOR

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In spite of recognising the potential of electronic commerce (e-commerce), a majority of the architecture-engineering-construction (AEC) industry participants still adopt a 'wait-and-see' approach in their investments of information technologies. Quantitative study and benchmarks can help the industry to have a better understanding and implementation of e-commerce. Research work that focuses on electronic procurement (e-procurement) benchmarking in the Canadian AEC sector makes headway in evaluating the value of e-commerce quantitatively. The initial findings of the research suggest the need for a conceptual e-procurement model. Literature is synthesised to highlight the issues while proposing to take this by undertaking further benchmarking studies of e-procurement in the UK AEC sector.

Keywords: benchmarking, construction industry, electronic commerce, electronic procurement.

INTRODUCTION

Academics, industry associations/institutions, and information technology (IT) service providers have addressed the implementation of electronic commerce (e-commerce) in the architecture-engineering-construction (AEC) industry for decades both in the UK and worldwide. The benefits of e-commerce initiatives for the AEC industry are emphasized in many ways. The main benefits include better quality work, better financial control, better communications, and simpler and faster access to common information (Rivard 2000). E-commerce also can change the fundamental structure of the industry through reengineering the workflow and the way of sharing information, which suggests many opportunities for improvement in the area of procurement and project management.

As an e-commerce consideration, electronic procurement (e-procurement) has progressed from electronic data interchange between suppliers and buyers to the addition of enterprise resource planning in the 1970s and then web-based technologies in the 1990s (Issa *et al.* 2003). E-procurement is possible in the AEC industry because the opportunities for e-commerce initiatives exist in the procurement process among contractors, trade contractors, and their cooperative suppliers/manufacturers. However, implementation of e-procurement is not straightforward, nor does it bring the claimed short-term savings for the industry. Therefore, it is important for industry participants to understand the business benefits and gains during e-procurement implementation sufficiently. Furthermore, benefits and gains of e-procurement are only anecdotal prior to determining their values. Measurements are required to

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determine the impact of e-procurement and the value to adopters. Quantitative studies can help the industry to evaluate the value of e-procurement, and benchmarks can help the industry to have a better understanding and implementation of e-procurement. Benchmarking of e-procurement process between industry sectors has been successfully applied in banking, insurance, retailing, manufacturing, and many other sectors (CEBI 2002, NAM 2003, CBoC 2004, Statistics Canada 2004).

This paper presents research that focuses on benchmarking e-procurement in the Canadian AEC sector. The initial findings of the research suggest a conceptual e-procurement model for the Canadian AEC industry participants to plan their future e-procurement strategies. Considering the similarity between the Canadian AEC sector and the UK AEC sector, it is possible to undertake a similar benchmarking exercise and progress it further. Literature is synthesised to highlight the issues while undertaking the benchmarking exercise in the UK AEC sector. The structure of the paper is as follows. After giving the definitions of relevant terms, the paper will focus on the review of the research in the Canadian AEC sector. The key issues from the literature synthesis are then grouped to highlight the future research work in the UK AEC sector.

E-COMMERCE, E-BUSINESS AND E-PROCUREMENT DEFINITIONS

To better understand the concepts of e-commerce, e-business and e-procurement it is essential to define these three terms and the relationship between the three. E-business usually refers to all business transactions by electronic means, primarily using the Internet. It also refers to the integration of all business activities that include redesigning of business process or reinventing of business model with internal process of a business through information and communication technologies (DTI 2004). This definition of e-business fits with the broad definition of e-commerce. E-commerce at its grass root level can be described as an electronic method of doing business, typically over the Internet (Anumba and Ruikar 2001). However, e-commerce can be broadly defined as a modern business methodology that addresses the needs of organisations, merchants and consumers to cut costs while improving the quality of goods and services, and increasing the speed of service delivery (Kalakota and Whinston 1997). Given the similarities in both adoptions, this paper considers e-business and e-commerce as interchangeable terms.

E-commerce comprises a number of areas depending on the type of activity under consideration. E-procurement, for example, refers to business-to-business purchase and sale of products and services by electronic means. Kalatota and Robinson (2000) define e-procurement as the electronic integration and management of all procurement activities including purchase request, authorization, ordering, delivery, and payment between a purchaser and a supplier. The research in the Canadian AEC sector considers e-procurement primarily as the electronic bidding and tendering processes that deliver projects (Chen and Rankin 2006). E-procurement can also be applied to suppliers or specialist subcontractors.

BENCHMARKING RESEARCH IN THE CANADIAN AEC SECTOR

Based on the definition of e-procurement, the research in Canada investigated the level of penetration of e-procurement in the AEC industry, identified the barriers and challenges of implementing e-procurement, and recommended strategic solutions for

the industry. The research was carried out and completed during a 2-year M.Sc. project. Research methodologies used in the project included:

1. Carrying out several case studies on e-procurement related issues among the members of Nova Scotia architecture-engineering-construction industry.
2. Exploring e-mail and web usage among members of construction association of Nova Scotia (CANS).
3. Developing, and delivering an online survey among members of CANS.

The steps for completing the research including:

- An examination of the recent e-commerce initiatives related to the applications of e-procurement in the industry;
- Quantifying the business connectivity of the industry members by measuring their capabilities to interact with suppliers or business partners through the Internet;
- Identifying the key issues associated with e-procurement applications;
- Identifying the fundamentals of carrying out a benchmarking exercise;
- Determining the best practices of e-procurement in the manufacturing sector, and making a comparison with the AEC sector;
- Recommending strategic approaches for the industry.

All the steps mentioned above are described in detail in Chen and Rankin (2006). In this paper, attention is paid more to the benchmarking exercise (step 4 and 5) and the initial findings of the exercise.

Fundamentals of Benchmarking

Benchmarking is a means of identifying performance levels. It is a tool for improving processes, and a technique for strategic management. Nowadays benchmarking is widely recognised as a continuous improvement tool for organisations to establish achievable goals or enhance their performance based on a comparison of organisation's processes, products or services with those identified as the best practice (Kozak 2004). The fundamentals of doing a benchmarking exercise include: 1) a host, 2) a partner, 3) a set of selected metrics, 4) a selected benchmarking type, 5) a series of selected benchmarking procedures, and 6) a selected analysis method.

A host is an organisation or a group of organisations that carry out a benchmarking exercise. A partner refers to the organisation(s) being benchmarked. In the most rigorous sense, benchmarking is a one-on-one activity, which aims to indicate the detail of how an individual organisation performs a process. However, benchmarking is also applicable to groups of organisations for highlighting the industry trends. Metrics refer to a group of identified parameters either quantitative or qualitative for the host and partner to measure their performance. Researchers prefer quantitative measures to qualitative measures due to the ease of measurement and the simplicity of identifying gaps (Holloway et al 1998). Nevertheless, such measures do not give any insights into why the sampled areas perform well or poorly, they only produce values in absolute numbers. There are many types of benchmarking. The most widely adopted are four alternatives, internal, competitive, functional, and generic. Benchmarking procedures differ from one exercise to another according to the purpose of benchmarking. Generally, the procedures are designed to examine the gaps between the host and partner and to identify the weakness and strength of the sampled area. Analysis occurs after the comparison between the host and partner. Researchers use mathematical and statistical methods to do benchmarking analysis currently, such as scorecard, scatter chart, radar chart, column chart, and bar chart.

Benchmarking Exercise in the Canadian AEC Sector

The research in the Canadian AEC sector adopted the fundamentals emphasized above to carry out the benchmarking exercise in e-procurement. The host was the AEC sector. The partner was the manufacturing sector. The manufacturing sector was selected to do the comparison. The comparison between the two sectors helped the AEC sector to discover the potential opportunities for improvement in e-procurement implementation.

When considering establishing metrics for a comparison between the AEC and the manufacturing sectors, the generic metrics for measuring e-procurement were set up first, and then the metrics were applied to the AEC sector and the manufacturing sector to examine their applicability. Only those metrics that were applicable to both sectors are kept for performing the comparison. Altogether eight metrics were chosen to carry out the comparison, which included business unit, supply chain structure, business attitude, process type, process complexity, category of products, maturity of technology infrastructure, and flexibility of technology infrastructure. The former six metrics were quantitative measures and the later two were qualitative measures.

The selected benchmarking type was functional benchmarking. Functional benchmarking occurs between organisations from different industry sectors that undertake a similar process of production or service. This fits well with the AEC and the manufacturing sectors.

The selected benchmarking procedures could be outlined as categorising, setting metrics, applying, and analysing (see Figure 1). Categorising includes reviewing benchmarking inputs of e-procurement and generalising the influencing factors. Setting metrics includes identifying the parameters, values for quantification and value for measurement. Applying refers to adopting the metrics to the AEC sector and the manufacturing, collecting data, and making the comparison between the two sectors. Analysing refers to doing the analysis based on the comparison results and predicting the potential opportunities for improvement.

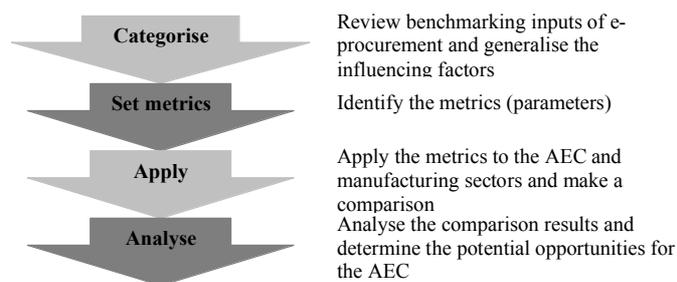


Figure 1: The procedures of benchmarking (Chen and Rankin, 2006)

The Initial Findings of the Benchmarking Exercise

Having completed the benchmarking exercise in e-procurement, the research in the Canadian AEC sector presents significant findings. The findings can be summarised as the following:

- Opportunities for the large size enterprises in the AEC sector to improve their e-procurement applications;
- Opportunities for the sector to adopt more sophisticated and advanced e-procurement applications;

- Opportunities for the sector to improve its business relationship with customers/clients through e-procurement;
- Opportunities for the sector to reengineer the supply chain structure through e-procurement;
- Need for the sector to do staff training in order to improve technical skills of operating e-procurement;
- Opportunities for the sector to decrease processing cost through e-procurement;
- Concerns about the security of technology infrastructure than on the process quality;
- Concerns about the integration of internal e-procurement systems;
- Better applications of e-procurement in the supply side than the demand side in the sector;
- A need to switch the role of technical support of e-procurement operations from the participants of the sector to outside IT service providers;
- A need to establish a conceptual model for the AEC sector to consider its e-procurement together with its overall e-solutions.

The Recommended Conceptual Model

The findings of the benchmarking exercise indicated potential opportunities of e-procurement for the Canadian AEC sector. However, the majority of industry members still want to stay with the current procurement processes and will implement e-procurement at a slow rate. Therefore, it is essential to establish a conceptual model of e-procurement for the Canadian AEC sector to consider its future e-procurement strategy development. Members of the Canadian AEC sector emphasised a work platform for them to transfer information, communicate, and do business. Based on the outputs of the benchmarking exercise, a conceptual model was recommended as a strategic guide for the members of the industry to plan or design their future e-procurement operations. The model (see Figure 2) primarily includes two parts, an e-procurement platform (at the bottom of the figure) and the participants of the AEC sector in e-procurement (at the top of the figure). The platform symbolizes the concept of working environment for the industry participants to perform e-procurement. The parallel solid ellipses symbolize the industry participants working collaboratively. The potential benefits for adopting such a model include better communications, more opportunities to do staff training and education, and improved business environment.

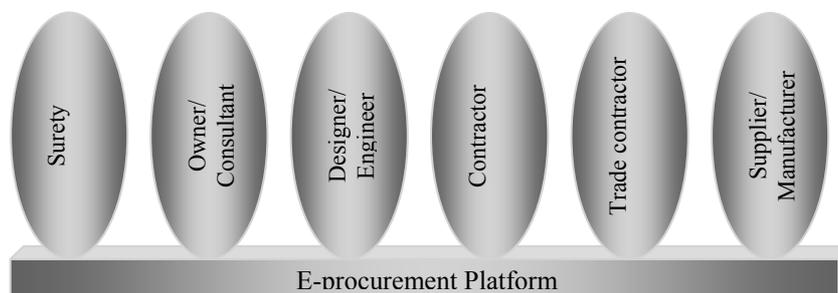


Figure 2: Conceptual model for e-procurement (Chen and Rankin 2006)

BENCHMARKING E-PROCUREMENT IN THE UK AEC SECTOR

The research that focuses on e-procurement benchmarking in the Canadian AEC sector made some headway in evaluating the value of e-commerce quantitatively.

Considering the similarity between the Canadian and the UK AEC sectors, it is possible to undertake a similar benchmarking exercise and progress it further. In this section, literature is synthesised to highlight the possibilities for the UK AEC industry to progress with similar benchmarking studies in e-procurement. More research work will be carried out for a 3 year PhD study.

Although applications of benchmarking in the UK AEC industry sector are fairly new, there is a strong case for the more widespread use of them in the industry. The construct IT benchmarks is an extremely good UK example. The benchmarking exercise is deemed to cover all electronic systems for capturing, storing, manipulating, retrieving and transmitting data during the different phases of construction (Atkin *et al.*, 1999). Out-of-sector comparisons are selected from automotive components, nuclear decommissioning, automobile manufacture, real estate management, engineering production, and manufacturing generally. The completed studies include: 1) briefing and design; 2) cost estimating and bidding; 3) cost and change management; 4) construction site processes; 5) supplier management; and 6) facilities management. The benchmarking exercise that has applied to the use of IT to support supplier management is deemed appropriate for further adoption to a wider scope of e-procurement implementation. The factors that affect the value of implementing e-procurement include the industry characteristics, the nature of products, the technological issues, and the complexity of procurement process (DTI 2004).

The characteristics distinguishing the UK AEC industry from the other sectors include: 1) conservative attitude towards adopting innovations (Paulson 1995); 2) being relatively inefficient when compared to other sectors such as manufacturing and electronics (DTI 2004); 3) being fragmental in participants, processes, and information (Egan 2002); and 4) being highly specialised through the number of small to medium sized enterprises with five or fewer employee (Construction Statistics Annual 2007). The industry characteristics, such as low productivity, fragmentation, and specialised organisation structure all call for a need to implement e-commerce initiatives, while the industry's conservative culture requires the highly targeted e-solution. When evaluating e-procurement at industry level, metric(s) should be selected to present those industry characteristics that add value during the e-procurement implementation through calling for the e-procurement solutions.

In the AEC industry, the components of a final one-off product are very complicated and require a large amount of services, physical goods, and equipment (Yisa et al 1996). When evaluating e-procurement at a product level, metric(s) should be selected to present those attributes of products that deliver value during the e-procurement implementation through improving services of procurement. Although technology is not the first thing to be considered when implementing e-procurement, technological infrastructure is still acted as the fundamental during the implementation. In the AEC sector, the infrastructure of industry members for performing e-procurement covers a large range of technological levels, from very basic to advanced ones (Voeller 2001). During the late 1990's, the AEC industry sector in the UK considered establishing e-commerce portals to carry out procurement activities with enthusiasm (Wilkinson 2005). However, most of portals withered quickly as the dot.com bubble burst by the end of 2001. In order to gain the promised benefits of e-procurement, the industry has to consider other sensible e-solutions that can be achieved in the near future. Carefully designed features of the infrastructure provide the basis for implementing e-procurement efficiently. When evaluating e-procurement at technology infrastructure level, metric(s) should be selected to present those features of technology

infrastructure that can add value during the e-procurement implementation through technical supports. Procurement in the AEC industry primarily refers to the bidding and tendering processes that deliver projects. Procurement can also be applied to suppliers or specialties (Chen and Rankin, 2006). Traditional procurement processes in the AEC industry include procurement plan, procurement status, and procurement execution (Peter, 2002). When perform the same procurement processes electronically, internal operation activities of every individual process are reengineered. Therefore, the overall e-procurement processes improvement can be measured by studying the actual activities and the detailed breakdown of these dependent activities. When evaluating e-procurement at process level, parameter(s) should be selected to present those processes that create value during the e-procurement implementation through transforming the internal operation activities.

CONCLUSION AND DISCUSSIONS

Considering the fact that most industry members in the AEC sector still take a wait-and-see approach in implementing e-procurement, it is therefore essential to examine the impacts of e-procurement and determine its values during implementation. The research in the Canadian AEC sector made some headway in evaluating e-procurement. Outputs of the benchmarking exercise in the Canadian AEC sector emphasised opportunities for the large size enterprises to improve their applications of e-procurement. The outputs also predicated opportunities in three areas: more sophisticated e-procurement applications, business relationship improvement, and procurement process cost decrease. It is also necessary to establish a conceptual model for the sector to develop its future e-procurement strategy based on the outputs, such as the difference between the supply and demand sides in adopting e-procurement, and the concern to switch the role of technical support of e-procurement. Given this foundation, the next stage of the research will compare and contrast how these findings apply to the UK context, if at all. The next stage of the research will determine the trends and preferences of the UK industry members in implementing e-procurement. The potential opportunities for the UK AEC sector to develop e-procurement, and the concerns of the UK sector need to be investigated in the future research work. This will be pursued through a three-year PhD research programme and will undertake a similar benchmarking exercise in the UK AEC sector.

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