

AN ASSESSMENT OF THE LEVEL OF ADOPTION OF E-BUSINESS PRACTICES BY NIGERIAN CONSTRUCTION CONTRACTORS

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The development of e-business applications in the Construction Industry (CI) has improved significantly and it is perceived as a mainstream to improved information flow and productivity. However, not much has been achieved in developing countries like Nigeria. This study investigates the state of e-business technologies application in the Nigerian Construction Industry (NCI) supply chains. A survey of e-business practices among Nigerian Construction Contractors (NCCs) was conducted with the aid of a structured questionnaire. Descriptive statistics are used to analyse the data collected. The results showed that the use of e-business for construction project management is below 50% of all the areas investigated. Some of the most important challenges impinging on the development and adoption of e-business by the NCCs includes finance, security, manpower, training, cost, maintenance and obsolescence etc. others challenges include cyber crime (hacking, financial crimes, piracy sales of work and viruses) and privacy (anonymity, computer matching, spamming and flaming). The paper concludes that e-business can be improved through increase financial, security, and technical support to NCCs by the government and e-business service providers.

Keywords: e-business, e-business service providers, government, Nigeria.

INTRODUCTION

The Construction Supply Chain (CSC) is a lengthy process which may involve large numbers of skilled professionals and firms with much repetition of activities, heavy exchange of information and the accumulation of paperworks. These require close coordination to achieve good cost, time and quality performance (Toole, 2003). Information and Communication Technology (ICT) can facilitates the transfer of knowledge and information between project teams, enabling the development of new knowledge for innovation and assisting the Construction Industry (CI) to cope with the increasing complexity of projects (Ruikar *et al.*, 2005). Some benefits of ICT critical to the performance of the CI are the reduction of the time for data processing and communication among project team (Peansupap and Walker, 2005). This is because computer networks facilitate communication and collaboration among remote users to readily exchange information, spread benefits and make organizations to become global (De Lapp *et al.*, 2004).

This has generated a growing use of e-business (Rivard *et al.*, 2004) in the CI. Virtually all firms now use the Internet in parts of their supply chain program (Lancioni *et al.*, 2000). However, many firms still struggle with implementing and

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justifying e-business initiatives (Barua *et al.*, 2004) especially in developing economies. Such is the case in the Nigerian Construction Industry (NCI) where the use of ICT remained confined to basic application like word processing and data processing and no much of industry specific applications (Oyediran, 2005). Studies on e-business application in the NCI remain few and far between. This paper investigates the level of adoption of e-business and associated challenges.

LITERATURE REVIEW

E-Business capability is the ability of a firm to use Internet technologies to share information, process transactions, coordinate activities and facilitate collaboration with suppliers and customers (Devaraj *et al.*, 2007). The e-business process applies to three main types of relationships namely, Business-to-Business (B2B); Business-to-Client (B2C) and Business-to-Government (B2G) (Aranda-Mena, 2004). NOIE (2001) contends that B2B is considered to have larger impacts across the economy than B2C. Typically, B2B is about transforming the back office functions of firms to make them more efficient and this in turn impacts along the entire value chain of an industry. Therefore the focus of many firms is on ensuring the B2B transactions are operating effectively. The B2G e-business relationship is focused on improving the quality of government services to the business community through the rationalisation of licensing, compliance and enforcement activities (Aranda-Mena, 2004).

New e-business technologies facilitate quick information sharing and collaboration between downstream and upstream partners and enable companies to “trade inventory for information” (Dell, 1999). Examples include jointly developing demand forecasting (Aviv, 2001) and Vendor-Managed Inventory (VMI), also referred to as direct shipment or automatic replenishment (Kulp *et al.*, 2004). Timely information sharing helps speed up decision making and often results in shorter lead times and smaller batch sizes (Cachon and Fisher, 2000). Firms use the internet to improve clients’ relations and collaboration by providing easier access to information, developing more flexibility to respond to customer information requests, and speeding up the transaction time to shorten product cycles (Chen and Paulraj, 2004). Thus e-business technologies allow firms to create a seamless integration of enterprises in a supply chain, through providing accurate real-time information and the coordination of activities between business entities to improve efficiencies, productivity and competitive advantage (Devaraj *et al.*, 2007).

The benefits of e-business technology to construction firms include providing commercial efficiencies through more effective design and construction information management, procurement and contract management. Of particular importance are specific e-business technologies and applications that facilitate web-based project management and dissemination of accurate design data, online tendering and procurement processes and efficient contract management. This makes the CI ideally suited for e-business technology (London and Bavinton, 2006). Productivity improvements for the CI depend upon more efficient and effective information management (Davidson, 2004). E-business technologies have the potential to transfer complex design information accurately (Elliman and Orange, 2000) thereby eliminating data transfer error (NOIE, 2001) as well as minimising delays along the CSC; reduction in transaction costs; and e-bidding. The website creates an electronic auction market enabling firms to receive a wide range of competitive quotations from vendors (Weninger, 1999).

Establishing full concurrency in sharing information during the contracting, designing, engineering and construction processes are essential to enhance efficiency. Current Internet technology makes it possible to extend networks and individual capacity and offer the opportunity to enable virtual enterprises (Worst, 2009). However, the CI is at the very early stages of e-business adoption, and this lags the adoption levels of other industries (NOEI, 2003). The slow adoption rate may not be unconnected to the impediments peculiar to the nature of the CI (London, 2006). The low adoption is disturbing because of the critical role the CI plays in the overall economy in relation to employment and Gross Domestic Product and the flow on effects; its linkages to other sectors in terms of information flow and contractual relationships; and the significant investment of resources in ICT by government and leading players in the CI as they develop innovative e-business industry solutions (London, 2006).

Challenges to e-business adoption

The challenges to e-business adoption depend on the characteristics of the business such as the industry, business type and organisational culture (Aranda-Mena, 2004). Some of the underlying reasons for the slow adoption of innovative technology may include; the industry's conservativeness, high degree of fragmentation in both the procurement process and production systems, absence of management driven IT strategy (Catridge, 2002); low capacity utilization (Rebolj and Menzel, 2004); lack of awareness of the concept and benefits of e-business (Parish *et al.*, 2002); □informed resistance to innovation based on values and attitudes (Frank, Zhao and Borman, 2004);the perception of an insecure environment; the need for a regulatory and legal framework; lack of systems; (Bennett *et al.*, 2003) and market incentive, pressures, rewards and uncertainty regarding the financial returns from investments in various resources versus economic benefits (Veeramani *et al*, 2002).

The temporary nature of contractual relationships does impact upon e-business adoption in terms of risk management. The competitive nature of the construction markets and the level of integration of existing business processes between actors along the CSC are also factors impeding e-business in the CI (London, Chen, and Bavinton, 2005). Aranda-Mena and Stewart, (2005) find a number of major impediments including: privacy, trust, uncertainty of financial returns and lack of reliable measurement, fraud, lack of support and system maintenance. Similarly, London, and Bavinton, (2006) categorise e-business impediments into four including; perceptions and attitudes; compability of the innovation, market incentives (uncertainty regarding returns) and heterophilic and homophilic communication.

Characteristics of the Construction Industry (CI)

The CI is project-based and therefore contractual relationships are constantly forming and reforming as firms respond to projects. Thus Construction is disadvantageously mobile, shortermist/temporaneous and fragmented or disintegrated (Cornick, 1996). The CI is characterised largely by a sea of atomised, non-cohesive, fragmented Small and Medium Enterprises (SMEs) who are non-strategic actors (London, 2005). Collaboration is complicated by factors such as time and data losses during information exchange and misunderstandings because of ill-defined information and iterative negotiations when subtask activities conflict (Lottaz *et al.*, 2000). Thus information and communication gaps are perennial problems in the CSC (Vrijhoef and Ridder, 2007). Increased integration and coordination among different processes and parties is considered as one of the ways to solve most of the problems (Thabet, 2000). However efforts to automate information system across the CSC have been largely

unsuccessful (Cornick, 1996). But the internet has finally brought about a medium that can help fast track the total integration of processes with the growing use of automated tools for integrated management of projects (Testa, 2004).

The Nigerian Construction Industry (NCI)

The NCI is strategic to Nigeria's development efforts as the dominant contributor to capital formation and a significant contributor to the GDP (Anyawu *et al.*, 1997). Unfortunately, the NCI has been bedevilled by challenges including low demand and consistent low productivity and poor output over the years (Adeyemi *et al.*, 2005). The industry is made up of an organised formal sector comprising mostly Multinational Firms (MNFs) and an unorganised informal sector comprising mostly of Indigenous Firms (INFs). The few large firms, mostly MNFs which constitute just about 5% of the total number of contractors in the formal sector, control about 95% of the construction market by contract value, giving the INFs just about 5% share of the market (Oladapo, 2007).

ICT adoption in Nigeria faces challenges including erratic power supply, high cost of computer hardware and software and low capacity utilisation (Oladapo 2006). Power has been unreliable, leading to high production costs for firms, who are forced to procure and run their own power generating facilities (AfDB/OECD, 2004). The factors significantly impacting the level of ICT usage are either internal or external to the NCI. Some of internal factors include i.e., the type of business (whether contracting, consulting or academic), management knowledge and perception of the benefits of ICT were significantly correlated with the level of ICT use in the NCI. However, none of the external factors were significantly correlated with the level of ICT use. Other impediments are fear of virus attacks and high rate of obsolescence of ICT software and hardware (Oladapo, 2007).

METHODOLOGY

Research Design; when a study is designed primarily to describe what is going on or what exists then survey research design is considered very appropriate. Questionnaire survey was adopted because it was deemed more appropriate. The questionnaires were delivered by hand to the respondents who fill them out at their own convenience. Given the Nigerian environment mailed questionnaire is considered inappropriate hence direct delivery by hand was chosen.

Sampling Design and Procedure; The target population of this research are the contracting and subcontracting firms in the major Nigerian cities of Abuja, Lagos and Port Harcourt drawn from both MNFs and INFs. Convenience and purposive sampling techniques which involves obtaining information from accessible firms was used for the administration of data collection instrument. The sample size for this research is 100 construction firms. Total number of 120 questionnaires was administered and a total numbers of 65 valid questionnaires were returned. Most respondents were given the questionnaire at their offices while a fraction of the respondents were given at their construction site.

Method; primary data were collected using structured questionnaire. The questionnaire is structured into 29 questions grouped into four (4) sections. The first section details the background information of respondents' companies. The second section deals with information and communication hardware and software of the firms. The third section deals with practices of e-business by the contractors. And lastly the fourth section deals with information on challenges confronting e-business practices.

Data Analysis; The study uses descriptive statistics to analyse the data. Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. Together with simple graphics analysis, they form the basis of virtually every quantitative analysis of data. With descriptive statistics the study describes what is or what the data shows.

RESULT

About 43.2 % of firms investigated use the internet for business transactions. Only 10.8% of firms have website, while 29.7 are in the process of having a website (see table 1). For project collaboration only 10.8% use the internet, 51.4% use physical meetings. The most popular virtual conferencing is teleconferencing 18.9%, 37.8% have no experience of virtual conferencing (see table 1).

Table 2 e-business applications I

s/no	Type of network	%	website	%	project collaboration	%	Virtual conferencing	%
1	No network	48.7	No website	43.2	Physical meetings	54.1	No eonferencing	40.5
2	Internet	43.2	In the process of development	29.7	All of the above	24.3	Teleconferencing	18.9
3	Intranet	5.4	Limited connectivity /service	16.2	Exchange of mail/courier	10.8	Audio conferencing	16.2
4	Extranet	2.7	Website	10.8	Extranet/internet	10.8	Net meeting	13.5
5	Total	100.0	Total	100.0	Total	100.0	Video conferencing	10.8
6	-	-	-	-	-	-	Total	100.0

Table 3 e-business application II

S/no	e-purchasing	%	e-tendering	%	e-tracking	%	Internet marketing	%
1	Never before	40.5	Never before	37.8	Never before	40.5	Mailing potential clients	51.3
2	Once in a while	37.8	Very rare	21.6	Once in a while	32.4	Mailing newsgroup	5.4
3	Very often	16.2	Once in a while	18.9	Very often	18.9	Web publishing	27.0
4	All the times	5.4	Often times	13.5	All the times	8.1	No internet marketing	16.2
5	total	100.0	Very often	8.1	Total	100.0	Total	100.0
6	-	-	Total	100.0	-	-	-	-

For e-purchasing only 5.4% use the e-purchasing all the time while 37.8 % have no experience of epurchasing. E tendering is used by only 22.6% of the firms. About 50% of the firms use etracking for projects managemament. In terms of internet marketing, emailing clients (27%) and consulants (24.3%) are most popular while 16.2% have no experience with internet marketing (see table 2).

About 70% use either e-mail or fax to communicate project report, while 21.6% use the post. Only 2.7% of the respondents use Electronic Fund Transfer (EFT) as most payments are in paper cheques (86.5%). Only popularity of e-payments 35.1% have never used it before while only 2.7% use constantly. About 10.8% use email for quotation (see table 3).

Table 4 e-business application III

S/no	Project report	%	payment mode	%	e-payment	%	subcontractor quotation	%
1	E-mail	62.2	Paper cheque	86.5	Once in a while	43.2	Physical contact	54.1
2	Mail/post	24.3	Cash	8.1	Never before	35.1	Print media	18.9
3	Fax	8.1	Electronic fund transfer	2.7	Sometimes	18.9	E-mail	13.5
4	E-conferencing	2.7	Others	2.7	All the times	2.7	Electronic media	10.8
5	Others	2.7	Total	100.0	Total	100.0	Web publishing	2.7
6	Total	100.0	-	-	System	2.7	Total	100.0

Table 5 e-business applications IV

S/no	headquarters communication	%	internet searching	%	Internet information sharing	%
1	Fully network	43.2	Specialist materials	37.8	E-mail	56.8
2	Limited network	27.0	Foreign materials	29.7	Net telephone	18.9
3	Non connectivity	21.6	All materials	13.5	Web publishing	10.8
4	Poor connectivity	8.1	Some materials	13.5	Net paging	8.1
5	Total	100.0	No material at all	5.4	Net voicemail	2.7
6	-	-	Total	100.0	Net faxing	2.7
7	-	-	-	-	Total	100.0

Table 6 challenges for e-business

s/no	General	Mean	Security	Mean	Medical	Mean	Privacy	Mean
1	Finance	8.5	financial crime	7.31	Radiation exposure	7.25	Anonymity	7.53
2	Security	8.33	Viruses and worms	7.31	Job stress	7.11	Computer matching	7.14
3	Maintenance	7.89	Hacking	7	Eye strain	6.25	Spamming	6.78
4	Training	7.78	Software piracy	6.94	Damage muscles	6.19	Flaming	6.33
5	Cost	7.44	Unauthorised use of work	6.64	-	-	-	-
6	Obsolescence	7.36	-	-	-	-	-	-
7	Manpower	7.31	-	-	-	-	-	-
8	Computer crash	7.31	-	-	-	-	-	-
9	Power supply	6.28	-	-	-	-	-	-

Only 43.5 % of sites have internet connection to headquarters of firms. About 35% of internet searches are for specialist materials. The email is most popular means of information sharing (54.1%) among firms (see table 4).

Challenges of e-business in construction; The result indicates that finance (M=8.5) related challenges are the most important challenges impinging on the development and practices of e-business by the NCCs. Other important challenges are security (M=8.33), maintenance (M=7.89), training (M=7.78), cost (M=7.44), and obsolescence (M=7.36) etc.

In terms of security, financial crimes, Viruses and worms and Hacking are the most important. Some of the most important privacy challenges affecting the development and practices of e-business among construction contractors include anonymity, computer matching, spamming and flaming. The most important medical challenge that affects the growth and development of e-business among construction contractors includes job stress, damage muscles, eye strain and radiation etc.

DISCUSSION

Security challenges like computer hacking is a global problem not limited to Nigeria alone. Privacy of many firms has been compromised besides cyber financial crimes resulting in the lost huge sums of money negatively affect the practices of e-business in Nigeria. This has discouraged some of them from adopting e-business. Additionally, viruses and worms are another challenge faced by e-business practices. This is responsible for crashing computer and the lost of valuable information. Training and manpower development are critical for successful implementation of e-business practices. The cost of effective training and wages that the manpower demand is hardly within the reach of most firms, this constitutes a constraint to e-business practices. Maintenance is important; to maintain internet or any information technology is very expensive. This have indeed discouraged many NCCs from venture into e-business program. Piracy is yet another challenge faced in e-business practice.

This finding agrees with similar studies by Aranda-Mena, and Stewart, (2005) in Australia. Thus governments and market leaders have a significant role in understanding the real challenges faced by the groups of firms which supply to them and are highly reliant upon them. It is not only an understanding but an ethical position to develop supportive strategies to enable change in the CI (London, and Bavinton, 2006). One of the most severe challenges to e-business practices in Nigeria is public power instability or accessibility inefficiency and high cost of private sourcing. This is very important in any country that wants its country to be proficient in the use of internet. Electricity plays a vital role in e-business practices and the poor public electricity in Nigeria is a serious concern. This finding is supported by the findings of Oladapo (2006, 2007). Power has been unreliable, leading to high production costs for companies, which are forced to procure and run their own power generating facilities (AfDB/OECD, 2004).

However some factors to assist in the process of e-business adoption have been suggested including- rewards, incentives and initiatives by governments including seeding programs, investment incentives and tax rebates etc (NOIE 2001); managerial characteristics or philosophy of the firms (Gray and Lawless, 2002); culture of the firm (Elliman and Orange, 2000); SMEs characteristics related to flexible specialisation (de Berranger and Meldrum, 2000). It is the flexibility of SMEs that can make adoption of ICTs easier, compared to larger more bureaucratic and inflexible

firms (de Berranger and Meldrum, 2000). The governments and market leaders have a significant role in understanding the real challenges and to develop supportive strategies to enable change in the CI (London, and Bavinton, 2006).

CONCLUSIONS

The paper finds that e-business adoption is at its infancy stage in NCI. There are less than 40% adoption in all the areas investigated such as e-procurement, e-purchasing e-tendering e-conferencing e-payment e-tracking and e-marketing etc. Only few NCCs use internet in their day to day business transaction like sending e mails. The Managing of construction projects is achieved by physical contact and paper works. The adoption of e-business among the NCCs is challenged by lack of Finance, Manpower, Training, Security, Maintenance, Cost, Obsolescence, Computer crash and Power supply etc. The NCCs working with banks and other stake holders must work with the government financial support to hasten adoption of e-business in the construction industry. There are needs for the government to develop supportive strategies to enable change in the industry including providing incentives like subsidies. The ICT service providers working with regulators and construction stakeholder must allay the threats of security in the cyberspace. Accordingly, project Web sites must have a strong security system to limit access and prevent breaches. Security must be put in place to curb cyber crime so that contractors will be encouraged to be practicing e-business. E-business service providers may support the NCCs to hasten adoption by providing free training and technical support. Effective manpower should be pursued through human capacity development seminars, work shops and symposia for contractors. In addition Government must invest in ICT support programme for the NCI. And finally there is urgent need for Government to improve power supply so as ease the cost of adoption.

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