

EXPLORING E-BUSINESS TECHNOLOGY TO SUPPORT IMPROVEMENT IN THE INFRASTRUCTURE PROCUREMENT PROCESS IN THE GHANAIAN CONSTRUCTION INDUSTRY

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ABSTRACT

There is growing interest globally in the conduct of construction business transactions by utilising electronic means through the Internet and or dedicated network of computers and other ICT elements. This is often referred to as e-Business technology. The infrastructure project procurement process in the Ghanaian construction industry is predominantly a paper-based transaction. This approach has several procedural limitations, notably concerning communication difficulties between project partners (consultants, architects, construction managers, quantity surveyors, engineers, suppliers, contractors and subcontractors including statutory authorities); this in most cases has led to transactional delays, inadequate communication processes, and lack of transparency in the procurement process. These issues therefore need to be addressed in order to maintain an efficient and effective infrastructure procurement system in the Ghanaian construction industry. Advances in Information and Communication Technologies (ICT) have had a significant impact on organisation's business processes, using them as key drivers in sharing project information and other relevant business engagements. This paper is a literature synthesis based on an on-going PhD research which aims to propose a framework for e-Business Technology Transfer to the Ghanaian Construction Industry utilising International Joint Venture projects as a medium.

Keywords:

ICT, e-business Technology, Infrastructure, Procurement System, Construction Industry

Introduction

A review of literature identifies that the advent of the Internet technology as a business system platform has been a catalyst for major changes in the operations and status of organisation procurement including construction (Croom and Brandon-Jones, 2007). There is growing interest globally in the conduct of construction business transactions by utilising electronic means through the Internet as it is an information intensive industry (Brewer and Gajendran, 2009). Information in the form of communications between contractors, designers, clients and other key participants often predominates within construction and project success depends on the effectiveness and efficiency of these communications. Work by researchers such as (Howard *et al.*, 1998, Hassan and McCaffer, 2002, Acar *et al.*, 2005, Ingirige and Sexton, 2007) shows the growing development in this area.

More and more companies mostly in the developed economies are conscious of the needs to introduce Internet-based technologies such as e-Business in their operations, due to the benefits of: saving transaction costs; increasing competitive sourcing opportunities; and enhancing inter-organisational coordination (Ho *et al.*, 2008). The situation is not the same in developing countries as there is evidence to suggest that the uptake of ICT elements within construction is quite low. For instance, Ofori (1994a) and Ofori (1994b) studies countries such as Tanzania, Ghana, Kenya and Peru shows how backward the status of ICT uptake is. In countries particularly in the West Coast of Africa the situation seems extremely poor (Oladapo, 2006). However, Isikdag *et al.* (2011) recently noted that the utilisation of e-business elements such as e-Procurement within construction in the developing countries is beginning to present opportunities for improving the traditional procurement processes by improving communication and coordination along with expanding the marketplace for both suppliers and buyers.

Ghana in recent times witnessed some attempts by researchers bringing to light the benefits of this under developed source of competitiveness in both retail and the financial sectors e.g. (Hinson, 2011, Hinson, 2010, Hinson and Sorensen, 2006). Increased participation in the construction industry in recent time has been observed as a result of the improvement of the economy, notably in the influx of foreign construction firms to the country utilising International Joint Ventures (IJVs) and different forms of alliances. Although these activities have been observed within the construction industry, there has not been any detailed assessment of how these foreign firms help the national economy and also improve the skills and capacity of the indigenous construction firms within the Ghanaian construction industry.

The initial review of literature relating to construction in developed and developing countries indicates that key improvements in infrastructure delivery and better performance could be achieved through ICT elements within the construction industry. ICT can be used to achieve many functions and performance can be improved in many ways. In the context of Ghana where foreign firms and schemes where foreign and local collaboration is sought, ICT has the potential to spearhead improvement in the industry. One of such key ICT elements that has not been fully investigated in the developing countries context in general and Ghana in particular is e-Business Technology (eBT). Therefore, this research attempts to develop this undervalued and currently under developed source of competitiveness within the construction industry in Ghana in a way sympathetic to the needs of a developing country.

Literature Review

Overview of the Ghanaian Construction Industry

The construction industry in Ghana grew by 20.0% in 2011; second after Mining and Quarrying which recorded the highest growth of 206.5% (GSS, 2012). The construction industry remains one of the major routes for generating or creating new wealth and value to meet other economic and social goals in Ghana. However, the industry is fraught with problems such as low productivity, lengthy pre-contract award procedures, corruption, and delays resulting in time and cost overruns and unsatisfactory quality of work (Ahiaga-Dagbui *et al.*, 2011). The construction industry in Ghana is characterised by a multiplicity of small firms (Ayarkwa *et al.*, 2010). Eyiah and Cook (2003) noted that the large construction firms consist mainly of foreign firms whilst the small firms are mostly Ghanaian indigenous businesses. According to van Egmond and Erkelens (2007) out of a total of 7095 construction firms registered in Ghana in 2002, ninety per cent were small contractors who belong to classes D3 and D4 and undertake less complex construction jobs with tender sums

up to one million US dollars. Ayarkwa (2010) claims that the total amount of work executed by these small contractors ranges between 10% and 20% of the total construction output. However, these small construction firms could also be accounting for over 50% (cost-wise) of all building materials production and nearly 80% of all short-term employment (including casual labour), especially for unskilled workers in many deprived communities in Ghana (Amoah *et al.*, 2011). Resource management is an important key in the successful implementation of any project however, Ayarkwa *et al.* (2010) note that the management of resources such as labour, finance, materials plant and equipment is carried out haphazardly in Ghana and therefore does not promote good performance and enhanced growth.

The following section highlights procurement in relation to infrastructure development and some inherent challenges and the way forward.

Infrastructure Procurement in Ghana

Procurement processes and procedures in Ghana have gone through a number of changes, with the main objective of reducing or at best eliminating corruption in the procurement of physical infrastructure, realising value for money, efficiency in the procurement process, and streamlining the procurement process as well as establishing sanity in the physical infrastructure procurement environment among others (PPA, 2010). These socio-economic realities have intensified the search for more innovative means of delivering public services, such as physical infrastructure, and the need to achieve better services (Anvuur *et al.*, 2006). This culminated in the passing of the Public Procurement Act, Act 663, in 2003 (PPA, 2003).

Although Act 663 provides equal opportunity and a level field for industry players and procurement practitioners, the entire procurement process is manually based and this has led to practitioners calling for the establishment of ICT elements such as e-business in order to eliminate issues concerning corruption, delays and communication difficulties and to focus on organisational efficiency and value-adding processes in the infrastructure procurement process (PPA, 2010). The potential of ICT elements for improving the quality of procurement services in the construction industry is generally acknowledged (Oladapo, 2006).

The next section discusses the contribution of construction to national economies and identifies the importance of ICT and ICT research works within the construction industries world-wide.

ICT in Construction

Construction is unquestionably one of the most significant industry contributors to the economy of many countries in terms of GDP and employment (Hampson and Brandon, 2004). The industry plays a vital role in producing the needed economic infrastructure; therefore, the industry holds strong indicators as how any given economy is moving. The construction industry is one of the biggest in the world. The contribution of this industry towards global GDP is approximately 10%. The industry is also a potential employment generator and provides work to almost 7% of the total of employed people in the world (Economy Watch, 2010). In a survey report published by PriceWaterHouseCoopers (PwC),

it was suggested that global construction would grow by 70% from \$7.2 trillion today to \$12 trillion by 2020 (PwC, 2011).

For example, in UK, construction represents 7% of GDP or £110 billion per annum of expenditure, some 40% of this being in the public sector, with central Government being the industry's biggest customer (Cabinet Office, 2011, UKCG, 2009). Scaling the discussion down to the contribution of SMEs within the construction industry in the UK, Griffith (2011) further established that Small and Medium Enterprises (SMEs), especially the repair and maintenance subsector employment activities accounts for approximately 49%, or £51 billion, of annual construction output and employing over half of the entire industry's workforce. These statistics shows the significance of the construction industry and its contribution to the national economy. However, the construction industry has been perceived as underperforming in terms of meeting its own needs and those of its clients (Ofori *et al.*, 2011). Hence, several industry review exercises were undertaken in the UK in particular. One such review that is relevant to this research was the Latham (1994) Report. Latham (1994) clearly identified the lack of meaningful integration within the construction industry with particular reference to project partners as a major impediment affecting the performance of the UK construction industry. The report recommended strongly the use of ICT systems to facilitate communications within the industry as a means of securing improve performance. This culminated in numerous strategic national and international initiatives to address the application of ICT within the construction industry, such as the Department of Trade and Industry (DTI, 2001) which recommended several changes to the future of construction including the use ICT. ROADCON (Hannus *et al.*, 2003) project offered a vision for ICT in construction in addition to a set of roadmaps across 12 thematic areas. Although the construction industry knows the importance of ICT systems, its uptake within the industry has been low whilst the potential of e-Business technology to increase productivity and efficiency has not been exploited (Vitkauskaite and Gatautis, 2008).

The above discussion shows that construction can perform better when ICT systems are exploited fully. However, from a developing countries perspective, Ghana in particular, ICT systems such as e-Business technology has been under developed, therefore, this research attempts to develop this technology in the construction industry in Ghana.

Sections 2.4 – 2.5 discusses relevant e-business definitions and e-Business technology transfer via International Joint Ventures (IJVs) to Developing Countries and e-business trends.

Definition of e-Business

In recent years, the use of the Internet technology for business has been on the increase mostly across manufacturing, retail, banking and other business sectors. The benefits of using Internet technology to conduct business have been well noted and researched, the emergence of Internet technologies has far-reaching ramifications on the way business is conducted (Gunasekaran and Ngai, 2008). This act of conducting business can be referred to as electronic business (e-Business) and in some research documentation it is also referred to as electronic commerce (e-Commerce). To gain an understanding of e-Business or e-Commerce, this research attempts to identify definitions of this terminology and then relate it to the construction business process.

There are ranges of definitions for e-business and e-commerce. From the work of Damanpour and Damanpour (2001), that e-Business and e-Commerce is any “net” business activity that transforms internal and external relationships to create value and exploit market opportunities driven by new rules of the connected economy. Similarly e-Commerce is referred to as business transactions by electronic means through the Internet and/or dedicated networks (Anumba and Ruikar, 2002). According to Damanpour and Damanpour (2001), The Gartner Advisory Group, a research and advisory services firm, describes e-Business in terms of a quantity rather than an absolute state of a company. They consider a business an e-Business to the degree that it targets the market opportunities of conducting business under new electronic channels, which revolve around the Internet. This is an acknowledgement that e-Business comes in many forms and can be implemented to a very small or large degree. It is also an acknowledgement that the “Internet” and the “Web” are essential components of an e-Business and e-Commerce strategy. Fundamentally, e-Business can be defined as the interchange of goods, services, property, ideas or communications through an electronic medium for purposes of facilitating or conducting business (Costello and Tuchen, 1998) cited in Cheng *et al.* (2001).

Laudon and Laudon (2000) cited in Ruikar and Anumba (2008) defines e-Business as the use of the Internet and other digital technology for organisational communication, coordination and the management of the firm, it encompasses these different adaptations. In the broadest possible terms, however, e-business is an electronic way of doing business (Anumba and Ruikar, 2008). Therefore, companies must participate in external business relationships by using computer interactions (i.e. transactions, support, marketing, communication and collaboration) by either business-to-business or business-to-consumer, if it is to be considered an e-business (Damanpour and Damanpour, 2001). Cheng *et al.* (2001) argue that e-business infrastructure is used to improve communication and coordination, and encourage the mutual sharing of inter-organisational resources and competencies. This was further corroborated in a general perspective by Muffatto and Payaro (2004) arguing that e-business is the process whereby Internet technology is used to simplify certain company processes, improve productivity, and increase efficiency. It allows companies to easily communicate with their suppliers, buyers, and customers, to integrate “back-office” systems with those used for transactions, to accurately transmit information, and to carry out data analysis in order to increase their competitiveness. To support the inter-organisational sharing of resources and competencies in a network structure, communication and co-ordination need to be maintained (Cheng *et al.*, 2001).

From the above definitions Kalakota and Whinston (1996) are of the view that the original meaning of e-Business is attached to the establishment of a computer network to search and retrieve information in support of business decision making and inter-organisational co-operation.

The above definitions clearly explain the importance and usefulness of e-Business technology in all economic sectors including construction. However, this technology is under developed in developing countries particularly in the Ghanaian construction industry. Therefore this research attempt to utilise International Joint Ventures (IJV) projects within the construction industry in Ghana as the medium of transferring e-Business technology to the Ghanaian construction industry.

The next section discusses e-Business technology transfer utilising IJV projects.

1.1 e-Business Technology Transfer via IJVs to Developing Countries

Kogut (1988), argues that joint venture (JV) is used for the transfer of organisationally embedded knowledge which cannot be easily blueprinted or packaged through licensing or market transactions. JVs are considered an important alternative to acquisitions, contracting, and internal development. According to Ozorhon *et al.* (2007) international joint venture is a joint venture involving two organizations contributing their equity and resources and at least one partner having headquarters outside the country where the joint venture operates. A significant degree of risk is involved in joint venture investments (Shen *et al.*, 2001). These notwithstanding, JVs have been successful in many industrial sectors. There is a general desire within many industries to sustain the growth of JVs. For example in construction, IJVs have turned out to be an essential sector within the global construction industry. It provides an effective basis for achieving a win-win situation and implementing synergistic teamwork whereby the majority of the large scale construction projects in many developing countries have been delivered by using IJVs established between international and local construction firms. In the context of this research, IJVs are considered as a mechanism to transfer organisational knowledge (Kogut, 1988, Lyons, 1991, Ozorhon *et al.*, 2007). This according to Maskus (2004) refers to any process by which one party gains access to a second party's information and successfully learns and absorbs it into the production function.

Form a Sub-Saharan Africa perspective particularly in the Ghanaian construction industry context, Ahiaga-Dagbui *et al.* (2011) studies potential risk to International JVs in developing economies with particular reference to the Ghanaian construction industry. The study identified two major risks factors. They explained the risks as follows: the major risk factors including the microeconomic and financial risk factors and joint venture partner problems. The client's ability to finance the projects and poor technical, financial and managerial capacities of Ghanaian construction firms were the main factors in this group. The minor risks factors include the availability and high cost of construction materials, issues of bribery and corruption, power supply problems and security. However, Ahiaga-Dagbui *et al.* (2011) note that using IJVs as vehicles for such competition and technology transfer have been beneficial to developing countries construction industries.

Sections 2.6 – 2.8 discusses trends of e-business, barriers and significance to the Ghanaian construction industry.

e-Business in the Ghanaian Construction

The uptake of e-Business in the Ghanaian construction industry has been relatively limited and ineffective as compared to other engineering sectors such as the automotive or the aerospace industry (Ruikar and Anumba, 2008). One or two major reasons have been alluded to by many authors and researchers; the fragmented nature of the construction industry and the one-off nature of its products (Cheng *et al.*, 2001, Ruikar and Anumba, 2008). The complex nature of construction project activity has been well documented by researchers and construction industry players. Predominantly, construction project activity involves several key participants, for example, contractor, subcontractors, architect, engineers, and quantity surveyors (Egbu *et al.*, 2008). The construction project environment requires team work, involving inter-organisational collaboration and dialogue. According to Ruikar and Anumba (2008) traditional communication and document exchange models were often manual and

hence slow. Issa *et al.* (2003) conducted a survey to assess the USA construction industry's attitudes and perceptions with respect to e-Business focusing on determining the level of adoption of e-Business within project management systems by general contractors. The following common trends of e-Business in construction (see figure 1) have been identified: Product Promotion, e-Procurement, Project Management, Project Collaboration and Online Tendering (Alshawhi and Ingirige, 2003, Issa *et al.*, 2003, Ruikar and Anumba, 2008).

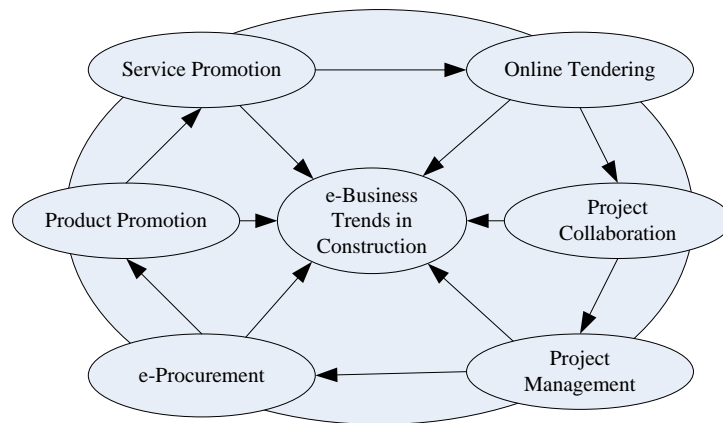


Figure 1 - e-Business Trends in Construction

Adapted from the discussions in Ruikar and Anumba (2008) and Issa *et al.* (2003)

Barriers to e-Business Initiatives in the Ghanaian Construction Industry

It is a commonplace to determine perceived barriers ahead of any findings to establish the exact barriers to the implementation of e-Business in the construction industry in Ghana. From Eadie *et al.* (2010a) and Eadie *et al.* (2007) enablers established in construction are considerably relevant for any modern day construction industry. On the contrary, the small nature of firms operating in developing countries construction industries, the identified barriers to a large extent may defer slightly even though some level of agreement is possible. From a developing country perspective Isikdag *et al.* (2011) carried out a web-based questionnaire survey to determine the key barriers to e-Procurement in the Turkish AEC Industry related to the technology, organisational strategy, market, human factors and processes. The findings of the survey include issues such as: technological infrastructure and related security; lack of ICT skills among staff; difficulties in re-engineering of business process for supporting the information flow in the e-Procurement process. These findings are similar to the result of the empirical analyses done on small-medium sized firms by (Love *et al.*, 2001). Vitkauskaite and Gatautis (2008) argue that the major barriers for increased uptake of ICT among SMEs are very much related to: a lack of resources; insufficient knowledge about ICT cost and benefits; absence of skills; as well as the prevailing traditions and culture in this sector. The situation in the Ghanaian construction industry may not be anything different from the works of Love *et al.* (2001) and Isikdag *et al.* (2011) as identified above. For example, (Owusu-Tawiah, 1999) cited in Ayarkwa *et al.* (2010) noted that the majority of Ghanaian contractors operating within the construction industry do not have sufficient funds and credit facilities and also lack appropriate technological capabilities, plant and equipment as well as key personnel to handle construction projects properly.

From the works of Eadie *et al.* (2007); Eadie *et al.* (2010a) and Eadie *et al.* (2010b) which was conducted in Northern Ireland and the UK amongst other things identifies infrastructure culture and other issues to consider critically as these issues have the tendency to derail implementation of e-Business within construction. As noted earlier Love *et al.* (2001) discovered among other things technical, financial, organisational and behavioural barriers to e-Commerce implementation in construction. However, in a more general view Ruikar and Anumba (2008) point out that general barriers to e-Business mainly fall into three categories, namely infrastructure, trust and reliability, and regulatory issues. Additionally, Issa *et al.* (2008); Ruikar *et al.* (2008); Wilkinson (2008) and Ismail and Kamat (2008) conducted scholarly studies on different aspects of e-Business in construction mainly from a developed countries perspective. From the available literature, the construction industries in developing countries have been completely left out in most of the referenced studies, nonetheless, it provides a theoretical framework and platform for the commencement of research into the application of e-Business technology within construction from a developing countries perspective particularly Ghana. Most studies on e-Business technology application in construction have been conducted on developed economies. However, in recent times there have been attempts to undertake similar studies within the Ghanaian economy. Hinson and Sorensen (2006) conducted a study into the application of e-Business within the non-traditional export sector principally arguing that the adoption of e-Business practices has benefit for small Ghanaian exporters' organisational improvement.

Arguably, this study by Hinson and Sorensen (2006) can be confirmed as the first in the context of e-Business within the economy of Ghana. Sørensen and Buatsi (2002) assessed the use of the Internet within the export business in Ghana. Further, Hinson *et al.* (2007) focused on the Internet use patterns amongst internationalising Ghanaian non-traditional exporters. Although, there is an acknowledgement that some amount of work have been done on e-Business technology transfer to the construction industries in developing countries and some different sector(s) within the economy of Ghana, the body of knowledge did not appear to have supported the fundamental necessities of e-Business technology transfer within industries in developing countries particularly the Ghanaian construction industry. This research in part therefore, attempts to address these fundamental barriers in furtherance to adding value to existing body of knowledge in the area of e-Business technology in the construction industry in Ghana.

Significance of e-Business Technology to the Ghanaian Construction Industry

As noted previously, e-Business has precipitated the move from traditional internally focused logistics and Supply Chain Management (SCM) models to new systems built on network-based, ICT-facilitated collaboration. This entails the sharing of critical and timely data and relevant information on the movement of goods as they flow from raw material all the way through to the end user. The net effect is end-to-end supply chain optimisation based on open communication between networks of project partners. According to Moodley (2003), e-Business could provide the building blocks for an integrated ICT system, including: (1) a network of project partners; (2) a single point of connection to all participants in the value chain and production network; (3) a common digital platform to facilitate seamless communication and transaction processes among project partners; and (4) real-time response capabilities to adapt to unplanned events in the value chain. Additionally, the construction industry in Ghana stands to gain capacity improvement in the general construction process by taking advantage of the trends identified in section 2.6

Research Methodology

This paper is primarily based on a literature review of the research topic as the basis for formulating a comprehensive method to undertake research into e-Business technology transfer within the Ghanaian joint venture construction projects. Literature has been drawn extensively from different sources, particularly in the areas of construction where the current status of the Ghanaian construction industry has been reviewed together with ICT application in other jurisdictions especially in the developed economies and e-business application in the construction business. The materials for this literature review for this paper have been largely drawn from journals, conference proceedings, industry reports, relevant books and websites.

Future work of this Research

Research into ICT elements such e-Business in construction especially within construction in developing countries provides enormous challenges therefore, extensive research on e-Business technology and application in construction will be undertaken as this research progresses. This is intended to address research potential and requirements in the area of e-business technology in the Ghanaian construction industry. Broadly, the aim of this research is to propose a framework for e-Business technology transfer to the construction industry in Ghana utilising International Joint Venture projects as a medium. This is essentially to improve the infrastructure procurement process and in order to achieve the aim of this research, a set of objectives have been formulated some of these objectives include assessing the structure of the construction industry, procurement practices and the development of local skills; exploring the use of e-business as part of ICT and general infrastructure. Other objectives of this study would be to identify key fundamental requirements for implementing e-Business technology within the construction industry in Ghana; to develop a framework for the adoption of e-Business technology in the Ghanaian construction industry to help improve performance and transparency in the procurement process. As this research progresses, these objectives will be continually refined to meet emerging issues within the confines of this research. This research will continue by undertaking a comprehensive literature review into the research areas as stated above. This will then be followed by interviewing major industry players and some documentary analyses. The framework for the adoption of the e-Business technology will then be validated within the construction industry in Ghana by utilising a focus group approach.

Conclusion

Although there is a limited amount of literature on general e-Business technology and its application in construction in developing countries, particularly Ghana, the issues discussed in the literature above show that e-Business possesses a great potential that is likely to impact positively on almost all construction procurement processes. In spite of some difficulties alluded to in the literature especially the slow uptake of e-Business technology, there is evidence that e-Business improves collaboration and communication among construction partners and professionals and also improves performance in a project lifecycle.

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