

E-COMMERCE AND THE CONSTRUCTION INDUSTRY

Khalid Bhutto¹, Tony Thorpe² and Paul Stephenson³

¹*k.bhutto@shu.ac.uk*, ³*p.stephenson@shu.ac.uk*, Faculty of Development and Society, Sheffield Hallam University, Sheffield, UK

²*a.thorpe@lboro.ac.uk*, Department of Civil and Building Engineering, Loughborough University, UK

E-commerce has become a household name over the past few years, partly due to the phenomenal growth of the internet and advanced electronic communications. Various new business models and approaches for E-commerce have appeared and are now being embraced, representing a digital economy to replace the industrial economy of the last century. For traditional business around the world, E-commerce has sometimes been perceived as an opportunity or a threat. The rapid emergence of dot com culture has forced traditional big businesses, including construction organisations, to seriously consider E-commerce solutions as part of their business operations. While the construction industry plays an important role in the well being of the economy, the traditional image of the construction industry has often been one of an under-developed industrial sector. The emergence of E-commerce may therefore have the potential of bringing construction on par with other developed industries. This research suggests that different models and solutions are emerging in the market for E-commerce in construction. At present, industry's attitude towards E-commerce tends to be positive, albeit one in its infancy. The major issues may therefore be attributed to the lack of industry wide standards and agreement on a collective framework for E-commerce. The complex nature of construction, its processes and cultural issues involve commitment from all sectors of the industry for the eventual realisation of successful E-commerce.

Keywords: construction industry, E-commerce solutions, collective framework

INTRODUCTION

The last decade of the twentieth century will leave tremendous and long lasting impact on the technological developments. The rapid advancements in computer and telecommunication technologies have revolutionised the way we communicated. The emergence of the internet enabled by the merger of these technologies is changing the way the business used to be conducted. The internet has become a household commodity. It has enabled any individual to have access to the information never imagined of before. It is an economical real-time communication channel which has previously not been affordable. The changes from internet usage have forced businesses to improvise traditional trading processes, continuously improve the products and services, and create new business strategies. The result is a new business medium known as Electronic Commerce or E-commerce, and businesses on a world-wide scale are keen to make most from this innovative medium.

Construction is a major industrial sector. It makes a huge contribution to the world economy. The growth in construction activity is considered as an indicator of the good health of the economy. Government initiatives especially in the developed countries are encouraging the electronic switch over of businesses. Major construction clients

are also embracing E-commerce, therefore the construction industry simply cannot afford to stay behind in the rapidly growing field of E-commerce.

The aim of this research work is to review E-commerce, in general, and analyse it from a construction industry perspective. The principal research method applied is the literature review, and the research objectives are to: assess the magnitude of E-commerce growth, review the models and strategies developed for E-commerce, evaluate the E-commerce in construction industry and analyse the models and strategies under development in the construction industry.

E-COMMERCE

E-commerce Definition

Electronic commerce usually abbreviated as eCommerce or E-commerce has been defined in many ways. Garrett and Skevington (1999) explain it as, "trading by means of new communication technology (everything beyond voice telephony, fax and telex). It includes all aspects of trading, including commercial market making, ordering, supply chain management and the transfer of money". Another definition adopted by European Union (2000) states E-commerce as, "one of those rare cases where changing needs and new technologies come together to revolutionise the way in which business is conducted".

E-commerce Application

E-commerce has enabled a new virtual dot.com culture. For existing businesses, it is either an opportunity for improvement or a threat to be left behind, if not reacted quickly. Although the word E-commerce has become prominent in recent years, the concept itself is not unique. Collaborative working tools and EDI (electronic data interchange) have been around for sometime. Unitt and Jones (1999) identify EDI, as the grand daddy of E-commerce. EDI has been in practical use for business to business data transfer for last 15–20 years (Bhutto, Thorpe & Stephenson, 2005). Unfortunately, it has not been able to grow to full-blown E-commerce because of the 'hub-and-spoke' configurations of EDI, lack of common standards and the huge investment involved (Garrett and Skevington 1999). However, the situation has changed with the exponential growth of internet. It has made E-commerce a reality. The internet is rapidly becoming the technology of choice for E-commerce, and it offers business an easier way to link with other business and individuals at very low cost.

E-commerce Growth

The way E-commerce is growing is unprecedented. Auron, Decina and Skillen (1999) report that global on-line consumer and corporate purchases in 1998 exceeded \$13 billion annually. McCarthy & John (1999) put the figures of internet commerce to reach between \$1.4 trillion and \$3.2 trillion in the early part of this decade, up from a range of \$55 billion to 80 billion in 1998.

E-commerce Impact

E-commerce is the enabler for the digital transfer of global trade. In view of Andersen Consulting (2000), "the industrial Economy has now given way to the electronic economy". E-commerce is changing the way companies traded traditionally. Many attempts have been made to evaluate the impact of E-commerce on the long tested and well-established trading methods. Coulson (1999) rate it as break point changes,

changes that so alter customer expectation that they redefine the market or create entirely new markets.

NEW BUSINESS MODELS FOR E-COMMERCE

To thrive in the internet economy, businesses need a new model for commerce that addresses requirements maximising the life time value of a business relationship. Business activities that used to be well defined and structured will defuse across the enterprise and among partners and customers. McCarthy & John (1999) agree that, as the internet channel becomes the reality for world commerce, companies that provide non-stop electronic commerce for their partners and internal and external customers will be successful and at the top of their sector.

It is also emphasised (Andersen Consulting 2000) that, if E-commerce were only about technology, it would be the 'next big thing', but nothing more. The potential of E-commerce points to a fundamental economic change that is much more pervasive. Moreover, this requires strategic and organisational change that is also pervasive and fundamental.

As a direct result of the requirement of new business models and strategies, individuals and organisations have come up with novel and completely unexplored ideas to reap the early fruits of the E-commerce. Virtual Storefront, marketplace concentrator, information broker, transaction brokers, electronic clearinghouses, reverse auctions, digital product delivery, content provider, and on-line service provider are some examples of innovative business models.

E-COMMERCE SOLUTIONS AND STRATEGIES

E-commerce Tools

There are vast numbers of tools available in the market to start with E-commerce. It includes ERP, Datawarehousing, workflow/workgroup, customer relationship management, ECR (efficient consumer response), sales force automation, call centres, and document management. Companies make their use at varying degrees and levels depending upon the nature of the business.

E-commerce Practice Models

For E-commerce, shopping window or point of communication is the web page. Numerous techniques and technological innovations are being applied to attract more and more people to the company web pages. These practices can be categorised (Gloor 2000) as shown in table 1.

Process Integration

Ultimate target of the E-commerce adoption is the seamless process integration removes bottlenecks. That target is usually met by gradual movement towards the integration. Figure 1 illustrates that time-related movement.

Enabling Technologies for E-commerce Transformation

Technologies for manipulating and locating information are crucial to provide added value to existing products. Gloor (2000) identifies two main tools for that purpose as follows:

Table 1: E-commerce practice models

Practices at Present	Current best practices	Future Best Practices
Size conversion charts	Express checkout (one click ordering)address book	Use of bots to identify shopping options and compare prices
Online catalogue	Intelligent searches and recommendations	Digital wallet I-e centralised payment, shipping and status centre
Store locator	Interactive sites i-e videos, games, virtual dressing rooms	Voice recognition search and navigation
<i>Fast intuitive, easy to use</i>	<i>Optional services I-e hemming, gift wrapping</i>	<i>Hyper interactive site I-e virtual chat room</i>
Keyword search	Products displayed by demographic one to one profile	Personalised services-individual shopping assistance
Shopping cart	Dedicated server at ISP	Personalised catalogue with custom ordering capability
Easy to locate on search portals	Global Markets and Distribution (Multiple language translations)	Product catalogue mapped to the personal measurement profile
Hosted by ISPs	Click through on major projects	Retail site to become their own portals
HTML based	Personal Sizing wizard tutorial	Site application outsourcing
Business to consumer site	<i>HTML and dynamic content (JAVA)</i>	Site extended to integrate with supply chain suppliers
Multiple customer support channels	Site fully integrated with outlets (Business to Business)	Totally dynamic content applications
Secure server, privacy protection	Real time on-line text based support]	Real time on-line video conferencing support
Accept major credit cards	Password protected profiles	Alternative payment (cyber Cash) and Billing methods (on-line billing)
English centric site		True Global Marketing –multiple sites incorporating localised language and culture

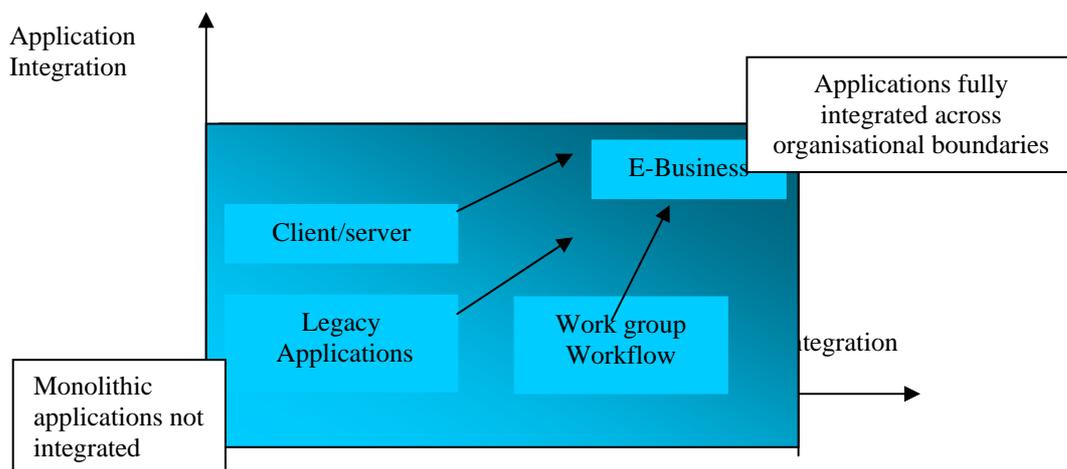


Figure 1: E-Business Application and Process Integration (Gloor 2000)

Information Filtering: Is one of the important technologies, employing methods such as collaborative filtering, where a user can search for information based on other users’ experiences and preferences. Constraint-based filtering restricts searches based on external constraints. Rule based filtering uses artificial intelligence techniques to optimise searches based on domain specific rules.

User Profiling: Another core Web technology that is concerned with collecting information about preferences of users allowing vendors to adopt their offerings to the needs and tastes of their customers. They can then target their marketing efforts much more efficiently, offering each customer what she or he is looking for.

In the future, agent-based concepts will gain great importance. Users will delegate searching and other repetitive tasks to agents. Companies that offer agent-based services will gain a competitive advantage.

Web Page

E-commerce for buying and selling over the internet has been seen as the dominant use of the web since its inception. In the mean time, E-commerce has evolved as the enabler for re-engineering the whole value network of a company, far surpassing the initial scope of E-commerce. Nevertheless the end user pre-dominantly judges the quality of a company by the quality of the company Web site.

Organisational Impact

Implementation of the technology in an organisation and in business processes requires the assessment of issues in a broader context. Technologies are often assumed as “plug and play” entities, while studies have shown that introducing them without addressing their social –economics dimensions (e.g. business needs, culture, learning requirement, and incentives) can cause problems (Sloan and Low 2000). E-commerce or any other IT system implementation brings organisational changes and this is unfortunately a neglected area resulting in the cultural resistance. Eason (1988) explains that the implementation of information technology leads to changes in the structure of jobs and other organisational practices. Frequently these matters are dealt with in an ad hoc way as a problem arise and constitutes a piecemeal and unsystematic way of changing from one form of organisation to another. The result is often tension and conflict in the social structure and an under-utilised technical system. Successful E-commerce implementation necessitate a supportive and effective organisational structure.

Human Resources

E-commerce is made possible by the technological revolution in computer and communication technologies, its implementation and successful use mainly depends upon an organisation’s structure and efficient management. The human element is still the most crucial factor in the E-commerce (Gloor 2000). Companies that have successfully combined the latest internet technology with the human element are gaining the most.

E-commerce Implementation Methods

It takes a careful management strategy to implement E-commerce tools in any organisation. Gloor (2000) suggests two options for implementation strategy as follows:

Evolutionary process (Bottom up): Existing business process can be automated by introducing new internet based tools and technologies to dramatically speed up existing processes.

Staging a revolution (Top down): Business strategy and the associated business processes can be fundamentally questioned and re-thought to make full use of the internet and its associated technologies.

Process Mapping and Reengineering

Before automating the processes for E-commerce it is essential to understand the process thoroughly otherwise the change will be partial, not integrated, or not even beneficial. Gloor (2000) recognises that full benefit from E-commerce can only be reaped if the knowledge involved in each e-business process is appropriately managed.

Outsourcing

The growing functionality of new software continuously branching out into new application domains has made software deployment increasingly complex. Even a modestly large software system is impossible to install without major investment in time, money and external consultants. Companies increasingly avoid this hassle by moving the operation of whole business process to external outsourcing companies. This fits well into current tendency to focus on core competencies and have all the non-crucial services performed and managed by outside service providers. Besides IT, other area of business can be outsourced, given the real-time communications available from E-commerce tools. Organisations are sticking to their core activity and sub-let everything else not in their expertise.

Supply Chain Management

E-commerce provides the opportunity for businesses to redefine their supply chain. Some important points in supply chain management are as follows (Sloan and Low 2000):

- E-commerce offers the potential to take account of the entire range of interactivity possible over the internet
- It is necessary to cascade the benefits of E-commerce through the supply chain
- E-commerce provides the opportunity to create a competitive advantage

Electronic Procurement

Primarily e-procurement saves cost and increases profit margins. It enables significantly better use of administrative time, efficient order taking, and streamlined business solutions. Sloan and Low (2000) suggest some benefits of e-procurement as:

- Repetitive tasks may be undertaken by the system
- Reduced cost of procurement and increased profit margins
- Reduced procurement cycles
- Promoting emphasis on “Value Added” services
- Increased access to contract opportunities

E-COMMERCE AND CONSTRUCTION INDUSTRY

E-commerce is not only about trading over the internet, but it is the use of any of the electronic channels for trading transactions. EDI, developed two decades ago, can be

called as the start of E-commerce. However, initially, it could not be fully developed in construction because of many factors, including:

- Point to point nature of communication (difficult to work within)
- Multi-party construction projects.
- High initial investment for the construction industry.
- Hub and spoke nature of its working (not greatly beneficial to most)
- Construction companies (except the large ones with a large supply chain)
- Agreement on standards required, for sending structured and formatted documents.

However, with the growth of internet, the old EDI working on virtual private networks can be converted to the internet, making its use economical. Some of the barriers in the use of EDI are further reduced in the presence of open HTML and XML standards. Regardless of EDI, the internet, or any other channel used, the nature of the construction business tends to favour the E-commerce. Research (Baldwin, Thorpe and Carter, 1999) has shown the potential of extended use of E-commerce tools like EDI, e-mail, electronic image processing and CAD data exchange in the construction industry. Moreover, the industry is already employing some of these tools. A good percentage of construction companies are making use of Electronic Document Management Systems (though greatly pushed by clients) at present. New web-enabled EDM systems will make the switch to E-commerce much easier. In the UK, Bluewater and the Royal Opera House are just two recent mega schemes that may not have been completed on time without computerised document management systems. The greater use of web-based extranets has been made by construction companies on big projects, especially when working with technologically advanced clients in collaborative environment. Systems established by Taylor Woodrow and BAA (British Airport Authority) for Gatwick and Stansted Airport projects and extensive use of extranets for the design of new Cambridge University Computer Laboratory (CICA 2000a) are such examples.

E-commerce Benefits

The benefits are potentially huge from E-commerce. With bills of quantities available to all, the QS will have to become more closely integrated into the team and the scope for, say; designers to deal directly with trade contractors (and vice versa) should reduce the scope for conflict. If nothing else, the reduction of paper and the jobs that depend on shuffling it will help to make every one more profitable. In the USA, current estimates suggest that cost savings from on-line trading will add 1% to margins. Moreover, CICA (2000b) reports the following advantages from E-commerce, suggested by construction organisations:

- Faster Transaction Times
- Reduced Costs
- More up-to-date information
- Less paperwork
- Wider Market
- More Information

However, organisations also pointed to initial set-up cost, loss of personal contact, the need to re-train staff, security issues and increased internal cost, as some of the disadvantages from E-commerce. The research survey also reports that the culture of the industry, implementation cost, security, lack of suitable trained staff, legal issues, and telephone charges are considered as major constraints for E-commerce in the industry.

Current E-commerce Models for Construction

At present the majority of large construction companies maintain their web sites, though mainly for information and contacting, and as an advertising medium. Some of the sites also provide recruitment facilities. The major initiatives in construction now are the creation of construction electronic market places. Companies from within the industry and from outside are striving to tap into this potential market.

Market Places and Third Party Facilitators

Internet companies outside the industry see the huge market potential in the construction sector. In USA, 150 to 200 internet companies focusing on design and construction have been started in the last few years. The applications developed by these firms may deeply affect how construction companies do business; how they design, build, and manage projects. They will create new kinds of tasks and positions, and they will eliminate the traditional tasks and positions. The resulting on-line collaboration and E-commerce services offer the opportunity to greatly streamline design and construction operations.

Some of those set-ups and the web sites include:

- Construction Exchange (www.constructionexchange.com).
- UK construction (www.ukconstruction.com).
- Web-based application provider like Build Point (www.buildpoint.com).
- Build.com (www.build.com), site for building and home improving,
- Material supply and procurement.
- Joint venture of UK construction giants (www.arrideo.com).

There are numerous such models available in the market for construction. A successful model would be the one that understands the complexity of the process, makes it efficient, cares for small players, does not provide a quick fix, and where the long terms implications are understood. Aspinall (1999) rightly comments that E-commerce is more than internet trading. E-commerce is a new way of working and doing business, encompassing organisational structures, reshaping traditional industries and introducing new market realities.

CONCLUSIONS

The exponential growth of internet use has made the dream of E-commerce a reality. The expanding market for E-commerce is simply too huge to ignore for any business. Rapid developments in the technology are improving and provided on-line services very quickly. E-commerce adoption has its organisational and business implications too. It is not a magical solution to revolutionise a business. Careful strategic planning and strategies are needed. In order to succeed in this innovative and unique medium, it requires a diverse and multidirectional approach. In the construction industry, the

potential benefits are considerable owing to the nature of the business. Comparatively, the construction industry is not performing on par with other business sectors in E-commerce. However, it is encouraging to see a number of models and initiatives coming to the surface to bring traditional construction processes on-line. External internet organisations also see a huge potential in construction E-commerce. Standardisation and consolidation of systems is a major requirement to help support the effective models and genuine developments. Comprehensive and collaborative efforts are required to make the most from E-commerce in the industry, and only those models that understand the complex business of construction will survive.

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