e-BUSINESS USE IN THE GHANAIAN CONSTRUCTION INDUSTRY: THE DRIVERS

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This paper reports on a questionnaire survey undertaken to evaluate e-Business use in the Ghanaian construction industry. The views of construction professionals and local construction firms in Ghana were consulted in this questionnaire survey. Additionally, the survey is intended to show evidence of e-Business activities and professional groups within the industry likely to use e-Business. The initial result shows that, there are different levels of e-Business initiatives and understanding within the industry. Further, e-Business related activities are done in haphazard manner due to low technological capacity. This evaluation provides a unique opportunity to assess the capacity of contractors and other professional groups for e-business technology transfer either through joint ventures or collaborations, considering the significant amount of investment and foreign construction firm activities within the Ghanaian construction industry.

Keywords: e-Business, construction industry, professional groups, technological capacity

1. Introduction

Recent technological advances have improved performance within construction industry (Adzroe and Goulding, 2004, Goulding and Lou, 2013). Technological issues within construction have become ever more critical and ranging debates among researchers and construction industry professionals are still underway at different levels within the construction sector. For example, Smyth (2010) recently pointed out that, there have been several innovative initiatives within construction in many countries in the last two decades to introduce technological reforms to improve industry performance.

Substantial evidence in technology transfer literature suggest that technological know-how relating to developing countries construction industries is similar to the situation in Ghana. Technology transfer remains an essential component in the development of the construction industries in developing countries (Carrillo, 1996). One of the technologies that has the potential to achieve significant improvement in performance in the construction industry is 'e-business'. E-Business is this context refers to exploiting the capabilities of ICT and the Internet to aid business process to be more efficient and responsive. Evidence from literature suggest that despite the novelty and the little use of e-Business application within the construction industry in developed economies, there is a strong link to substantial research in the sector (Aranda-Mena and Stewart, 2004, Chen *et al*., 2011). On the other hand, empirical evidence on e-Business in construction in developing countries is scant. Therefore, there is the need for developing countries construction industries like Ghana to reform technologically and take advantage of the opportunities offered by e-business in order to attract the needed investment from their counterparts from developed countries. The way forward for the Ghanaian construction industry is to develop the capacity and capability of industry players to enable them to take advantage of the influx of foreign construction firms seeking partnerships and joint ventures in Ghana. Adzroe and Ingirige (2013) reported recently that utilising e-business in construction activities can bring substantial benefits to construction industries in developing countries.

In this regard, this research was developed to evaluate e-business use in the Ghanaian construction industry and also to assess the capacity of contractors and other professional groups for e-business technology transfer via joint ventures. The paper first presented a brief literature review followed by the research method adopted. It then presented the findings of the research and discusses based of e-business activities, drivers, impact and barriers. The paper concluded by presenting a way forward following from the findings of the survey.

2. Brief Background of the Construction Industry in Ghana

The construction industry in Ghana is characterised by a multiplicity of small firms (Ayarkwa *et al.,* 2010). According to van Egmond and Erkelens (2007) out of a total of 7095 construction firms registered in Ghana, ninety per cent (90%) are small contractors who belong to lower classes and undertake less complex construction jobs with tender sums up to one million dollars ($1,000,000.00). This was confirmed by Amoah *et al.* (2011) in their work "factors affecting construction performance in Ghana: the perspective of small-scale building contractor". Industry reports indicate that majority of Ghanaian contractors 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, Owusu-Tawiah (1999) cited in (Ayarkwa *et al.,* 2010). This goes further to support the qualitative evidence provided by Ofori (1984) many years ago where key issues such as delay in payment to contractors for work done, lack of credit facilities and poor communication structure were identified. On the other hand, GBN (2009) also identified outmoded equipment, low level of trained personnel and lack of qualified supervision as some of the nagging problems confronting local contractors operating in the construction industry in Ghana. Based on the work of Cairns (1992), Ayarkwa *et al.* (2010) argued that construction activity is increasingly becoming highly technical and sophisticated with high standards of quality and specification arising from the development of new technologies, the growing sophistication of employers or clients and increasing competition across the industry. Issues of technological know-how and personnel development are concerns engaging industry practitioners and government discussions in recent time.

3. The Current State with Regard to e-Business in Construction

e-Business was originally coined by IBM in 1997. IBM explained e-business to mean the value "customers derive from network computing" (IBM, 1997). Since then several definitions of e-Business emerged. For example DTI 2000 believes that it is the utilisation of ICT facilities in collaboration with the internet to processes of any business including construction. According toAranda-Mena and Stewart (2004) and Li (2007) the terms e-business and e-commerce have created misconceptions. They explained that the misconceptions include the lack of understanding of the difference between 'e-business' and 'e-commerce'. e-Commerce is essentially a part of e-business that is concerned with financial transactions and therefore does not require shared or redesigned

business processes. Typically, e-business is anchored on the capabilities of ICT facilities to thrive and this has been demonstrated in many economic sectors (Aranda-Mena and Stewart, 2004, Li, 2007). e-Business essentially has the potential to streamline organisations processes through integration thereby enhancing the traditional processes (Ruikar and Anumba, 2008). e-Business aims at ensuring optimisation of communication and sharing information without making any reservation of the traditional barriers that exist between design, engineering and construction within the construction industry (Worst, 2009). It is obvious that e-business has a solution to fragmented and geographical barriers within construction industries (Oyediran and Odusami, 2005, Worst, 2009).

Drivers, impact and barriers are important aspect of e-business implementation. Drivers and barriers to e-business have been identified in literature. For example, previous studies in the US, Australia and Italy (Minahan and Degan, 2001, Davila *et a*l., 2003, Hawking *et al*., 2004, Ronchi *et al*., 2010) have ranked these drivers and barriers for the general procurement of goods and services. Eadie *et al*. (2007) in previous research, ranked the drivers and barriers to e-procurement from a construction contractor's perspective in the Northern Ireland public sector. For the purpose of this paper and in the context of the Ghanaian construction industry: drivers of e-business are those factors that encourage and promote e-business implementation: impact of e-business on the other hand, is the ability to quantify gains, opportunities and benefits to an organisation: whilst barriers to e-business are factors considered as impediments to e-business adoption.

3.1 e-Business Enabling Technologies

From literature, it has been pointed out that e-business requires adequate technologies to survive. Within construction, there are several attempts to harness the capabilities of e-business technologies to provide innovative solutions, smooth partnering principles, easy global procurement and a shift in the image of the construction industry from labour workers to professional information controllers (Perera *et al.*, 2012). Perera *et al.* (2012) discussed the importance of enabling technologies for the conduct of e-business activities within construction. They identified two main technologies namely: cloud computing and BIM as recent e-business technologies, in complement with web-based project management software provided a platform from which e-business activities within the construction industry can be utilised, maximised and maintained. It is important to know also that technologies such as the Internet and CAD are identified alongside cloud computing and BIM as e-business enabling technologies within construction. This notwithstanding it is important to understand the capabilities and roles of this technologies and their tangible effects on construction industry activities most especially when considering it from developing countries perspective particularly Ghana where these technologies understandably have not fully attained maturity.

This survey is about e-business usage in the Ghanaian construction industry. To take this further, detailed review of literature and synthesis in the area of e-business activities and enabling technologies will assist in bringing into perspective the role of technology in supporting e-business initiatives and activities. The details of the survey analysis and findings within the context of the Ghanaian construction industry have been presented.

4. Research Method

A questionnaire survey was conducted to investigate the usage of e-business in the Ghanaian construction industry. Based on the spread of construction firms in Ghana, the country has been divided into three (3) zones based on the advice and assistance offered by the association of building and civil engineering contractors of Ghana (ABCECG). To obtain adequate view of the subject matter, a total number of 105 questionnaires were distributed through the offices of the ABCECG to the three (3) zones to contractors who were randomly drawn from each of the three (3) zones. The questionnaire consisted of 6 sections: Background Information of Respondent Organisations, e-Business in Respondent Organisations, IT Investment Advice and e-Skills Development, Drivers, Impact and Barriers of e-Business, Improvement of e-Business and Future of e-Business in Respondent Organisations. A total number of 67 questionnaires were returned. Out the 67 returned 10 were incomplete therefore not suitable to be used for analysis. However, 57 questionnaires representing 54% was found accurately filled and complete, hence useful for analysis. This response rate is considered as hugely successful (Hoxley, 2008). Figure 1 shows the organisations that participated in the questionnaire survey exercise. Total number of 16 building contractors, 10 architectural firms, 7 property developers, 5 civil engineering contractors and 9 quantity surveying firms allowed staff at different management levels to participate in the questionnaire survey.

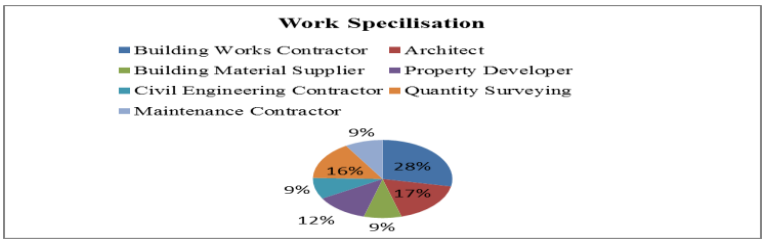

Figure 1: percentage of respondent organisations

The participating organisations varied in size as shown in figure 2. The largest type in this survey employed between 10-49 workers (46%), followed by 1-9 (19%) and 50-249 (19%) respectively and 250 and over representing 16% of the organisations that participated in the survey.

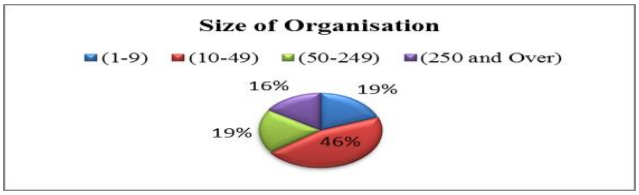

Figure 2: Percentage of Size of Respondent Organisations

The data collected from the questionnaire survey was analysed using SPSS software package. Descriptive statistics was used to analyse details of the data collected. According to (Pallant, 2010) descriptive statistics describes the basic characteristics of the data in a study. It provides summary about the sample in addition to simple to understand graphs. Also it provides what the study shows (Najimu, 2011). Descriptive statistics was adopted to provide a clear understanding of the trend of e-business usage in the Ghanaian construction industry.

5. Analysis and Discussion of Survey Data

5.1 e-Business in Respondent Organisations

For e-business activities in the respondent organisations, respondents indicate the degree to which design activities (drawings) are computerised and exchanged electronically. Results from cumulative cross tabulation indicate respondents from architectural practice (architects) are the most to undertake this activity. For example, 70% of architects agreed to compress design documents and send them electronically using the internet. This is followed by property developers; a little over 56% confirmed undertaking this e-business activity. This is a confirmation that both architects and property developers are the most professional groups likely to use this activity (design). These results from both architects and property developers may require further investigation to determine the volume or figures for such e-business activity. Design activity is predominantly a core competence of both architects and property developers within the construction industry in Ghana. On the other hand, contractor categories such as civil engineering, building materials suppliers and building works results indicate they use less design activity within the construction industry in Ghana, as shown in Table 1. For example, just a little over 37% of building works contractors agree to use this activity, whilst civil engineering contractors and building material suppliers recorded 40% equally. Quantity surveying is the least professional group within the construction industry in Ghana that show interest in this activity, only 33% indicate they use design activity. These results confirm the fact that in the Ghanaian construction industry, design activity is completely done separately from building the facility hence; contractors are not part of the design solution.

Table 1: e-Business in Construction Organisations in Ghana

Cumulative Cross Tabulation of e-Business Activity (Design)												
Design Activity	None		Low		Medium		High		Total		Cum(NL) %	Cum (MH)%
	No	%	No	%	No	%	No	%	No	%		
Building Works Contractor	3	18.75	7	43.75	4	25	2	12.5	16	100	62.50	37.50
Architect	1	10	2	20	2	20	5	50	10	100	30.00	70.00
Building Material Suppliers	2	40	1	20	1	20	1	20	5	100	60.00	40.00
Property Developer	1	14.3	2	29	3	42	1	14.3	7	100	43.30	56.30
Civil Eng. Contractor	2	40	1	20	1	20	1	20	5	100	60.00	40.00
Quantity Surveying	2	22.22	4	44.44	2	22.22	1	11.11	9	100	67.00	33.00
Maintenance Contractor	1	20	2	40	1	20	1	20	5	100	60.00	40.00

From cumulative cross tabulation analysis of internet technology (see Table 2) in the Ghanaian construction industry, results indicate amply that there is high presence of internet within the construction industry in Ghana. For example, the entire respondent organisations surveyed, in exception of maintenance contractors who recorded lower that 50%, all the other organisations agree to have internet. However, it is not clear from the survey results if the internet is actually supporting their e-business initiatives and their core business activities. These results can be linked to the availability of some basic technological infrastructure for e-business initiatives in Ghana.

Table 2: e-Business Technology - Internet

Cumulative Cross Tabulation of e-Business Technology (Internet)												
Internet	None		Low		Medium		High		Total		Cum(NL) %	Cum (MH)%
	No	%	No	%	No	%	No	%	No	%		
Building Works Contractor	1	6.25	4	25.00	9	56.25	2	12.5	16	100	31.25	69.00
Architect	1	10.00	2	20.00	2	20.00	5	50.00	10	100	30.00	70.00
Building Material Suppliers	1	20.00	1	20.00	1	20.00	2	40.00	5	100	40.00	60.00
Property Developer	1	14.29	1	14.29	2	28.57	3	42.86	7	100	28.58	71.43
Civil Eng. Contractor	1	20.00	1	20.00	1	20.00	2	40.00	5	100	40.00	60.00
Quantity Surveying	2	22.22	1	11.11	1	11.11	5	55.56	9	100	33.33	66.67
Maintenance Contractor	1	20.00	2	40.00	1	20.00	1	20.00	5	100	60.00	40.00

5.2 IT Investment Advice and e-Skills Development

Figure 3 shows general outlook of IT investment obtained by the respondent organisations. 51% of the various organisations procured IT investment advice through the assistance of professional IT service provides as against 39% who depend on their IT department for IT investment advice. These organisations may fall within 50-250 and over categories as shown in figure 2. Results indicate 7% and 4% obtained advice through university and government or third part recommendations.

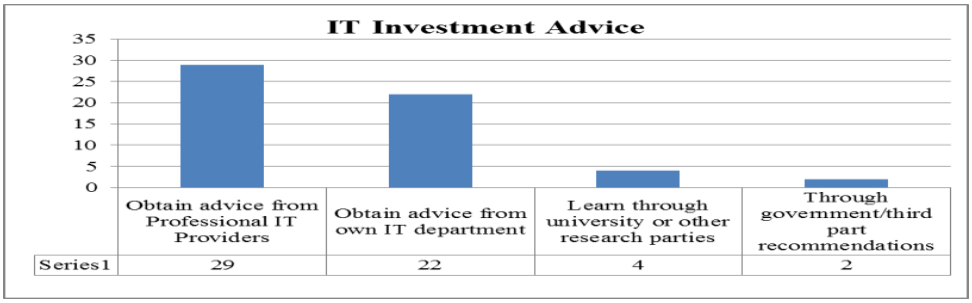

Figure 3: IT Investment Advice

5.3 Drivers, Impact and Barriers of e-Business in the Ghanaian Construction

5.3.1 Drivers

Results indicate reasons respondent organisations engages in e-business. As shown in figure 4, as many as 36 of respondent organisations confirm that their main driver of e-business is the competitive advantage it offered. Other variables like customer expectation, competitor engage in e-business and supply chain expectation received mixed responses as indicated in figure 4. These results underscore the fact that there is a growing interest and awareness of e-business within the Ghanaian construction industry.

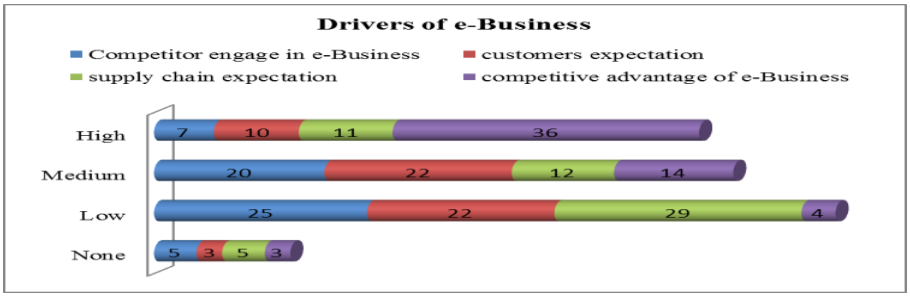

Figure 4: Drivers of e-Business

5.3.2 Impact of e-Business

Table 3 shows respondent organisations ranking the following and their influence on the decision of implementing e-business in future to enhance their business activities. Respondents ranked growth of revenue as the most influential factor offered by e-business followed by quality of products and efficiency of business processes in second and third positions respectively as the three most important influential factors offered by e-business. As an immature technological industry, their ranking reflects offerings of e-business that in their view would support construction business activities.

Table 3: Ranking of Impact of e-Business in the Ghanaian Construction

Impact	N+L Cumulative *f*		M+H Cumulative *f*		Ranking Based on Cum *f* M+H
	Cum *f*	Cum %	Cum *f*	Cum %	
Growth of Revenue	0.23	14.10	1.23	86.00	1st
Efficiency of Business Processes	0.12	7.00	1.36	93.00	3rd
Procurement Cost of Supplied Goods	0.35	22.80	1.41	77.10	4th
Quality of Products	0.34	22.80	1.34	72.20	2nd
Quality of Customer Service	0.36	33.40	1.85	66.70	15th
Productivity	0.52	47.40	1.90	52.60	16th
Management & Control	0.19	12.30	1.65	87.70	10th
Accounting & Adm	0.34	24.60	1.69	75.50	11th
Internal Organisation Relationship	0.29	24.60	1.76	75.50	13th
Staff Training	0.27	17.60	1.51	82.40	7th
Market Research	0.25	15.80	1.56	84.30	8th
Innovation	0.31	26.30	1.73	73.70	12th
Research & Development	0.22	29.90	1.50	70.10	6th
Time & Cost Savings	0.60	52.60	1.92	47.40	17th
Organisational Innovation	0.13	8.80	1.49	91.30	5th
Competitive Advantage	0.51	43.80	1.81	56.10	14th
Expansion of Partnership	0.24	19.30	1.56	80.70	8th
Visibility to Supply Chain	0.30	22.80	1.60	77.20	9th
Improving Collaboration	0.75	64.40	1.94	31.60	18

N=None L=Low M=Medium H=High Cum *f*=Cumulative frequency

5.3.3 Barriers to e-Business Implementation

Respondent organisations were requested to identify the level of influence of the following barriers (see Table 4) of implementing e-business within the Ghanaian construction industry. Considering the most ten influential barriers to e-business implementation in the Ghanaian construction industry as indicated in Table 3, the respondent organisations ranked lack of research and development in IT as the most influential factor followed by lack of electric power supply, legal barriers in that order.

Some of the identified barriers appear to have direct bearing on e-business development within developing countries construction industries.

Table 4: Ranking of Barriers of e-Business in the Ghanaian Construction

Barriers	N+L Cumulative *f*		M+H Cumulative *f*		Ranking Based on Cum *f* M+H
	Cum *f*	Cum %	Cum *f*	Cum %	
Cost of Investment	0.29	19.3	1.64	80.70	13th
Resistance to Change	0.30	21.10	1.61	79.00	12th
Con in Using New Tech	0.19	14.10	1.53	86.00	9th
Lack of IT Skills	0.12	7.00	1.20	93.00	5th
Legal Barriers	0.13	8.80	1.18	91.30	3rd
Interface with other systems	0.29	17.50	1.27	82.50	8th
Security of Data Transaction	0.14	8.80	1.23	91.20	7th
Changeable IT Needs	0.21	14.00	1.19	86.00	4th
Modification of Legal System	0.19	14.10	1.57	86.00	10th
Lack of Power Supply	0.15	10.60	1.15	89.50	2nd
Basic Competence in IT	0.50	45.70	1.73	54.40	14th
Availability of Professional Software	0.21	14.00	1.21	85.90	6th
Cultural Influence	0.27	22.80	1.60	77.20	11th
Socio-economic Problems	0.29	24.60	1.78	75.40	15th
Lack of R&D in IT	0.12	7.00	1.12	93.00	1st

N=None L=Low M=Medium H=High Cum *f*=Cumulative frequency

5.4 Improvement of e-Business

Results indicate in figure 5 shows that almost all respondent organisations agrees that to improve e-business implementation with regards to internal resources, there should be more investment funds, more expenditure in IT infrastructure, increase IT working staff, more senior management involvement and better training for working staff.

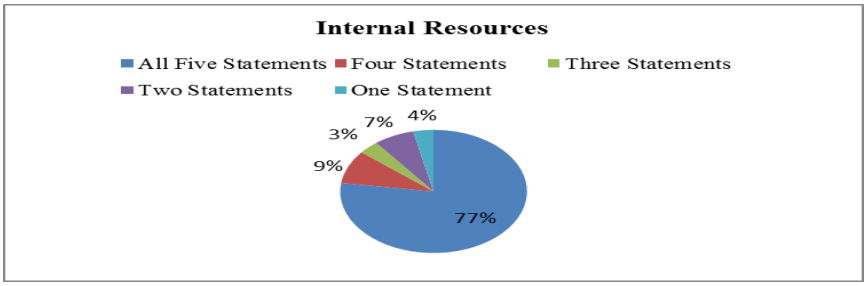

Figure 5: Improving e-Business Implementation

Figure 6 shows respondent organisations heavily agrees that improving e-business with regard to business process requires automation of business process, integration of different business processes, reengineering business processes and the connection of e-business value to business performance.

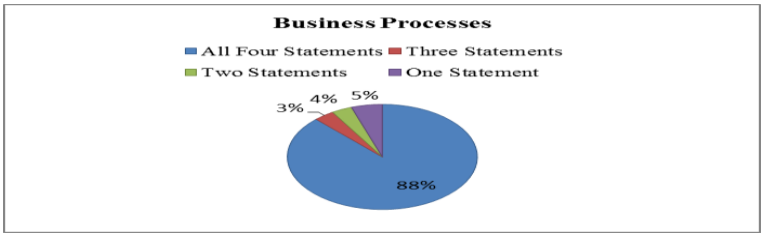

Figure 6: Improving e-Business with Regard to Business Processes

5.5 Future of e-Business in Respondent Organisations

Results from figure 7 indicate organisations willingness to commit resources for future investment in e-business. For example, out the 57 organisations surveyed, 22 agree to commit resources between 6-12 months, 10 plans to do investment in e-business between 19-24 months whilst 8 organisations believe to invest in e-business between 13-18 months. 12 respondent organisations indicate no plan for investment in e-business.

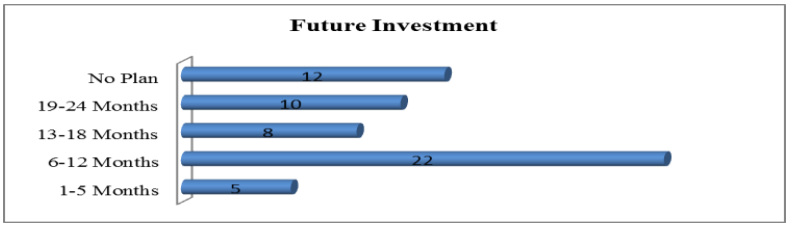

Figure 7: Organisation's Commitment to e-Business

6. Conclusion

This paper has evaluated e-business use in the Ghanaian construction industry and gauged the e-business activities amongst the various key players within the construction industry in Ghana in line with CIB Task Group 83 worldwide survey on e-Business in the construction industry. The study was conducted using questionnaire survey administered to different professional groups within the construction industry in Ghana. Findings of this study reveal different levels of e-business activity amongst key players within the construction industry in Ghana. For example, architects are found to undertake e-business activity in the area of electronic transfer of design documents followed by property developers. However, this activity is not found popular amongst contractors and other professionals like quantity surveyors. It is also evident that all the organisations that participated in this research have access to the Internet, this suggest that there is future for e-business initiatives and

activities based on this common platform to launch e-business applications. Investment advice towards e-business vary, majority of the organisations sought investment advice from IT service providers whilst others obtain advice from own IT department or from third party recommendations. Drivers for e-business implementation may vary depending on the organisation type; results reveal most of the organisations believe e-business can bring about competitive advantage. In the context of the Ghanaian construction industry organisations ranked *growth of revenue* as the most influential factor offered by e-business followed by *quality of products* and *efficiency of business processes*. On the other, they identify *lack of research and development in IT* as the most influential barrier followed by *lack of electric power supply* and *legal barriers* to e-business implementation. They indicate that to implement and improve e-business organisations should provide adequate investment in IT infrastructure and staff development. Indications from tables 1 and 2 suggest that there is adequate capacity within the construction industry in Ghana for e-business technology transfer opportunities. This study will further inform the future trend of e-business in the Ghanaian construction industry.

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