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Peter Love  
*Edith Cowan University*

Zahir Irani  
*Brunel University*

Janice Burn  
*Edith Cowan University*

Marinos Themistocleous  
*Brunel University*

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# CONSTRUCTING STRATEGIES FOR E-COMMERCE: THE ROLE OF E-COMMERCE IN SMALL CONSTRUCTION COMPANIES

**Peter E. D. Love**

We-B Centre, School of Management  
Information Systems  
Edith Cowan University

**Zahir Irani**

Information Systems Evaluation and  
Integration Group  
Brunel University

**Janice M. Burn**

We-B Centre, School of Management  
Information Systems  
Edith Cowan University

**Marinos Themistocleous**

Information Systems Evaluation and  
Integration Group  
Brunel University

## Abstract

*Many Australian businesses have begun to embrace e-commerce to improve organisational performance and sustain a competitive advantage. For example, businesses from the automotive, banking, insurance and retail industries have been able to leverage the benefits of information and communication technologies (ICT). Yet, those from the construction industry have been slow, perhaps even reluctant, to implement ICT to support e-commerce. This paper evaluates the barriers that small-medium sized contractors in the construction industry experience when confronted with the need to implement e-commerce to sustain competitiveness. Unstructured interviews were undertaken with managers from 20 small-medium sized contractors from the State of Victoria in Australia, with annual turnovers ranging from \$1-50 million. The financial, organisational, technical and human barriers that were identified are presented and discussed. The paper concludes by proposing strategies that small-medium sized contractors may adopt if they want to leverage the benefits of e-commerce.*

**Keywords:** E-commerce strategies, small-medium sized contractors, information and communication technology in construction

## Introduction

E-commerce is revolutionising the way that organisations conduct their business operations, and is set to have significant socio-technical implications (Currie, 2000). Whilst consensus on the revenue streams from e-commerce are unavailable, there remains numerous predications on e-commerce growth rates. For example, the Forrester Research group (1999) suggests that e-commerce will double every year over a five-year period surging from US\$43 billion in 1998 to US\$1.3 trillion by 2003. In light of the impact e-commerce is expected to have on organisations and its expected growth, much research has been directed to developing and/or redefining business models. For example, comprehensive discussions and comparisons of different business models used in e-commerce have been reported by Dickey *et al.*, (2000), Shaw (2000) and Burn and Barnett (1999). However, the impact that e-commerce has had is not restricted to strategic business planning, but also has tactical and operational implications. For instance, issues surrounding privacy and security, 'on-line' transactions and payment, and software and hardware selection for different user population and business needs (O'Connor and O'Keefe 2000, Banning and Tung 2000, Warren *et al.*, 2000).

The scope and application of e-commerce continues to grow, with business applications increasing. For example within the construction industry Elliman and Orange (2000) and Anumba *et al.* (2000) describe e-commerce examples that support supply

chain management, and include the development of information platforms for construction material exchange. Such systems support business-to-business as well as business-to-customers enterprise models. The implementation of these systems continues to grow in popularity, with examples including those developed by VHsoft Technology.<sup>1</sup> Clearly there is much motivation by companies to embrace change while seeking improvements in performance. Such searches for efficiency and effectiveness gains are being advocated by Egan (1998), who called for reducing the cost base of construction by a third, whilst improving quality. Elsewhere, the US Construction Industry Institute set targets to improve project cost and schedule levels by 20 percent (Tucker, 1997). In comparison, Australian initiatives identified the potential time saving of 25 percent – 40 percent by reducing non-value added steps in the building process. Hence, such targets are leading construction companies to investigate improvements to business performance, with e-commerce clearly seen as a means to support their ambitious goals, although its evaluation remains somewhat difficult (Irani and Love, 2000).

## E-Commerce Business Models

The benefits of using the WWW and the Internet to conduct business-to-business transactions and to sell products have been well documented (eg, Gattiker *et al.*, 2000). For example, e-commerce can reduce an organisation's costs, particularly across supply chains, improve customer service, create additional revenue streams and create new business relationships. In particular, McAdam *et al.* (2000) suggests that small-medium sized contracting organisations may benefit from sharing resources through an enhanced collaborative process. Cheng *et al.* (2001) suggests that the strategic decision to adopt e-commerce requires an organisation to re-examine their business operations as well as their business relationships with customers and suppliers. Yet, the decision to embrace e-commerce may soon be a matter of survival and less strategic in nature. For example such a decision is expected to move from being strategic to one of a tactical decision, and then from being a tactical decision to being an operational process.

Love and Gunasekaran (1997) suggested that inter-organisational collaboration enabled by electronic information exchange and sharing, can create a competitive advantage for organisations that re-engineer their supply chains. In doing so, optimising the benefits of collaboration as well as reducing risks associated with ICT implementation. However, Gulati (1999) suggests that the benefits gained from the collaboration are dependent on the *exchange relationship* between organisations such as trust, interdependence and bargaining power.

While research has widely publicised the benefits of e-commerce, little attention has been given to the barriers that organisations face when confronted with the need to implement e-commerce to sustain their competitiveness. For example, business organisations in the construction industry have been slow, perhaps even reluctant, to implement information and communication technologies to support e-commerce (DIST, 1998). In addition, the Australian construction industry has been criticised for its poor performance and productivity in relation to other industries (DIST, 1998). This is often attributed to the fragmented nature of the construction industry, as no single organisation can dictate and therefore be responsible for establishing and maintaining the necessary communication networks for a construction project. Consequently, this industry sector is faced with ineffective communication and information processes, which have inadvertently contributed to project cost and time overruns. Alty (1993) suggests that for projects to be procured successfully, construction businesses must communicate and exchange information more effectively by adopting IT. Indeed, Latham (1994) attributes the adoption of IT as an enabler in the reduction of project costs, which in turn provides competitive advantage.

As such Australian construction organisations are being encouraged to transform their business operations to conduct business transactions electronically in a “seamless supply chain” (DIST, 1998). Yet, the traditional adversarial and low profit margined nature of the construction environment has created a reluctance to explore and implement new and different methods for performing business operations (Love *et al.*, 2000). With this in mind, the authors of this paper propose to add to the body of literature by identifying the barriers that small-medium sized contracting organisations are experiencing when confronted with the need to implement e-commerce and strategies to overcome these.

## Information and Communication Technology in Australia

Many small-medium sized firms find it difficult to compete in today's competitive markets. Acknowledging this point Chan *et al.*, (2000) and Wiele and Brown (1998) have propagated innovative strategies for improving work practices, and the quality of

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<sup>1</sup>Detailed information of this e-commerce system can be obtained at [www.vhcome.com](http://www.vhcome.com).

products/services. E-commerce has been wisely acknowledged as particularly useful for contracting organisations to revive their communication and coordination processes (Chan *et al.*, 2001). However, the up-take of ICT by businesses in the construction industry has been very slow (DIST, 1998). This point has been reiterated by Love *et al.* (2000) who state that "*contractors lag well behind other industries, some of which are allied*". It would appear that contractors have ignored emerging technologies that have the ability to provide significant performance improvements. Noteworthy, however, this is not the case for all contractors, as some embraced the Internet by adopting electronic mail, remote login, file transfer protocol, Intranet and Extranet services.

Research undertaken by Love *et al.* (1996) found that contractors had simply used IT to automate existing processes. Contractors reported that the associated benefits of IT adoption were simply reduced cycle times and as a result increases in productivity, positioning such benefits as operational within the taxonomy discussed by Irani and Love (2000). A similar study undertaken by Marosszeky *et al.* (2000) confirmed these findings and reported that some contractors had re-designed their business processes to leverage IT benefits, and as a result achieved significant productivity gains. While there are some businesses leveraging IT benefits, most inter-organisational applications of IT are confined to the automation of communications. For example, e-mail partially replaces ordinary mail, telephone and fax, and it is common for CAD files to be e-mailed to and from consultants, and Electronic Fund Transfer (EFT) automates payments among contractors. Such technologies have helped reduce cycle time and are now considered competitive necessities (DIST, 1998). Fundamentally, if businesses in construction are to leverage the full benefits of IT, then the way in which projects are procured needs to be re-structured (Love *et al.*, 1998). For example, network structures can be used to support the formation of inter-organisational collaborative partnerships and the implementation of business-to-business e-commerce.

Tam (1999) and Deng *et al.* (2001) have both used a similar structure to support an Intranet and Extranet facility, which can transfer and exchange information within and between organisations involved in a project. The use of business-to-business e-commerce has been limited to only a few projects in Australia, for example, the Acton Peninsula National Museum in Canberra (Walker *et al.*, 2000). Noteworthy, the businesses involved in this project are some of the industry's forerunners in the adoption of ICT in Australia.

According to DIST (1998) the factors that tend to inhibit the adoption of information and communication technologies in construction include:

- resistance from management;
- tight profit margins which make it difficult to fund investment in an IT infrastructure;
- lack of IT awareness;
- lack of employee education and training;
- degree of organisational change required; and
- a belief that the industry is doing well without IT.

Khalifa *et al.* (1999) suggest that one of the major barriers associated with the adoption of ICT is risk, which can be either *perceived* or *real*. Perceived risk is associated with the fear of the unknown, whereas real risk involves the actual physical risk of data transfer, authentication issues and the use of information. In addition, the implementation of e-commerce may require organisations to re-examine their existing processes, systems and people (skills and training/attitude and behaviour) so that a culture of innovation can be stimulated (Lefebvre and Lefebvre, 1993, Irani and Sharp, 1997).

Dieterich (1998) further suggests that small-medium sized enterprises (SME's) face an evaluation dilemma, as the payback for investing in business-to-business or business-to-consumer e-commerce typically extends beyond 12 months. Consequently, many SME's who require revenue generation are unable to outlay funds to support an e-commerce infrastructure. Many of the technological issues used to support e-commerce have been found to be confusing and not well understood by managers and employees of SME's (Burn and Bode, 2001, Tetteh and Burn, 2002). In addition, Elliman and Orange (2000) suggest that the adversarial and competitive nature of the business in construction is a barrier to implementing e-commerce inasmuch as there is a degree of uncertainty associated with formation of business partnerships and virtual organisations. It is noteworthy that by overcoming the barriers, parties are able to develop the necessary core values for e-commerce, which are those beliefs, practices and activities of the companies that demand an e-commerce environment. Hellsten and Klefsjo (2000) indicate in their proposed virtualized total quality management that core values form the direction for identifying the required techniques and associated supporting tools.

## Research Approach

Since the emergence of e-commerce there has been a tendency to focus on its benefits, successes and technological issues rather than the barriers that businesses may encounter when implementing e-commerce. With this in mind, the research approach was exploratory in nature and therefore relied on the use of unstructured interviews. Fifty firms who were selected from the Yellow pages in the Southwestern State of Victoria in Australia were invited to participate in the research, which aimed to identify their perceived barriers to implementing e-commerce. In total, 20 small-medium sized contracting organisations, with annual turnovers ranging from \$1 to \$50 million (see Table 1) agreed to be interviewed.

**Table 1. Details of the Firms Interviewed**

Company	Turnover (\$M)	Number of Employees	Type of work	Level of IT Implementation	
				Head Office	On-Site
A	30	35	C, I, R	Medium	Low
B	17	22	C	Low	Low
C	8	3	C, CM, I	Low	Low
D	10	13	CM, D	Low	Low
E	1	3	M, RE	Low	Nil
F	5	15	D, CM, LI	Low	Nil
G	1	2	D, M	Low	Nil
H	50	45	CM, I, M, RE, RF	Low	Low
I	15	15	D, CM, I	Medium	Low
J	12	12	D, C, I, M, RE	Medium	Low
K	25	25	CM, D, I, LI, RF, R	Medium	Low
L	8	5	CM, D, R, M, RE	Medium	Low
M	12	7	C, I, M	Low	Low
N	10	8	D, R, RE, RF	Low	Low
O	18	12	C, D, I, M, RE	Medium	Low
P	13	8	D, RE, M	Low	Low
Q	10	5	C	Low	Nil
R	1	2	D, RE	Low	Nil
S	15	9	D, R, RE,	Low	Nil
T	8	5	CM, LI, M, RE	Low	Nil

Key: C-Civil Engineering, CM-Commercial, I-Industrial, LI-Light Industrial, RE-Renovation, RF-Refurbishment, M-Maintenance and Repair, R-Residential, D-Domestic Housing,

## Data Collection

Unstructured interviews were conducted on a one-to-one basis with a Company Director, and were open to stimulate conversation and to breakdown any barriers that may have existed between the interviewer and interviewee. The interviewee was allowed to talk freely without interruption or intervention, to acquire a clear picture of their perspective about their organisation's perceptions about e-commerce. Prior to the commencement of the interview, the interviewee was asked to describe their organisations current level of ICT adoption and indicate whether it was high, medium or low. Following this, the interviews aimed to gain:

- an understanding of the constructs that the interviewee uses as a basis for forming opinions and beliefs about e-commerce;
- an understanding of the problems associated with the implementation of information and communication technologies; and
- the confidence of the interviewee, to overcome the reluctance to be truthful about an issue other than through confidentially in a one-to-one situation.

The researchers acted as a neutral medium through which questions and answers were transmitted. The researcher's aim was to obtain objective data through maintaining the friction of an interesting conversation, which avoided unbalanced questions and obtained bias-free data. In trying to clarify the respondent's answers the researchers were careful not to introduce any ideas, which may form part of the respondent's subsequent answer. Furthermore, the researchers were also mindful of the feedback respondents

gained from their verbal and non-verbal responses. Hence, the researchers avoided giving overt signals such as smiling and nodding approvingly when a respondent failed to answer a question, which could lead to respondents withholding responses to later questions. The interviewees reviewed the notes from the interviews and their views were invited to ensure their accuracy.

## Findings and Discussion

Table 1 identifies the characteristics of contracting organisations interviewed (i.e. Turnover, Number of Employees, and Type of Work), and the level of e-commerce implementation in Head Office and On-site. It is worth noting that although there is no clear indication that the three characteristics have significant impacts on the level of e-commerce implementation, some general observations can be made:

- the higher turnover and number of employees the higher the level of e-commerce implementation;
- a contractor with a higher turnover is expected to bid for more projects or for larger projects, and thus may use IT to support competitive business practices such as the production of tender documentation and post contract administration; and
- with more employees, a contractor may need to invest in developing a productive communication and coordination network, which is IT-based.

The barriers that were identified from the interviews have been categorised as follows: *organisational, financial, technical, and behavioural*. Figure 1 depicts the interdependency of these barriers. In addition, *risk, uncertainty, change* and *knowledge* were identified as the underlying factors that businesses considered as being the constraints to the introduction of ICT to support an e-commerce infrastructure.

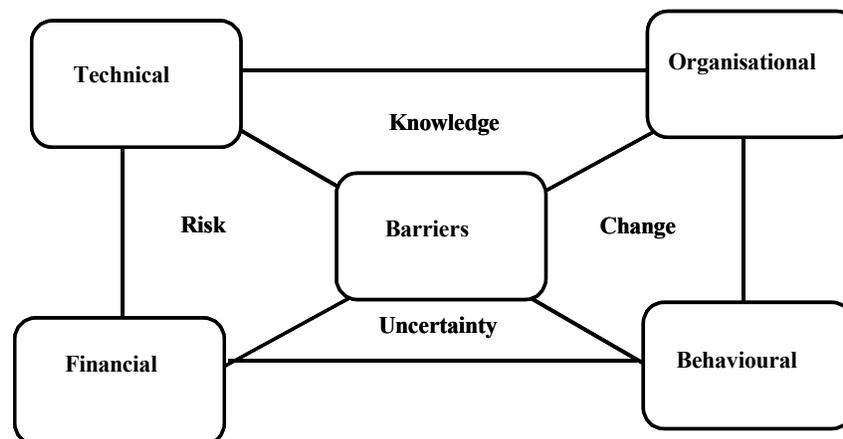


Figure 1. Barriers to Adopting E-Commerce in Construction

The *organisational barriers* that were identified included the following:

- indirect or hidden costs;
- inability to quantify (financially) the impact of e-commerce;
- inappropriate investment appraisal techniques;
- myopic strategic planning;
- lack of employee knowledge;
- lack of an IT infrastructure;
- a reluctance to form collaborative partnerships; and
- a general reluctance to change the way business was undertaken.

It was generally perceived that firms did not want to change as they were not able to foresee the benefits that e-commerce offered. In fact, none of the 20 businesses interviewed had begun to embrace business-to-business e-commerce, despite the forthcoming introduction of electronic tendering for Government projects and the General Sales Tax (GST). Seventeen firms considered e-

commerce to be simply an interactive web page. In fact, when probed about the idea of sharing information and knowledge using the Internet there was found to be a general consensus that this would jeopardise their competitive advantage.

One interviewee did state that they would like to transform their business processes by developing appropriate internal structures, systems and protocols to take advantage of web-based technologies. While the interviewee recognised the urgency to employ such technologies, the degree of change that was required to transform their business was considered to be too dramatic, at least in the short and medium terms. Essentially, this business like all others was heavily reliant on cashflow and thus, could not invest in technologies that would not bring about immediate benefits.

The *financial barriers* that were identified focused on investment issues, such as:

- the cost of system requirements and maintenance;
- investment risk;
- amount of available credit;
- cost to training and education;
- losses in productivity; and
- market uncertainty.

The firms were not aware of any techniques that could be used to evaluate the investment potential of e-commerce. In fact, it was generally found that the decision to invest in IT was based on a gut feeling. Interestingly enough, such conclusions are similar to those reported by Irani *et al.* (1999), Irani and Love (2000) and Bode and Burn (2001) where case studies from the service and manufacturing sector were reported, respectively.

Businesses were asked to indicate the extent of IT being utilised at their head office and on-site so as to assess the potential for the use of e-commerce. Only six firms stated that their level of IT usage was of medium level. These firms used e-mail to transfer CAD files, and general correspondence to clients and project team members. Low levels in this instance referred to simply using PC's for tasks such as word processing, fax and the like. Without ample investment in ICT small contractors will never be able to leverage the benefits of e-commerce. If contractors evaluated their investments in ICT in a rigorous and systematic manner by taking into account the direct and indirect benefits and costs of implementation then they may be able to gain the financial and non-financial benefits offered by e-commerce.

The *technical barriers* that were identified pertained to issues such as identifying the type of technologies that would match the organisation's business requirements, the types of software, lack of education and knowledge about system requirements, the risks associated with security and authentication. In addition, one contractor pointed out that if their information system was not aligned with the technologies adopted then this could result in loss of business and added costs. Therefore, the firm appointed an external consultant to make sure that the IT was aligned with the technologies being implemented. However, this can be costly, and may subject the organisation to on-going costs, which they may not be able to afford – again this has been reported as a major headache for SMEs (Bode and Burn, 2001). However, this can also be viewed as an evaluation problem that could be overcome if the firm were able to think strategically about how they could leverage the benefits of e-commerce in their marketplace. In this instance the firm may consider investing in a bespoke e-commerce system which is integrated with an IS that is responsive to environmental and organisational changes.

The *behavioural barriers* that were identified focused on issues to do with the fear that jobs would be lost, changes in working habits, the requirement to undertake additional training and skill development, and the degree of uncertainty and change that technology instils in people. When people are confronted with change they naturally resist it and may need gentle persuasion to overcome the fear of the unknown, especially if it is technology related. As a result, it is important to identify and use appropriate channels of communication to ensure the workforce is informed of changes and its impact on their job functions. Otherwise, the grape-vine might take over and support the development of a fear-based culture.

## **Conclusions**

The adoption of new technology remains a lengthy, time consuming and complex process that requires substantial amounts of organisational capital. As such, the evaluation of information and communication technology remains an important process that requires careful management and control. The challenge facing companies is their positioning relative to customer needs, which requires inherent flexibility. The research presented has identified that larger the organisation and more complex the business

operations the higher the level of IT implementation. Nevertheless, the results indicate that the level of e-commerce implementation has yet to mature in the small-medium sized contracting firms that were sampled.

This paper has identified that there are substantial barriers to implementing e-commerce, which can affect organisational performance at a micro and macro level. These can be categorised as *technical, financial, organisational* and *behavioural*. In addition, risk, uncertainty, change and knowledge were identified as the underlying factors that acted as constraints to the introduction of ICT to support an e-commerce infrastructure. In fact, none of the businesses interviewed had begun to embrace business-to-business e-commerce. The level of IT employed by these organisations was limited to CAD, e-mail applications and word processing.

While the research was limited to a specific region in Australia, it is suggested that many small-medium sized firms will face similar dilemmas. In starting to overcome some of the barriers identified in this paper, the authors suggest that small-sized firms consider the following descriptive recommendations if they are to effectively leverage the benefits of e-commerce:

- *Be clear on what kind of change is required:* e.g. A major shake-up versus moderate process improvement, slow versus rapid roll-out of technology; each involves different implications (from financial to structural); decide what approach is best from both a customer (internal and external) and competitive viewpoint.
- *Plan:* Schedule the project and do not skip steps that must occur throughout the development, implementation (rollout) and adoption process. This can be supported by setting out clearly defined objectives, critical success factors and responsibilities; focus on the detail and establish criteria.
- *Pre-empt resistance:* Managers need to respond to resistance; *hook* into what people have got to gain or lose by changing from adopting new technology.
- *Prepare employees:* Address the training, education and development of employees prior to initiating the change programme and adopting the technology. This will provide staff with the confidence and ability to overcome barriers to IT-related business process change.
- *Communicate:* ensure communication is two-way e.g. establish feedback sessions, anonymous comment or suggestion slips, open dialogue; identify *how* information should be cascaded throughout the organisation and *do not* use the grapevine.
- *Ownership:* Recognise that people are much more inclined to support what they help to create (stakeholders) and resist what is forced upon them.
- *Avoid complacency:* Create an environment where people are dissatisfied with the status quo; drive people out of their comfort zone; shock treatment, where rapid change is required, creates urgency and momentum.
- *Set your sights on the specific objective:* for example, is the aim to be first to adopt X technology through e-commerce, to gain Y% market share.

The authors of this paper believe that by identifying the barriers to e-commerce, small-medium sized firms may be better positioned to respond to the problems and challenges that they might encounter in its implementing.

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