

**A STUDY OF E-BUSINESS TECHNOLOGY
TRANSFER VIA FOREIGN DIRECT INVESTMENT IN
THE GHANAIAN CONSTRUCTION INDUSTRY**

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Dedication

This thesis is dedicated to my mother, Cecilia
Yaasihor Yawa Addo

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To God be the Glory

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Declaration

I declare that the research in this thesis was undertaken by me in accordance with the University of Salford requirements for the award of a PhD degree by research. Prior to submission, some research findings were published in a report and as refereed conference papers (see Appendix - I).

No part(s) of this thesis has previously been submitted to the University of Salford or any other institution for the award of a diploma, degree or any other qualification.

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Eric Kofi Adzroe

List of Abbreviations

A2A	Administration to Administration
A2B	Administration to Business
A2C	Administration to Consumer
ABCECG	Association of Building and Civil Engineering Contractors of Ghana
AEC	Architecture, Engineering and Construction
B2A	Business to Administration
B2B	Business to Business
B2C	Business to Consumer
BPI	Business Process Improvement
BPR	Business Process Reengineering
C2A	Consumer to Administration
C2B	Consumer to Business
C2C	Consumer to Consumer
CAD	Computer-aided Design
CIB	International Council for Research and Innovation in Building Construction
CRC	Cooperative Research Centre
CS	Case Study
CSDP	Case Studies Design Protocol
DMMA	District, Metropolitan and Municipal Assemblies
e-BT	e-Business Technology
e-BTT	e-Business Technology Transfer
e-Business	Electronic Business
e-Commerce	Electronic Commerce
EDI	Electronic Data Interchange
e-GP	Electronic Government Procurement
e-Procurement	Electronic Procurement
e-Tendering	Electronic Tendering
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GIBs	Ghanaian Indigenous Businesses
GIPC	Ghana Investment Promotion Centre
GIS	Geographic Information System
ICT	Information and Communication Technology
ICT	International Competitive Tendering
IJV	International Joint Venture
IL	Legislative Instrument
IMF	International Monetary Fund
ISPs	Internet Service Providers
IT	Information Technology
ITT	International Technology Transfer
JV	Joint Venture
KPI	Key Performance Indicator
LWAN	Local and Wide Area Network
MORH	Ministry of Road and Highways
MWRWH	Ministry of Water Resources, Works and Housing
NCT	National Competitive Tendering
PCI	Process Change Initiatives

PFI	Public Finance Initiative
PPA	Public Procurement Authority
PPP	Public Private Partnership
PwC	Price Water House Coopers
RFQ	Request for Quotation
RGD	Registrar General's Department
RII	Relative Importance Index
RT	Restrictive Tendering
SCM	Supply Chain Management
SMEs	Small and Medium Enterprises
SPSS	Statistical Package for the Social Science
SSBCs	Small – Scale Building Contractors
SSRCs	Small – Scale Road Contractors
TST	Two Stage Tendering
TTA	Technology Transfer Agreements
UK	United Kingdom
UPS	Uninterrupted Power Supply
USA	United States of America
VR	Virtual Reality
WB	World Bank
WW2	World War Two

ABSTRACT

The literature relating to construction in implemented and developing countries indicates that key improvements in construction work delivery and better performance could be achieved through ICT elements and e-business. In view of the improvement of Ghana's economy, a key role of Ghana's Government is to improve the construction industry to enable it meet the government's agenda for delivering economic and strategic infrastructure that meets Ghana's middle-income status. This is of particular significance to the Ghanaian construction industry; however, local construction firms lack the technological capacity and capability to work in an integrated environment that is supported by e-business technology. These limitations can be overcome if local firms are encouraged to take advantage through collaboration in view of the increased participation in the construction industry by large foreign firms who employ qualified personnel and have the capacity to deploy e-business and appreciate it in their operations. Notably, these foreign construction firms are taking advantage of the good investment climate in Ghana and are utilising Foreign Direct Investment (FDI) as a mode of entry. However, the issues pertaining to detailed assessments of how these foreign firms help to improve skills and technological capacity and capability of local firms in line with the investment laws have not been adequately investigated. Assessing the capacity and capability requirements of the local firms can provide the baseline for technology transfer from foreign firms to their local counterparts, moreover, this has been subjected to a very limited academic research in some cases, none at all. This research seeks to identify the fundamental requirements for e-business technology transfer to the Ghanaian construction industry for improving procurement and project management processes through an in-depth exploration of the issues identified.

This research is premised on interpretivist research philosophy and utilises FDI as a medium of e-business technology transfer to the Ghanaian construction industry. Therefore, the case study research strategy was adopted in conducting this research. Although positioned within interpretivist philosophical stance, a mixed method research approach consisting of a questionnaire survey of local firms within the Ghanaian construction industry to explore the technological capacity of local firms as a precursor to e-business technology transfer and semi-structured interviews of case study foreign and local firms were employed to investigate the research questions. The findings of the questionnaire survey demonstrated that the capacity of the local firms operating in the Ghanaian construction industry is quite low

coupled with limited knowledge about e-business. Additionally, the case study revealed barriers such as low ICT skills and technical skills and inadequate national ICT infrastructure to support the deployment of e-business. Also, the case study revealed that e-business can bring about improved communication, reduction in postage and travel cost and online access to tender documents. What is more, the in-depth case study revealed key fundamental elements for e-business technology transfer, namely: capacity and capability development; legal/security systems and ICT/Internet infrastructure. A conceptual framework was then developed representing the fundamental elements of e-business technology transfer informed by the findings of the research. The research provided an original contribution to the development of e-business capability within local firms in the Ghanaian construction industry.

CHAPTER 1 : INTRODUCTION

1.1 Introduction

This chapter presents a detailed overview of this research, and is organised as follows: first, the background to the research is presented, followed by the research problem and identification of the research gap. Then, the research aim, objectives and the research question are outlined. This chapter, moreover, highlights the scope of the research and, finally, the structure of the thesis is presented.

1.2 Background to the research

The construction industry accounted for 17.0% of Ghana's GDP in 2011, compared with 8.6% in 2010 (AEO, 2012). The industry remains one of the major routes for generating or creating new wealth and value to meet other economic and social goals in Ghana. Since 2008, Ghana has recorded an economic boom and the construction industry has played a major role. Economic indicators have shown moreover that the construction industry has realised rich dividends of this boom (AEO, 2013). The economic growth has resulted in rapid expansion of the construction industry. For example, the road and real estate sectors have received significant attention recently, as the government is the main developer. Moreover, there are more opportunities for the private sector to take advantage of the high demand for infrastructure development (UKIT, 2012). However, the industry is fraught with issues, such as lengthy pre-contract award procedures, corruption, and delays resulting in time and cost overruns and unsatisfactory quality of work; consequently, the industry's performance can generally be described as poor (Anvuur *et al.*, 2006, Ahiaga-Dagbui *et al.*, 2011). The construction industry in Ghana is characterised by multiplicity of small firms made of indigenous businesses (Ayarkwa *et al.*, 2010). Eyiah and Cook (2003), noted that the large construction firms largely comprise foreign firms while the small firms are mostly Ghanaian indigenous businesses. There are moreover indications that the majority of the foreign firms prefers to establish and work on their own. This could underscore the fact that the capacities of local firms in Ghana are low both in terms of skills and finance, the highlight of which may correlate directly with low productivity and management issues.

Productivity has a direct link to managing resources; from construction perspective it is considered an significant factor in the successful implementation of any project. Ayarkwa *et al.* (2010), noted that the management of resources such as labour, finance materials, plant and equipment is conducted haphazardly; thereby not promoting therefore, better performance and enhanced growth. Such firms are unable to work favourably with foreign contractors who are technically capable and are able to capture a major share of the local construction market; especially when it concerns a more complex infrastructure project (van Egmond and Erkelens, 2007). However, Ayarkwa *et al.* (2010), argued that construction activity is becoming complex and more technologically sophisticated; therefore,, there is the need for more ICT enable technologies such as e-business within the construction industry to enhance the capacity and performance of local contractors. Undoubtedly, this left Ghana's construction industry extremely vulnerable to external competition. Improving performance within the construction industry in Ghana through capacity and capability development and technology infusion has become an significant issue. Other sectors, such as banking and exports, have evidence of utilising e-business in the areas of pre-sales activities and communications and this can be emulated by the construction industry (Sørensen and Buatsi, 2002, Sorensen and Hinson, 2009). Ayarkwa *et al.* (2010), contended that construction firms in Ghana have no alternative choice; therefore,, there is a need to develop the expected capacities to meet the requirements of the industry.

One way the local firms can develop their capacities and capture positive business trends in the construction industry is through collaboration with Foreign Direct Investment (FDI) firms, who are big foreign construction firms operating in Ghana. In the context of this research, FDIs in construction are considered a major platform that provides the means of transferring ICT and e-business to local firms, because they have the capacity to use and appreciate ICT and e-business in their operations. As argued by Rivard (2000), Ekholm and Molnár (2009) and recently Azhar (2014), ICT facilitates the exchange and management of information and has a lot of potentials for information process component that can improve the Ghanaian construction industry. The immense contribution of ICT and e-business in business development has proven to be a crucial factor for all sectors, including construction. E-business plays a vital and strategic role in the sustenance of growth of business organisations (Seyal *et al.*, 2000, Underwood and Khosrowshahi, 2012). Accordingly, e-business is changing business processes in construction by providing integrated environment for construction professionals to engage (Issa *et al.*, 2003, Kasim, 2011). e-Business has the potential to overcome some of the process and communication inefficiencies (Combe, 2012).

Some of the common construction e-business trends include: service promotion, e-procurement, project management, project collaboration and online tendering (Ruikar and Anumba, 2008). Increasingly, ICT is becoming a competitive tool for achieving business goals (Sarshar *et al.*, 2002). However, technical and managerial capabilities are considered the main drivers in adopting ICT-based elements in the construction industry, such as e-business. Here, it is of significance to improve the capacities of personnel working with the local firms through ICT skills and management training in order to acquire the necessary competencies that can support e-business technology. With reference to this, FDIs are seen as the ideal vehicle to support e-business technology transfer within the construction industries of developing countries particularly the Ghanaian construction industry. The construction industry improvement is significant to Ghana's economy. Furthermore, the need to adopt modern technologies within the construction work delivery process places a particular significance on the construction industry in terms of capacity and capability development. Increased participation of foreign firms in the Ghanaian construction industry undertaking complex and strategic infrastructure projects through FDIs, which often occasioned collaboration between foreign firms and local firms provide an opportunity for local firms to improve their technological capacities. As noted earlier, utilising FDI in construction to promote collaboration between foreign and local firms purposely for technological improvement within the local firms has become an significant aspect that presents a research opportunities.

The following section discusses the research problem.

1.3 Research problem

As noted earlier, the construction industry provides infrastructure that plays a critical role in stimulating economic growth (AEO, 2012). Kessides (1993), noted that several researches conducted in developing countries established that infrastructure capital has a significant and positive effect on economic output. Ngowi (2002), moreover, observed that in developing countries, (in less developed countries as well as newly industrialised ones), the construction industry is the key barometer of economic performance. Further, Ngowi (2002), argues that the construction industry the world over contributes a significant percentage of the GDP of these countries and provides the basis for employment to a substantial portion of the working population. For example, in the implemented countries like the United Kingdom (UK), it is established that Small and Medium Enterprises (SMEs) especially 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 (Griffith, 2011). Advances in technology contributed immensely to the development of the construction industry in the implemented countries. Björk (2001), noted that among many technological applications current ICT infrastructure offers excellent opportunities for the construction industry to be more efficient. Most recently, Hinson (2011), posited that ICT element such as e-business provides a tool for better acquisition, storage, sharing and utilisation of information.

Despite these prominent spotlights in the construction industry in the implemented countries, the developing countries face major challenges which are, lack of technology culture, low accumulation of foreign technology, low accumulation of local technology, inappropriate procurement systems, poor quality management structure and low technical capacity (Ofori, 1994a). However, the construction industry in developing countries has shown strong potential to influence economic growth and remains a viable industry in these countries. Eyiah (2004), argued that the significance of the construction industry is more felt in developing countries where infrastructure facilities required for improved economic fortunes and living conditions are relatively undersupplied. Examples of how the construction industry can influence an economy has been studied widely and is available within the broader economic and construction industry literature (Hillebrandt, 2000). For example, the construction sector in Sub-Sahara Africa evidently has an average growth rate of 4-5% (Lopes *et al.*, 2002). There have been several attempts to bring the construction industry to an acceptable technological standard through many initiatives and interventions; largely through research collaboration between foreign contractors and local contractors (Ofori, 1994a).

The challenges facing the construction industries in developing countries have been well researched and solutions proposed. Appropriate technology and innovation have been noted by Ngowi (2002), as a serious issue as developing countries are unable to adopt or adapt. Ofori (1994a), identified the significant role played by donor agencies and Foreign Direct Investment (FDI) in supporting the construction industries in technology transfer and innovation. Measuring development in the construction industries in developing countries is significant and efforts should be made to periodically ascertain the progress made in the implementation of construction industry development programmes (Ofori, 2001). From another perspective, Ofori (1991), pointed out that improving the efficiency of indigenous construction firms and enhancing their ability to cope with their unfavourable operating

environment has been an significant element of construction industry development in developing countries. Ofori (2012), proposed that the Ghanaian construction practitioners must acquire ICT knowledge as it is the way to go. Other significant issues such as investment in construction and economic growth in developing countries have received inadequate attention (Lopes *et al.*, 2002).

Even though there have been well researched works in the area of technology, innovation and capacity development in the construction industries in developing countries (Ofori, 1994a, Ngowi, 2002), barriers such as inadequate of Internet infrastructure, low technology culture and inadequate trained personnel have become permanent features of the Ghanaian construction industry and have affected the industry in Ghana negatively. This is further exacerbated by the traditional work method where construction management activities and procurement are conducted manually through excessive paper work and human to human contacts. According to Osei-Tutu *et al.* (2010), the traditional method in the construction management process, especially procurement, can lead to delays in communication, bribery and tender manipulations. Therefore, the need to intensify the search for a more innovative way such as the deployment of e-business in the construction process to improve communication is of paramount significance (Osei-Afoakwa, 2012, Essel, 2014).

This clearly underpins and justifies the perspective in which this Ph.D research is situated, that is to develop a framework for the adoption of e-business technology to support improvement in communication in the construction management process and procurement within the construction industry in Ghana. Furthermore, the following section focuses on identification of the theoretical gap followed by a presentation of the aim and objectives of the study, and the research questions.

1.4 Identification of gaps

Previous studies within the construction industries in developing countries, Ghana in particular pointed out capacity, technological and generally poor performance concerns (Anvuur *et al.*, 2006, Ahiaga-Dagbui *et al.*, 2011). Negative impact of corruption on the performance of the construction industry has been highlighted (Osei-Tutu *et al.*, 2010). The need to improve performance within the industry in terms of project procurement has moreover been identified by practitioners across the industry (PPA, 2010). Developing technological capacity of construction practitioners in Ghana has been proposed (Ofori,

1994a, Ofori, 2012). Björk (2001), noted that among many technological applications, ICT infrastructure offers excellent opportunities for the construction industry to be more efficient. Recently, this was confirmed by Hinson (2011). As earlier noted in Section 1.3 issues concerning the use of ICT systems to improve performance in the construction industry in Ghana has been recommended (Sørensen and Buatsi, 2002, Sorensen and Hinson, 2009). However, responses to addressing these concerns, especially ICT elements and e-business technology (e-BT) have been subjected to very limited academic research (in most cases none at all) and government level discussions and debates, compared with the financial sector of the economy of Ghana has not progressed to a satisfactory level. These issues concerning limited academic research in e-BT which is considered undervalued and currently under implemented source of competitiveness within the construction industry in Ghana forms the specific theoretical gap identified for this research. Therefore, this research attempts to fill this gap of knowledge pertaining to the construction industry in Ghana.

The following section discusses the scope of this research.

1.5 Scope of the research

This research focuses on e-business technology transfer to the local firms in the Ghanaian construction industry. Accordingly, the research focuses on FDI in construction as a medium for e-business technology transfer to the local firms in the industry ultimately to support them to improve upon communication in the general construction management activities, including procurement. In this research, FDI firms are large foreign construction firms working in Ghana who engaged in big projects, employ qualified personnel and have the capacity to deploy e-business and appreciate it in their operations. Construction management and procurement activities are considered a major aspect of the physical project delivery process where value for money and information processing and dissemination are key determinants. However, this can be achieved only through a well-defined procedure supported technological in the competitive business environment such as construction. This research explores the significant contribution of ICT and Internet based technologies, e-business for the construction industry, including drivers, impact and barriers. In respect of this research, emphasis is placed on the process of transferring e-business technology from foreign construction firms to local firms who are in collaboration with foreign firms utilising Technology Transfer (TT) principles. Data collection for the research will be conducted in Ghana targeting Ghana government agency responsible for procurement, local contractors

who are in FDI collaboration arrangement with foreign construction firms operating in Ghana, and experts/consultants working in the construction industry in Ghana. Based on the analysis of data and findings, a framework for e-business technology transfer to the local firms in the Ghanaian construction industry will be implemented to help improve communication in the project management and procurement activities.

The following section presents the research aim and objectives, and the research questions.

1.6 Aim, Objectives and Research Questions

1.6.1 Aim

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI).

1.6.2 Research objectives

In order to achieve the aim of the research, the following specific objectives have been formulated:

1. To explore general ICT in relation to e-business, including drivers and barriers to construction e-business and the processes of e-business technology transfer through technology transfer principles;
2. To assess the structure, procurement practices and the influence of foreign contractors through FDI on the development of local skills in the Ghanaian construction industry;
3. To identify key fundamental requirements for implementing e-business technology within the construction industry in Ghana;
4. To develop a framework for the adoption of e-business technology in the Ghanaian construction industry to help improve communication performance;
5. To validate this framework within the construction industry in Ghana by utilising industry experts.

1.6.3 Research questions

Sections 1.2 and 1.3 described the background to the research and research problem in which pertinent issues were raised and discusses. Following that, research objectives for this study was formulated (see Section 1.6.2). Based on the research objectives, the following research questions have been implemented to address the aim (see Section 1.6.1) of the research and the gap identified in 1.4:

1. How do bottlenecks negatively affect construction management activities, including procurement within the construction industry in Ghana, and how e-business can help minimise these?
2. What motivates foreign contractors to support skills development and e-business technology transfer to the construction industry in Ghana?
3. How does e-business technology promote construction business improvement in Ghana?
4. What are the primary requirements for e-business technology within the construction industry in Ghana?

Table 1-1 demonstrates the linkages between research questions, research objectives and the chapters in which they are presented and discussed.

Table 1-1 Linkages between research questions and objectives in the thesis

The aim of the research: to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI).		
		
Research questions	Research objectives	Chapters
1. How do bottlenecks in the works procurement process affect performance in the construction industry in Ghana and how e-business can help minimise these?	Objective 1. To explore general ICT in relation to e-business, including drivers and barriers to construction e-business and the processes of e-business technology transfer through technology transfer principles	Chapter 2 Chapter 5 Chapter 6
2. What motivates foreign contractors to support skills development and e-business technology transfer to the construction industry in Ghana?	Objective 2. To assess the structure, procurement practices and the influence of foreign contractors through FDI on the development of local skills in the Ghanaian construction industry	Chapter 2 & Chapter 6
3. How does e-business technology promote construction business improvement in Ghana?	Objective 1. To explore general ICT in relation to e-business, including drivers and barriers to construction e-business and the processes of e-business	Chapter 2 &

	technology transfer through technology transfer principles	Chapter 5
4. What are the primary requirements for e-business technology within the construction industry in Ghana?	Objective 3. To identify key fundamental requirements for implementing e-business technology within the construction industry in Ghana	Chapter 2 & Chapter 6
	Objective 4. To develop a framework for the adoption of e-business technology in the Ghanaian construction industry to help improve communication performance	Chapter 3 & Chapter 7
	Objective 5. To validate this framework within the construction industry in Ghana by utilising industry experts and academia.	Chapter 7

1.7 Research methodology

In order to answer the research questions and achieve the objectives set for this research, an appropriate research methodology is required to establish an overall research strategy. This research was positioned within the interpretivism philosophical stance. However, to achieve adequate coverage of the research area, a mixed method approach was adopted for data collection, where both the quantitative and qualitative techniques were used for data collection and the same analysis techniques were used in answering the research questions. A case study research strategy was used, whereby a questionnaire survey instrument was used to explore the capacity of local construction firms as a precursor for e-business technology transfer. Subsequently, semi-structured interviews were conducted to further explore emerging issues that were not answered by the questionnaire survey. The questionnaire survey data was analysed using the SPSS software package while data from the semi-structured interview was analysed using content analysis technique supported by NVivo software package. The research methodology adopted for this research and the various perspectives are discussed in detail in Chapter 4.

1.8 Contribution to knowledge

The main contribution to knowledge of this research will first of all, to provide an insight into e-business development and implementation through the identification of fundamental requirements in the context of the Ghanaian construction industry. Utilising an acceptable

mode of technology transfer, specifically relocating principles and ideas from Foreign Direct Investment (FDI) in construction in Ghana as a medium for e-business technology transfer within the context of developing country particularly Ghana can be seen as a contribution to literature in the subject area. This research seeks to provide a new concept in improving e-business technology capabilities of local firms through collaboration with foreign firms in Foreign Direct Investment (FDI) in the construction project environment. This means that the research will bring together knowledge from ICT, capacity and capability development and legal and security to address issues regarding e-business technology transfer within the Ghanaian construction industry. Additionally, the conceptual framework for e-business technology transfer to be implemented will be of a particular interest to the entire Ghanaian construction industry and policy makers. The conceptual framework will highlight the key fundamental requirement for e-business technology transfer and implementation in order to improve local construction firm's capacity for e-business technology transfer. The conceptual framework will be implemented and modified based on the results emerging from the research; it will present an original contribution by adding to the existing body of knowledge within the Ghanaian construction industry as it will present a new concept in respect of e-business technology transfer within the Ghanaian construction industry. Furthermore, the contribution to knowledge emanating from this research will be further discusses in Section 8.3 in Chapter 8.

The following section outlines the structure of the thesis.

1.9 Structure of the thesis

This research aims to develop a framework for e-business technology transfer to the construction industry in Ghana, utilising FDI projects as a medium. This is studied from foreign firms operating in the Ghanaian construction industry under FDI. For the purposes of this research, the thesis comprises eight (8) chapters as illustrated in Figure 1-1. Figure 1-1 moreover demonstrates how the chapters in the thesis are linked to the ultimate achievement of the aim of the research. Subsequently, the chapters are described below:

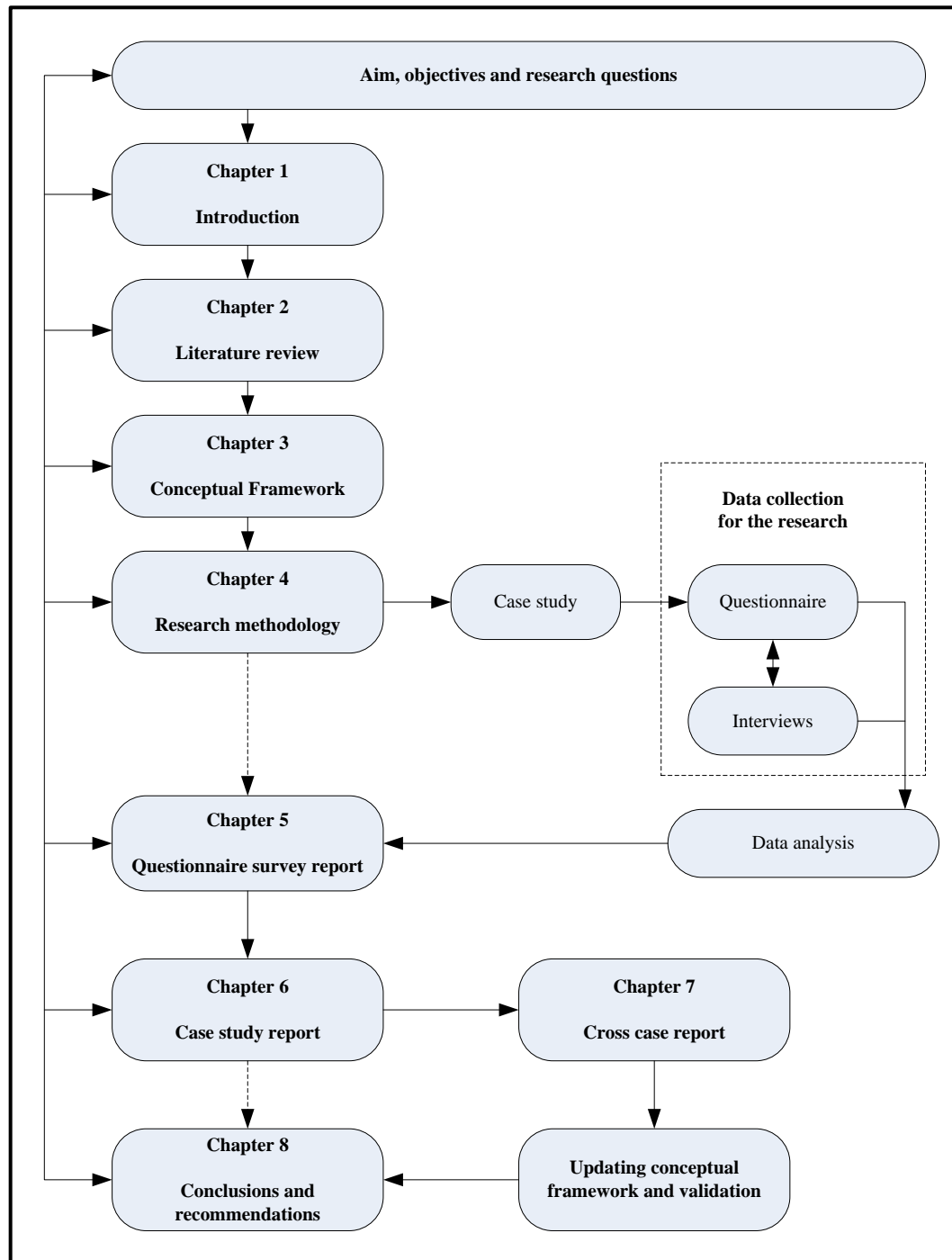


Figure 1-1 Overall structure of the thesis

1.9.1 Chapter 1 – Introduction

This chapter provides a brief outline of the structure of the thesis in the following order. First, it introduces the background to the research followed by research problem and identification of gaps. Second, it outlines the scope of this research, followed by the research aim and objectives, and research questions and then the structure of the thesis presents.

1.9.2 Chapter 2 – literature review

This chapter provides an overview of literature considerations for this research. A global perspective and outlook of the construction industry was described, this covers most implemented economies with examples from the UK and United States of America (USA) where key reforms identified which occasioned the recommendation for ICT in construction to improve construction related activities. This is followed by ICT initiatives in construction and its impacting effect, linking it to e-business in construction the main focus of this research. Detailed literature on e-business technology was explored within the context of construction and the implication for construction identified. Furthermore, the chapter covers barriers, drivers and the impact of e-business in construction and identification of some key e-business enabling technologies. In exploring e-business as a tool for improving construction processes in the context of developing countries, in particular, Ghana, this chapter identifies fundamental requirements of e-business. Using the fundamental requirement as a basis for e-business technology transfer, general technology transfer principles was described and a comprehensive description of the medium for technology transfer identified. For the purposes of this research, FDI was identified and discusses as the medium for e-business technology transfer from foreign firms to local firms in the Ghanaian construction industry. Furthermore, the chapter describes the development in the Ghanaian construction industry showing the chronological development of the construction industry.

1.9.3 Chapter 3 – Development of the conceptual framework

This chapter presents the development process of the conceptual framework, followed by the development of the conceptual frameworks for this research.

1.9.4 Chapter 4 – Research methodology

This chapter outlines the methodology adopted purposely to achieve the aim of this research, the objectives established in this research and moreover to meet the requirements of the research questions. For the purposes of this thesis, the chapter is structured as follows: first, the research model adopted for this research (Saunders Research Onion) is presented. This model encompasses research philosophies, research approaches, research strategies, research

choices and research techniques. The philosophical themes of the thesis are discussed in this chapter, followed by a description of validity and reliability and triangulation.

1.9.5 Chapter 5 – Findings and analysis of a questionnaire survey

This chapter focused on the outcome of a questionnaire survey conducted earlier in the research purposely to gauge the capacity of local firms within the construction industry for e-business technology transfer. To obtain an adequate view of the subject matter, a total of 105 questionnaires were distributed through the offices of the Association of Building and Civil Engineering Contractors of Ghana (ABCECG) to contractors and other professional groups identified within the Ghanaian construction industry. A total number of 67 questionnaires were returned. Of these, 10 were incomplete, therefore, not suitable to be used for analysis. 57 questionnaires representing 54% were found accurately filled and complete, hence useful for analysis. Results suggested that little is known about e-business in construction, hence low e-business activities within the Ghanaian construction industry. These results are further explored in Chapter 7.

1.9.6 Chapter 6 – Case studies of selected construction firms

This chapter of the thesis presents three case studies and focused on the analysis of findings from semi-structured interviews conducted. To explore thoroughly CS1, CS2 and CS3, four research questions were implemented and utilised. In each of the case, senior managers who form part of decision making were nominated to speak on behalf of their firms. In CS1, the interviewees included project manager of a foreign firm (PMF1); project manager for a local firm (PML1) and an assistant manager for a local firm (AML). In the case of CS2, three senior project managers were interviewed comprising a foreign firm represents by a project manager (PMF2), a local firm represents by its general manager (GML) and another local firm represents by a project manager (PML2). In respect of CS3, IT manager (ITMF) was nominated by a foreign firm; a manager (MGL) represents a local While a project manager (PML3) represents the second local firm. To further gain multiple perspectives, expert opinions were sought. Procurement and IT specialist (SIMG) from the Public Procurement Authority (PPA) and the other expert (CRF) was from a foreign private consultancy (who has participated and procured FDI projects in the last 12 (12) years in Ghana and other parts of Africa. In order to identify the main concerns of the interviewees and their perceptions regarding the process and mechanism of e-business technology transfer, content analysis was

done and key issues such as barriers, drivers and impact of e-business in the context of the Ghanaian construction industry emerged. Further, the primary requirement for e-business technology transfer emerged from the analysis of the content of the interviews.

1.9.7 Chapter 7 – Cross-case analysis

This chapter discusses the main findings of the research. Key findings from the questionnaire survey and case studies were compared and contextualised to give meaning to the aim of the research. The approach for the discussion is broadly designed based on the research questions established in Section 1.6.3. The thorough nature of the discussion in this Chapter confirmed the primary requirement for e-business technology transfer in the context of the Ghanaian construction industry. These requirements are capacities and capability development, legal/security systems and ICT/Internet infrastructure. In order to achieve the aim of the research, these requirements of e-business technology transfer in the context of the Ghanaian construction was used to modify the conceptual framework implemented earlier in the research. After which, experts within the case study organisations in the construction industry in Ghana validated the modified conceptual framework.

1.9.8 Chapter 8 – Conclusions and recommendations

This chapter concludes the research and presents it presents major contributions to a body of knowledge. The chapter, moreover covers generalisation of the results and limitations to the research. Suitable recommendations for further research were highlighted.

1.10 Summary and link

This chapter presents the overall structure of the thesis with adequate coverage of the background to the research; research problem and identification of research gaps. The chapter, moreover, provides an overview of the scope of this research. The next chapter (Chapter 2) presents a comprehensive literature review on key issues pertaining to the research.

CHAPTER 2 : LITERATURE REVIEW

2.1 Introduction

In view of this research, this chapter reviews relevant literature in relation to the set objectives establish. The chapter is established and undertaken to facilitate the understanding and relevance of the construction industry from the perspective of developed economies to developing economies particularly Ghana where this research is being conducted. Consequently, it moreover provides an understanding of the principles underlining technology transfer and in the context of this research e-business technology transfer to the Ghanaian construction industry. The chapter is organised as follows. The chapter explored the construction industry in the context of developed economies with an emphasis on its significance to economic development and some notable improvements undertaken especially within the United Kingdom (UK) construction sector. This is followed by the review of ICT and its application in construction after which the main research theme e-business technology transfer was explored via technology transfer (TT) concept utilising Foreign Direct Investment (FDI) as a medium.

2.2 The construction industry in developed countries

The construction industry worldwide is fragmented and characteristically engages in short-term activities in relation to project delivery. In other words, it can be described as temporary in nature as its activities or engagements have start and finish time (Cox and Townsend, 1998, Hillebrandt, 2000, Nitithamyong and Skibniewski, 2004). Unquestionably, construction is one of the most significant contributors to the economy of many countries in terms of Gross Domestic Product (GDP) and employment (Hampson and Brandon, 2004). For example, literature demonstrated that 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. According to Economy Watch (2010), the contribution of this industry towards the global GDP revolves around 10%. The industry is moreover a potential employment generator and provides work to almost 7% of the total employed person in the whole world (Economywatch, 2010). In a survey report published by PriceWaterHouseCoopers (PwC), it was suggested that global construction will grow by 70% from \$7.2 trillion today to \$12 trillion by 2020 (PwC, 2011). For example, UK construction products, such as national

infrastructure, residential, commercial, industrial and public buildings, are estimated to account for some 70% of UK manufactured wealth (NAO, 2005, Griffith, 2011). The construction industry has a finite capacity and it is essential that scarce resources are managed efficiently through innovative approaches (Owusu-Manu *et al.*, 2015).

The UK government's growth plan published in May 2011 "*Government Construction Strategy*" highlighted the critical significance of an efficient construction industry to the UK economy. The publication stressed that, the construction sector is a major part of the UK economy, representing some 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 (UKCG, 2009, Cabinet Office, 2011). Scaling the discussion down to SMEs within the construction industry in the UK, Griffith (2011), further established that Small and Medium Enterprises (SMEs) especially 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. In real terms, this sector of the industry is highly significant to the UK economy.

Similarly, the trend appears no different from other implemented economies across the world. For example, according to DOL (2004), the construction industry in the United States of America (USA) generated 4.4% of GDP or \$480 billion, in 2003, the industry employs 28% of those working in the sector i.e. good-producing industry, manufacturing, natural resources, and mining. The construction industry in the USA accounts for 5.2% of the national workforce (DOL, 2004). The USA "*construction industry is projected to be among the economy's top ten largest sources of employment growth through 2012, and predicted to grow at an average annual rate of 1.3% between 2002 and 2012*" (DOL, 2004).

From the above high points of the significance of the construction industry, the industries globally have not created the required impact to transform the gains into real benefits to clients. Although several attempts have been made to continuously develop and improve the industry, it is yet to create the desired impact. An significant aspect of construction industry development is to ensure that the industry contributes to the economy and stimulates activities in other relevant sectors (Ofori, 2001). In this context, it is prudent to have consistent and regular industry reviews in order to keep track of the direction of the industry. Ofori *et al.* (2011), hinted that in the past decade, a number of studies have focused on reviewing the construction processes, practices, and performances in various implemented countries and

these studies specifically focused on how to re-engineer, reinvent, revalue, and rethink construction to improve its performance. Contributing further to the debate of the construction industry improvement in the UK, Ofori *et al.* (2011), pointed out that in the UK, the construction industry has been perceived under-achieving, in terms of meeting its own needs and those of its clients. Hence, a Construction Task Force was established to advise the government (from the client's perspective) on the opportunities to improve the efficiency and quality of delivery of UK construction, to reinforce the impetus for change, and make the industry more responsive to customer needs". It is therefore, appropriate to note that the UK's initiative have become reference point for such similar initiatives as several countries have on their own undertook construction industry reviews (Egan, 1998). Furthermore, the Latham (2004), report in the UK identified clearly the lack of meaningful integration within the construction industry with particular reference to partners as a major impediment affecting the performance of the UK construction industry. The report recommended strongly the use of ICT to facilitate communications within the industry as a means of securing improved performance.

2.3 The construction industry in developing countries

According to Kenny (2007), construction is a \$1.7 trillion industry worldwide, ranging between 5 and 7 per cent of GDP in most countries and accounts for a significant part of global gross capital formation a little under one-third. As noted across the globe the sector's role in economic development is undeniable housing, roads, utility networks, schools and clinics are all built assets. The international construction industry is dominated by comparatively few very large firms. In most developing countries, the domestic construction industry is comprising a few larger firms, often state-owned, and a large number of small firms (Kenny, 2007). The gap between large foreign firms and small ones is extremely wide compared with implemented countries (Ofori, 1991, Ofori, 1994a). Ofori (1994b), further explained that, the gap between them is evident when two categories of contractors are considered in terms of turnover, resources, access to input, operating environment, technology and future prospects.

In the context of developing countries, Ofori (1991), defines large companies as foreign firms working in the country temporarily on large or technologically complex project, state-owned corporations, locally-based subsidiaries of foreign companies or joint ventures between foreign and local companies. Discussing the outlook of the construction industries in

developing countries, Ofori (2000), identified the need to improve capacities and capabilities in order to enhance the effectiveness of the construction industry in developing countries. Other areas that may require improvement include value for money to industry clients, viability, technology and competitiveness of domestic construction enterprises. However, the construction industries in developing countries have been making significant economic contribution ranging from 3% to 6% to the respective economies (Lowe, 2003). In contrast, Ganesan (2000), argued that the estimates of construction value added in the developing countries could be higher as the figures may not include the informal sector, which could generate a significant casual employment in urban and rural areas. It is pertinent to point out that the argument put forward by Ganesan (2000), is relevant to the construction industries in developing countries as structures for monitoring and evaluation of these industries are weak and in some cases not available. One way by which the construction industry can achieve improvement is through the deployment and use of information and communication technologies (ICT) (Bertot *et al.*, 2010). As observed by Adzroe and Ingirige (2013), advances in 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. Therefore, the following section discusses ICT initiatives and application in the construction industry, including developing countries.

2.4 Information and communication technologies in construction

This section present development trends in information and communication technologies (ICT) and further discusses various ICT initiatives within construction. Finally, the impact of ICT on construction was discusses.

2.4.1 What is ICT?

ICT is defined as “*technologies dedicated to information storage, processing, and communications*” (Ang and Koh, 1997). According to Björk (1999), Information Technology (IT) is defined to include all kinds of technologies used for the storage, transfer and manipulation of information, thus moreover, including devices such as copying machines, faxes and mobile phones. El-Ghandour and Al-Hussein (2004), consider ICT as a collective reference to the integration of computing technology and information processing. Generally, there is an evolutionary progress direction evident in the utilisation and role of ICT over the last 40 or so years. Nolan (1979), presented a framework that explains the evolution of ICT

within organisations. The framework of ICT evolution describes three such eras: the data processing era (1960-1980), the information technology era (1980-1995), and the networking era (1995-2010) (see Figure 2-1). This framework illustrates the growth that has taken place since the first commercially useable computing technology saw the light. Moreover, it demonstrates how technologies have matured, and continue to do so, while new technologies become available at an ever more rapid rate. These macro-evolutionary trends in technology provide the basis for individual organisations to evolve their own use of ICT. This framework confirms similar work conducted most recently by (Alshaw, 2007). This progression takes place on two distinct levels, that is the macro (global) level and the micro (organisational) level. Developments on the macro level relate to global trends in ICT evolution. The nature and role of ICT in organisations have evolved over the past 40 years from providing little more than data-processing support in the 1960s to being an indispensable strategic business asset to twenty-first-century corporations (Renken, 2004).

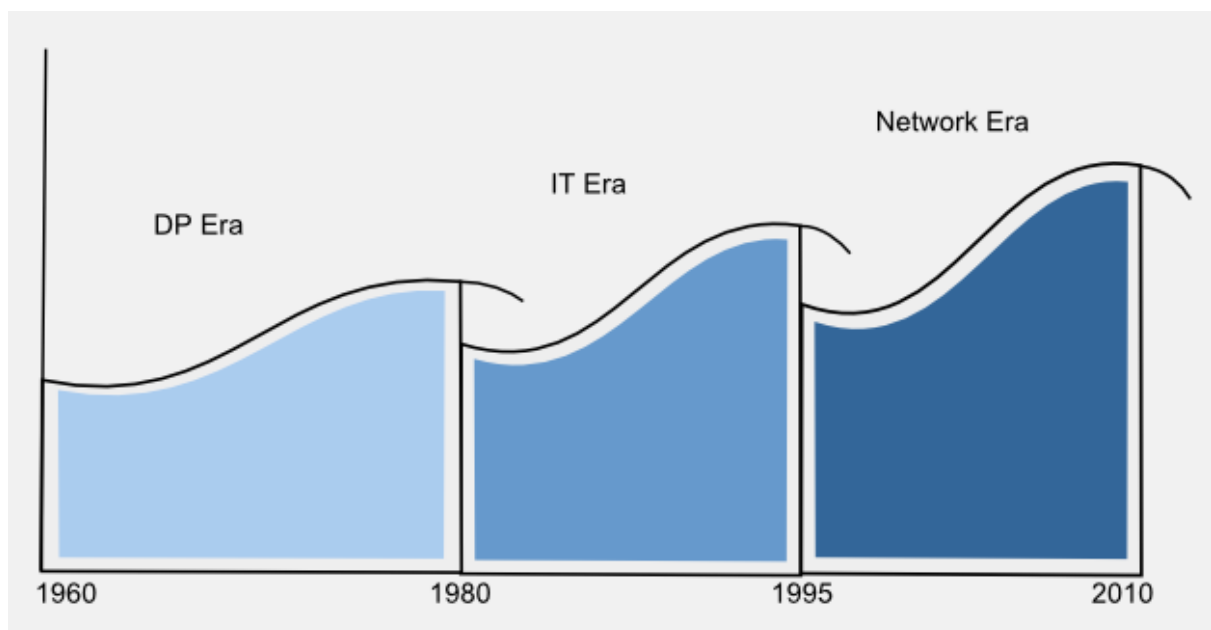


Figure 2-1 Eras of ICT development: Source Schultheis and Sumner (1998)

2.4.2 ICT research initiatives in construction

ICT holds within its domain many supporting technologies such as computers, software, network, telephone and fax machines and combination of these different items transform raw or semi raw data into useful information. The ultimate purpose of ICT is to facilitate the exchange and management of information and has a lot of potentials for information process component of the construction industry (Rivard, 2000, Galliers and Leidner, 2014). The

immense contribution of ICT in business development has proven to be a crucial factor for all sectors. According to Ekholm and Molnár (2009), “*modern object oriented ICT with well-defined information structures and efficient communication interfaces in the manufacturing industry shown to be an efficient tool and supports the integration of processes for product development, production, materials supply and maintenance*”. It is noted that ICT at this level of development is however missing in today’s construction process (Oliveira and Martins, 2011). ICT plays a vital strategic role in the sustained growth of business organisations (Seyal *et al.*, 2000, Underwood and Khosrowshahi, 2012).

In this vein, there have been several attempts by the implemented economies to leverage the application of ICT in the construction industry, which for numerous years accepted the use of ICT in a fragmented and sporadic manner than a coordinated and integrated approach. There have been 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 of ICT. ROADCON project offered a vision for ICT in construction Furthermore to a set of roadmaps across 12 thematic areas (Hannus *et al.*, 2003), while FIATECH (2004), the prime aim was to accelerate the deployment of emerging and new technologies that will revolutionise the capabilities of the capital projects delivery in the industry. Cooperative Research Centre (CRC) for Construction Innovation Hampson and Brandon (2004), this initiative was to capture what the Australian industry believes are its future directions. Strat-CON Kazi *et al.* (2007) project, Conversely, was initiated to align the ROADCON roadmaps. Similarly, European Construction Technology Platform ECTP (2008) vision 2030 is a strategic research agenda that “*addresses research needs in the field of ICT supported processes in the European construction sector in future and establishes directions for research, development and innovation*”. Construction in 2030 Erdogan *et al.* (2010), this project studies scenario-planning exercise that aimed to identify possible future issues that the construction industry might face. There still exists the question of technology uptake, guidelines to ICT providers on what needs to be further implemented; and equip researchers and academia with new research topics and ideas on relevant emerging ICTs for the construction sector (Kazi *et al.*, 2009). This vision of emerging ICT for the construction industry is not perceived as complete and final, rather it is a live and dynamic picture, which sets a scene for future developments (Sarshar *et al.*, 2002). Therefore, it is imperative to note that the construction industry is accepting ICT as an efficient tool for process improvement and productivity within the construction supply chain (Boddy *et al.*, 2007). Within Europe,

there have been several inter firm reports with strong indications of construction industry's readiness to deploy ICT as evident in Samuelson (2008) study of ICT use in the Nordic regions. The result of the study underscores the advances in personal computer technology in the construction industry. The report further indicates that most employees work with computers and over 70% of them, including site workers, have computers, e-mail and access to the Internet. However, the construction industry is greater than the activity of any individual; therefore, the industry cannot provide the answer to the desire of attaining efficiency in the construction business. Conversely, the construction industry has been under multidirectional control; thereby rendering it extremely difficult to focus the drive and direction of the industry in response to, and adopting new and relevant technologies. This is particularly the case where there is significant evidence within other sectors that technology implementation has been beneficial to such sectors. Sarshar and Isikdag (2004), in a study of global directions for construction ICT, have categorised the uses of ICT in construction as follows:

- ICT as an enabler for integration through the use of 3D modelling and visualisation applications, virtual reality (VR) applications, object-based product models, four-dimensional computer aided design, and construction process simulation applications.
- ICT as an enabler for collaboration and knowledge management through the use of virtual engineering teams using Groupware applications, knowledge and expertise management systems, data and knowledge warehouses, enterprise management systems, advanced AI applications (decision support systems, expert systems, neural network).
- ICT as an enabler of new ways of procurement and site management through the use of: digital catalogues, GIS applications, and mobile computing. The needs of the construction industry to adopt information technologies are addressed through business integration, software integration, formulating data exchange standards of the Internet, ICT education, implementing the project life cycle perspective, desktop engineering and implementing the virtual enterprise approach.
- ICT as an enabler for process improvement through the use of workflow tools, process mapping and modelling, KPI measurement tools.

These categorisations have already impacted positively on the way construction business is conducted since the advent of ICT mostly in the advanced economies. Reference can be made to the geographically dispersed nature of the construction work, meaning that communication is a major driver within the industry; this has resulted in the enthusiastic adoption of communication technologies such as e-mail, mobile communication systems, and the use of the Web. Researchers have been critical about the slow pace of uptake of technology and innovation within the construction industry (Zarli, 2003). The discussion revealed that numerous researches have been conducted with the aim of providing computer support for improving communication of design data and design intent in order to combat communication issues within the construction industry. For example, several initiatives variously led by academic researchers, standardisation bodies and industry consortia have implemented data/product models aimed at facilitating data exchange between software applications. Other initiatives have implemented dictionaries, thesauri, and several linguistic resources focused on Construction terms to facilitate communication and improve understanding between the various stakeholders operating on a project (Eastman and Augenbroe, 1998, Boddy *et al.*, 2007).

Although literature recently has pointed out that industry has received numerous ICT related technologies, the trend appears not to have changed as expected. Perhaps technology is becoming time constrained as they quickly are becoming ‘old fashion’, the tendency of changing technologies frequently, is an issue to consider as it is likely to have a financial implication, thereby becoming disincentive to small firms.

2.4.3 The impact of ICT on construction

ICT has played a major role in construction and the impact is evident in many construction activities most especially in the implemented economies. Therefore, any discussion about the impact of ICT within the construction industry should be built on the role it might play in facilitating the industry towards meeting its goals successfully (Hosseini *et al.*, 2012). ICT has become an increasingly significant part of today’s global economy. Businesses and corporations, including construction have moved beyond their borders to the international arena in order to find progressively more efficient techniques to run their operations (Bukartek *et al.*, 2007, Yang *et al.*, 2015). Advances in ICT application in diverse ways in recent times have affected business culture and all industries, including construction have been greatly influenced.

There have been several discussions regarding the fragmented nature of the construction industry due principally to the nature and spread of stakeholders and characteristics of construction project (Cox and Townsend, 1998). Nitithamyong and Skibniewski (2004), believed that this fragmentation has led to issues with communication and information processing and has contributed immensely to the proliferation of adversarial relationships between parties to a project. Further, fragmentation is often seen as a major contributor to low productivity in construction (Nitithamyong and Skibniewski, 2004). Ng *et al.* (2001), pointed out that many of the industry issues could be referred to the quantity and complexity of the shared communication. Faraj and Alshawi (1999), in their study highlighted a need for common data exchange standards, suggesting that this could be addressed by ICT. Conversely, Williams and Ozment (2002), believed that ICT uptake and widespread adoption in the construction industry may lead to shared common business processes. ICT is now utilised within the construction industry as a tool to reduce and in some cases eliminate issues generated by fragmentation (Nitithamyong and Skibniewski, 2004, Jabareen, 2009, El-Saboni *et al.*, 2009, Gatautis, 2015). ICT has proven to improve communication between parties participating in a construction project leading to better coordination and collaboration.

For example, in the management of construction project, Alaghbandrad and Asnaashari (2012), reported that ICT plays a significant role in design, management and execution, providing easy storage facility, access to accurate and updated information for construction organisations. ICT has provided modern communication facilities that enable construction practitioners to reach out to construction sites and head offices without geographical restrictions (El-Saboni *et al.*, 2009). Many authors and researchers recognise the potential competitive advantage offered by ICT. According to Harris *et al.* (2006), Furthermore to its general management capabilities and processing of project information, the impact of ICT on construction can be perceived in four categories. These include the use of electronic data interchange (EDI), visualisation – comprising computer-aided design (CAD), virtual reality (VR) and communication, which include video or data conferencing, intranet, integration employing tools such as InfoBase and project specific data bases (Harris *et al.*, 2006, Alaghbandrad and Asnaashari, 2012).

The effect of ICT is far-reaching when utilised within the domain of Internet technology. Using ICT within the sphere of the Internet is referred to as e-business (Amit and Zott, 2001, Oliveira and Martins, 2011). At this point, companies can conduct business over the internet

utilising the opportunities provided by the Internet. Firms, especially the established ones, including construction are creating new businesses which are being facilitated by the use of ICT and the Internet to create online business activities, further ICT and the Internet have supported the exploitation of new business ventures, and this is most evident in implemented economies as clearly suggested by literature. As suggested by Hosseini *et al.* (2012), the relevance of ICT and the Internet can no longer be ignored by construction industries in developing countries as the benefits are available from implemented countries Furthermore to pressure from globalisation where businesses are moving beyond their geographical locations. It is well understood that construction businesses in developing countries, in particular, Ghana, may need some level of collaboration in order to take advantage of the availability of these technologies. From this perspective, the most appropriate approach is the transfer of these technologies through joint ventures or foreign direct investment collaboration with foreign firms within the construction industries. One way by which construction industries can improve their performance and develop capacity and capability is through the cross-transfer of knowledge and technology, such as e-business through JV and FDI collaborations and alliances. This process is relevant to the construction industries of developing countries. The initial review of literature relating to construction in implemented and developing countries indicated 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 (Hashim *et al.*, 2013). In the context of Ghana, where foreign firms and local collaboration is sought, ICT has the potential to spearhead performance in the industry. One key element of ICT that has not been fully investigated thoroughly 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 current under implemented source of competitiveness within the construction industry in Ghana.

To gain greater understanding of the discussions concerning e-business technology transfer to the Ghanaian construction industry, it is pertinent to comprehend e-business technology in general terms and the linkage to the context of this research. To this end, the following section discusses some key and relevant elements of e-business technology.

2.5 e-Business technology

Under this section, the concept of e-business technology was explored and key elements of e-business technology identified. The identified elements have been discussed and general benefits to construction have been pointed out.

2.5.1 Concept of e-business technology

In recent years, the use of the Internet technology for business has been on the rise, mostly across manufacturing, retail, banking and many other business sectors. The benefits of using Internet technology to conduct business has been well noted and researched; the “*emergence of the Internet technology has far-reaching ramifications on the way business is conducted*” (Gunasekaran and Ngai, 2008). This act of conducting business using the Internet technology in conjunction with ICT infrastructure can be referred to as electronic business (e-Business) and in some research documentations it moreover referred to as electronic commerce (e-commerce) (Qin, 2010). Many businesses, including construction believed that the adoption of e-businesses provides the opportunity to improve operational efficiency, profitability and strengthen the competitive position (Beheshti and Salehi-Sangari, 2007, Neupane *et al.*, 2012, Turban *et al.*, 2015). Ahmed *et al.* (2005), believed that e-business is an umbrella terminology that encompasses e-commerce and e-procurement activities and refers to the utilisation of network computing and the Internet to transform a firm’s value chain (i.e. internal processes, suppliers and partner interaction, and customer relationships with the prime goal of creating value and competitive edge). To gain understanding into e-business or e-commerce, this research attempt to identify definitions of these terminologies and then relate them to construction business process.

There are a range of definitions for e-business and e-commerce. Damanpour and Damanpor (2001), are of the view that e-business and e-commerce refer to 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 cited as a business transaction by electronic means through the Internet and/or dedicated networks (Anumba and Ruikar, 2002, Ahmed *et al.*, 2005, Solaymani *et al.*, 2012). Accordingly, Damanpour and Damanpor (2001) described 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 moreover an acknowledgement that the “Internet” and the “Web” are essential components of an e-business and e-commerce strategies. 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*” (Cheng *et al.*, 2001).

Laudon and Laudon (2002), cited in Ruikar and Anumba (2008), define e-business as the use of the Internet and other digital technology for organisational communication, coordination and the management of the firm. Conversely, Wamelink and Teunissen (2003), defined e-business as the use of information and communications technology to change and improve business relationships. In the simplistic possible term; however, e-business is an electronic way of doing business (Anumba and Ruikar, 2008, Tran and De-Chun Huang, 2014). 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 (B2B) or business-to-consumer (B2C), if it is to be considered an e-business (Damanpour and Damanpor, 2001). In relation to this, Cheng *et al.* (2001), argued 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 conduct 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, Gatautis and Vitkauskaite, 2015).

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 computer network to search and retrieve information in support of business decision making and inter-organisational co-operation. To further understand e-business it is significant to gain an understanding in general terms of the various forms and application of e-business in both private and public sectors.

2.6 Forms of e-business

Ruikar and Anumba (2008) discusses broadly six (6) forms of e-business functionalities. These functionalities are briefly described below:

2.6.1 Business-to-Business (B2B)

Business-to-Business (or B2B as it is commonly referred to) is an electronic means of conducting business transactions between two or more businesses. It incorporates from manufacturing to service providers. For example, using B2B a company can leverage the Internet to place orders electronically, receive electronic invoices and make electronic payments.

2.6.2 Consumer-to-Consumer (C2C)

Examples of C2C business models include consumer e-auction and blogs. Although, there may be no financial transaction in C2C business models there is still an exchange of value and these are economic activities and could be referred to as peer-to-peer. Blogs, for example, have led to the development of new C2B and C2C applications by presenting the opportunity and tools for virtually anyone to express their views easily and to communicate these globally and inexpensively.

2.6.3 Administration-to-Administration (A2A)

Using A2A business model, government departments and agencies can nationally and or internationally communicate and exchange classified information through dedicated portals. Typical examples in many advanced jurisdictions include the national DNA database and other policing information.

2.6.4 Business-to-Consumer (B2C) or Consumer-to-Business (C2B)

The B2C model refers to commercial transactions between an organisation and customer or between customers and an organisation. For instance, when applied to the retail industry, a B2C process will be similar to the traditional method of retailing, the main difference is the medium used to conduct the business, the Internet. This method requires the consumer to have

access to the Internet. This as explained by Laudon and Laudon (2000), cited in Ruikar and Anumba (2008), by selling direct to customers or reducing the number of intermediaries, companies can achieve higher profits while charging lower prices. Some typical examples of the B2C category include Amazon.co.uk and eBay.co.uk. C2B, conversely, is a business model in which consumers offer products and services to companies at a cost. This business model is a reversal of the traditional business model, where companies offer goods and services to consumers. Typical examples of C2B model are online surveys.com, and survey monkey, where individuals offer the service to reply to a company's survey and in return the company pays the individual for their service.

2.6.5 Business-to-Administration (B2A) or Administration-to-Business (A2B)

The B2A category covers all transactions conducted between businesses and government bodies using the Internet as a medium. An example is that of Accela.com, a software company that provides round the clock public access to government services for asset management, emergency response, permitting, planning, licensing, public health and public works. A2B conversely, is an electronic means of providing business-specific information such as policies, regulations directly to business. A typical example of the A2B category in construction is e-tendering solutions that enable potential construction stakeholders to bid for government-led projects using online tendering tools (Eadie *et al.*, 2012).

2.6.6 Consumer-to-Administration (C2A) or Administration-to-Consumer (A2C)

Examples of C2A include applications such as e-democracy, e-voting, information about public services and e-health. Using such services, consumers can post concerns, request feedback, or information (on planning application progress) directly from their local governments/authorities. Conversely, A2C provides a direct communication link between governments (e.g. Local authority) and consumers.

2.7 Faces of e-Business

Damanpour and Damanpor (2001), discusses four faces of e-business, which originally was proposed by the Gartner Advisory Group. Each face explores e-business from different perspective Ruikar and Anumba (2008). The four faces include the following:

2.7.1 Face 1: Business and financial models

This phase focuses on the business model and the opportunities that operate as an electronic entity. Financial considerations such as reduced costs and operating efficiency are primary considerations. This model regards technology as an enabler of business opportunity and requires strict changes in the corporate culture, image, and accounting guidelines. The model can be used for an existing company (brick-and-mortar), new spin-off from a bricks-and-mortar or a small, unknown company (like amazon.com).

2.7.2 Face 2: Relationships

This face explores e-business from a relationship perspective as new collaborations are created and forged in e-business to enter new markets or enhance customer, supplier and business interactions (Qin, 2010). Customer relationship management, supply chain management and technology infrastructure management can be created by e-commerce change. For example, the traditional order and invoice process can be reported and transmitted electronically. Electronic marketplaces, catalogues and bidding systems, and Internet search can revolutionise business conduct, accelerate business activities, increase global competition, create global logistics networks, provide better customer relationships and cheaper and better services, and speed up goods and information along the entire supply chain.

2.7.3 Face 3: Commerce

This face focuses on electronic buying and selling. This requires the building of systems, services, models, and relationships to support the most effective buying and selling mechanism. This particular face overlaps the other three. It emphasises the significance of technology to business success, and customer demands (Damanpour and Damanpour, 2001, Barnes and Hunt, 2013). Central to the opportunity of leveraging the Internet and Web for e-business is the ability to use this medium to reach buyers throughout the buying process at all times, , including those that might otherwise be inopportune (Qin, 2010).

2.7.4 Face 4: Responsiveness

This face deals with efficiency and the timing of business transactions. Responsiveness, in e-business terms mean reducing the time between a business request and its fulfilment. It is

moreover about increasing the efficiency of the computing systems (operating systems and their support services) that provide fulfilment. This will help a company to complete a business transaction electronically, without resorting to hand-carried or faxed information. For example, the direct connection of a rent-a-car automobile request system to insurance companies results in improved efficiency, reduction of errors and hence customer satisfaction.

2.8 Synthesis of the concept of e-business

Considering the various definitions of e-business, and models of e-business it is, therefore, imperative to conclude that e-business technology is a process improvement led technology in supporting business process and inter-organisational relationships and coordination using the Internet technology platform, a medium through which a functioning e-business can be achieved. For example, from e-business forms (see Section 2.6.1 - 2.6.6) perspective; construction firms can use the Internet to place orders and receive invoices electronically, and possibly make electronic payments and can support project extranets. While e-business faces (see Sections 2.7.1 - 2.7.4) determines the focus of a business in terms of what e-business intends to achieve for the firm, they neither limit the usage of any model or idea, nor are all faces applicable to all companies. It is up to the construction firm to adopt and apply any of the four faces to their business.

However, from this research perspective, relationships and responsiveness faces (see Sections 2.7.2 and 2.7.4) fall within the confines of performance improvement. Section 2.7.2 seeks to promote collaboration between construction teams and that has to do with supply chain management and technology (Onetti *et al.*, 2012, Tran and Huang, 2014). Section 2.7.4 conversely deals with issues concerning efficiency and timing of business transaction. In effect, achieving a reduction in the time a request is made and its fulfilment. In essence, this face (see Section 2.7.4) can as well promote improvement within the Ghanaian construction industry. It is, therefore, significant to carry forward and contextualise these sections (Sections 2.7.2 and 2.7.4) in the context of this research and by extension within the Ghanaian construction industry which is the primary beneficiary of this research.

In light of this, the following section looks into the application of e-business in construction.

2.9 e-Business technology in construction

This section examines the application and trends of e-business technology in construction. It gives an indication as to the extent to which e-business is applicable within construction and areas of applications.

2.9.1 Extension of e-business concept in construction

As indicated in the literature, e-business potentially can be deployed and applied across all economic sectors and non-economic activities. According to Hashim and Said (2011), few writers define e-business in a broader context; that is '*the facilitation and integration of business process*'. However, in construction industry specifically, London *et al.* (2006), provide an extensive definition of e-business in the context of the construction industry as reported by Hashim and Said (2011):

"E-business in construction involves any electronic exchanges of information in relation to the various stages of the design, construction and operation asset life cycle which includes:

- 1. Internal organisational driven activity for firm core and support business, including industry specific and generic business software applications, websites, email and electronic banking.*
- 2. Externally linked online web based portals involving:*
 - Design collaboration and document management*
 - Online tendering*
 - Procurement, purchasing and invoicing*
 - Information*
- 3. Online or internal organisational facility management systems."*

It can be deduced from the discussions that there is no conclusive definition of e-business. It demonstrated that definitions are adopted based on the particular sector in question or where a particular research is being conducted. In the context of this research, the definition provided by London *et al.* (2006), is relevant as it encompasses all the components identified in the discussion presents in Sections 2.6 and 2.7. Further, e-business literature offered several definitions within construction which are significant and relevant to this research. Table 2-1 provides these identified definitions.

Table 2-1 List of e-Business definitions

Author(s)	Definition	Activity type
Ribeiro and Lopes (2001)	e-Business provides mechanisms for cross-enterprise coordination in the name of construction supply chain integration.	Construction Research
Robeiro and Love (2003)	<p>e-Business is defined as follows:</p> <p>Covers all aspects of relationships with clients, contractors, suppliers, installers, designers, and other partners.</p> <p>moreover includes service infrastructure, and multiparty, multidisciplinary (business-to-business) transactions.</p> <p>e-Business is the point where economic value creation and information technology come together.</p>	Construction Research
London and Bavinton (2007)	e-Business is defined as any business process or practice that takes advantage of or that relies upon the collection, transmission and storage of digital information through technology systems.	Construction Research
Kong <i>et al.</i> (2008)	e-Business is referred to as a system for construction products procurement to improve business processes, to cut administrative costs and provide more comprehensive information.	Construction Research
Baladhandayutham and Venkatesh (2010)	e-Business “ <i>includes buying and selling, on-line, but moreover other aspects of online business activity, such as purchasing, tracking inventory, managing production and handling logistics, customer support services, supply chain management and collaboration engineering</i> ”.	Construction Research
Tran <i>et al.</i> (2014)	It is an “ <i>advantageous method of procurement of goods, works, and services based on electronic tools, especially the Internet</i> ”	Construction Research

To summarise, the definitions of e-business within construction provide a significant dimension for this research. The definitions provided in Table 2-1 underscored the fact that the functions of e-business have been consistent even though the definitions in Table 2-1 span a period well over ten years. In this context functions of e-business can be referred to as, communication, business process, procurement and storage facility. As indicated previously in Section 2.8, e-business use the above mentioned functions to improve business delivery process. This is further confirmed in Section 2.9.1 that in construction e-business supports organisational communication, online tendering, procurement and invoicing and information management. Therefore, in essence, e-business technology can be defined as the utilisation of ICT equipment in conjunction with the Internet technology to create an enabling business

environment that potentially can manage all business activities within the construction business environment. Essentially, in the context of this research, e-business technology provides the basis for a firm to develop its capacity and capability within the context of the Ghanaian construction industry for the purposes of improving communication in the general construction process and procurement activities.

In the following section, barriers, drivers and the impact of e-business on construction were identified and explained.

2.10 Barriers, drivers and impact of e-business construction

This section sought to firstly, identify key elements that can hinder e-business implementation in construction. Secondly, identify drivers that have the tendencies to promote e-business in construction and thirdly, impact of e-business on construction available in the literature. These three elements of e-business are discusses within construction.

2.10.1 Barriers to construction e-business

From the work of Eadie *et al.* (2007) and Eadie *et al.* (2010b), barriers established in construction are considerably relevant to any modern day construction industry. In contrast, due to the small nature of firms operating in developing countries construction industries, the identified barriers to a large extend may defer slightly even though some level of agreement is possible. From developing country perspective Isikdag *et al.* (2011), conducted a web-based questionnaire survey to determine the key barriers to e-business in the Turkish AEC industry related to the technology, organisational strategy, market, human factors and processes. Findings from 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-business process. Furthermore, Vitkauskaite and Gatautis (2008), argued that the major barriers for increase uptake of ICT among SMEs are very much related to lack of resources, insufficient knowledge about ICT cost and benefits, absence of skills, as well as the prevailing traditions and culture in this sector (Aranda-Mena and Stewart, 2004). Moreover, identified culture as an impediment to e-business implementation, they recommended human resource development as the way forward. Similarly, the empirical work done by Najimu (2011), identified lack of skills, training and security as barriers within the construction industry in Nigeria.

From the works of Eadie *et al.* (2007), Eadie *et al.* (2010a) and Eadie *et al.* (2010b) which was conducted in Northern Ireland and within UK identified infrastructure, culture, security, and legal as some of the issues that are of concern or things to consider critically, as these issues have the tendency to derail implementation of e-business within construction. Love *et al.* (2001), identified technical, financial, organisational and behavioural as major barriers to e-commerce implementation in construction. However, in a more general view Ruikar and Anumba (2008), pointed out that general barriers to e-business largely fall into three categories, namely infrastructure, trust and reliability, and regulatory issues. Additionally, Ismail and Kamat (2008); Issa *et al.* (2008); Wilkinson (2008) and Ruikar *et al.* (2008a), conducted scholarly studies on different aspects of e-business in construction largely from a implemented country's perspective. In contrast, the construction industries in developing countries have been completely left out in most of these referenced studies, nonetheless, it provides a theoretical framework and platform for the commencement of research into the implementation of e-business within the construction from developing country perspective particularly Ghana. It is significant to note that, technology has been frequently cited as one of the major barriers to the implementation of e-business in this regard, the following sections describes briefly some relevant e-business technologies. Summing up, key barriers identified in literature include: ICT infrastructure, skills, finance, culture and regulatory/security issues.

2.10.2 Drivers/enablers to construction e-business

Existing literature identified numerous drivers to e-business adoption in construction as reported by Eadie *et al.* (2010b). Drivers or enablers in this context are described as determinants that have positive influence over successful implementation of e-business (Eadie *et al.*, 2010b). In a simplistic for drivers or enablers to construction, e-business is construction related activities that turns to promote awareness, development and implementation of e-business within the construction. Drivers to construction e-business based on organisation's desire to improve performance include: efficiency of business process, accuracy of business process, condense business cycle times, reduce costs and improve customer service (Issa *et al.*, 2003, Ruikar and Anumba, 2008). Furthermore, Eadie *et al.* (2007), identified construction related drivers/enablers to construction e-business.

Table 2-2 illustrates some relevant drivers to construction e-business as identified in literature (Eadie *et al.*, 2007).

Table 2-2 Drivers to construction e-business based on based on literature synthesis

No	Drivers based on literature synthesis
1	Price reduction in tendering
2	Reduction in time to source materials
3	Reduced administration costs
4	Reduced staffing levels in procurement
5	Gaining competitive advantage
6	Improving communication
7	Enhanced decision making and market intelligence
8	Reduced operating and inventory costs

2.10.3 Impact of e-business on construction

Within the construction industry, there is evidence of impacting trends of e-business in construction. For example, Ruikar and Anumba (2008), noted that reliance on third parties such as courier services, can sometimes lead to delays and moreover high amount of added expenses incurred in the delivery of project documents to project members who are geographically distributed. e-Business has the potential to overcome some of the process and communication inefficiencies (London and Bavinton, 2006). Some of the common construction e-business trends (see Figure 2-2) include:

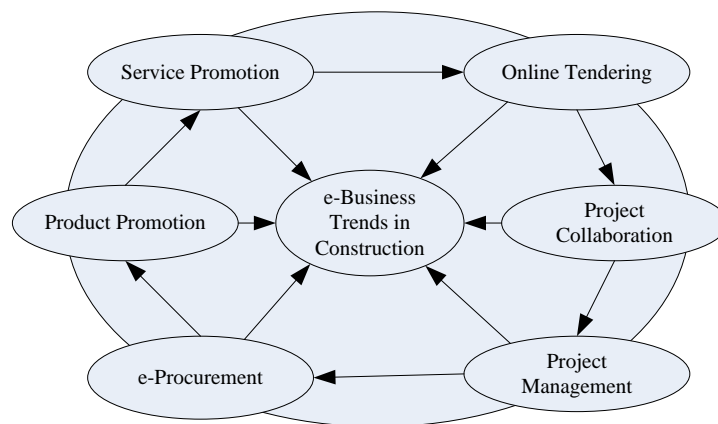


Figure 2-2 e-Business trends in construction

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

2.10.3.1 Service promotion

The Internet facility is being used to promote “companies by the dissemination of company service information” principally to potential clients of their services (Ruikar and Anumba,

2008, Chang *et al.*, 2013). Architect, designers, contractors and others within the construction sector are using the Internet for promotion.

2.10.3.2 *Product promotion*

The Internet is used by construction related firms for the purpose of product sales through online promotion. This is done either through an independent website or through an online vendor. Such promotion site displays all product and material specifications many include manufacturer and supplier details, product availability, quality assurance, cost and mode of delivery.

2.10.3.3 *e-Procurement through web directorate and search engines*

The Web can be used as a tool to procure information about construction related suppliers and their products (Chang and Wong, 2010). Several websites provide a search tool for the user to access varied information about the construction industry. Information about the industry may be varied and can range from items such as jobs and products to specific information about bidding process (Chang *et al.*, 2013).

2.10.3.4 *Project management*

Some websites are designed to streamline the construction business process. These services can be referred to as web-enabled project management (Alshawhi and Ingirige, 2003). Principally, the Internet can be used to improve and integrate the process of design and management of construction projects (Barnes and Hunt, 2013). This can yield several benefits. It can result in speeding up the process of communication between different parties involved in the project and avoid unnecessary delays.

2.10.3.5 Project collaboration

The web can be used to facilitate online collaboration for project partners, which allows project partners to collaborate and communicate with each other in real time (Galliers and Leidner, 2014). The concept of online collaboration defies the boundaries of time and geography and allows construction stakeholders to, exchange ideas and make submissions and comments no matter where they are located (Teece, 2010, Oliveira and Martins, 2010).

2.10.3.6 Online tendering

According to Ruikar and Anumba (2008), the Internet has revolutionised many aspect of the construction business and moreover made it possible to have online tendering services. This service allows for tendering information online along with project specification (Ruikar, 2004). e-Business has emerged to become an significant asset in many economic sectors as noted from literature (Weill and Vitale, 2013). Even though the uptake appears slow in the construction industry, efforts must be made to promote e-business within the construction business. *This research attempts to highlight the key role that e-business is perceived to play in assisting construction organisations to use the Internet to conduct their procurement related activities in the context of the Ghanaian construction industry.* As pointed out by Issa *et al.* (2003), the “Internet is changing the way business is done in construction”. Despite the immaturity of the technology and its short history, e-business initiatives are already transforming industries and becoming a key component (Issa *et al.*, 2003, Aboelmaged, 2010). Further, the Web has become a source for information, goods, and services, and a means of communication (Alshawhi and Ingirige, 2003, Issa *et al.*, 2003).

However, many authors pointed to the low nature of the e-business intake within construction despite the potential benefits reported in literature. The following sections identify some enabling e-business technologies.

2.11 e-Business enabling technologies

Perera *et al.* (2012), discusses the significance of enabling technologies for e-business activities within the construction. They identified two main technologies, namely: cloud computing and BIM as recent e-business technologies. When these technologies are used together with web-based project management software, it provides a platform from which e-

business activities within the construction industry can be utilised, maximised and maintained (Rodrigo *et al.*, 2011, Oliveira *et al.*, 2014). It is significant to know moreover that technologies such as the Internet and CAD are identified alongside cloud computing and BIM as e-business enabling technologies within construction (Kshetri, 2010). This notwithstanding it is significant to understand the capabilities and roles of these technologies and their tangible effects on the construction industry activities, most especially when considering it from developing country perspective particularly Ghana where these technologies understandably have not fully attain maturity (Kshetri, 2010, Oliveira *et al.*, 2014).

2.11.1 The Internet

The Internet is the fundamental technology upon which all other identified technologies operate successfully in an integrated project environment. Internet technology is changing the way business in general is done, , including construction (Issa *et al.*, 2003, Costa and Tavares, 2012). Many authors and researchers argued that, the internet has proved to remain the main bone behind the deployment of e-business initiatives (Issa *et al.*, 2003, Ruikar and Anumba, 2008). The internet has become the platform for the exchange of management information or data (Borase and Golahit, 2013). It provides a huge source for information, goods and services Furthermore to means of communication (Issa *et al.*, 2003). For example, in an e-business project environment, the internet provides search options for goods and services with filtering facility until individual specification is sought.

2.11.2 Building Information Modelling (BIM)

BIM is an example of construction related emerging collaborative technology. According to Costa (2012) BIM has emerged within the construction industry as an information digital support with the facility to integrate all life cycle information in rich 3D models, connecting supply chain and supporting all the actors along the entire life cycle of projects. Thorpe *et al.* (2008), agreed that BIM provides a strong facility for virtual reality simulations and foster visualisation and understanding.

2.11.3 Cloud Computing (CC)

CC is a computing style that provides power reference with IT as a service (Zhang *et al.*, 2010, Redmond *et al.*, 2011). There are generally speaking the following three service models

for CC: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) (Kumar and Cheng, 2010). CC is principled around the provision of computing resources in a pool for users through the Internet together with a mandatory application program environment (Zhang *et al.*, 2010). These applications can be applied to the construction industry in various project management aspects, , including but not limited to architectural design, structural analysis, cost estimating, project planning and control, and procurement management (Kumar and Cheng, 2010). CC solution appears to give an edge in cost as there is no need to recruit professionals and maintain ICT equipment (Zhang *et al.*, 2010, Alley *et al.*, 2012). Despite these highs, there are still nagging issues to be addressed by the proponents of CC technology, some of these issues are trust, security and interoperability (Kumar and Cheng, 2010). However, CC appears to meet e-business requirements in developing country's construction industries, any such deployments within the construction industries in developing countries may have the potential to support e-business activities and initiatives. Typical example of CC construction industry in developing countries can think about and use includes, google drive and drop box.

2.11.4 Computer Aided-design (CAD)

CAD refers to the application of any computer (with the requisite application software) to the solution of design problem. CAD has been utilised within the construction industry for many years. Prior to the introduction of CAD, designs have been done manually which mostly referred to as traditional drawing practices. Eastman *et al.* (2005), noted that the CAD technology stored non-graphical data objects about a building (i.e. Walls, doors, windows, paints, etc.) and associated component which comprises product data in a logical structure Furthermore to the graphical representation of the building. As earlier noted, this facility supports geometrical modelling in three dimensions which has the capability to automate the drafting tasks in the production of the designs. The limitations of the CAD facility were noticed as data transfer and other concern came to light. The suitability of any such transfers can only be adequate in an integrated environment provided by the Internet. CAD technology can become useful for e-business activity when utilised in conjunction with the Internet. It is, therefore, significant to address infrastructure issues, in particular, in developing country's construction industries in order to take advantage of e-business.

2.12 Fundamental requirements for e-business

This section presents and discusses the main components of fundamental requirements for e-business implementation as shown in Figure 2-3. The discussion focused on four conditions that facilitate e-business as shown in Figure 2-3. Earlier in Section 2.10.2 drivers/enablers to construction e-business was discussed, it is significant to mention that when these fundamental conditions are addressed, they can act as enablers for e-business implementation within local construction firms in Ghana.

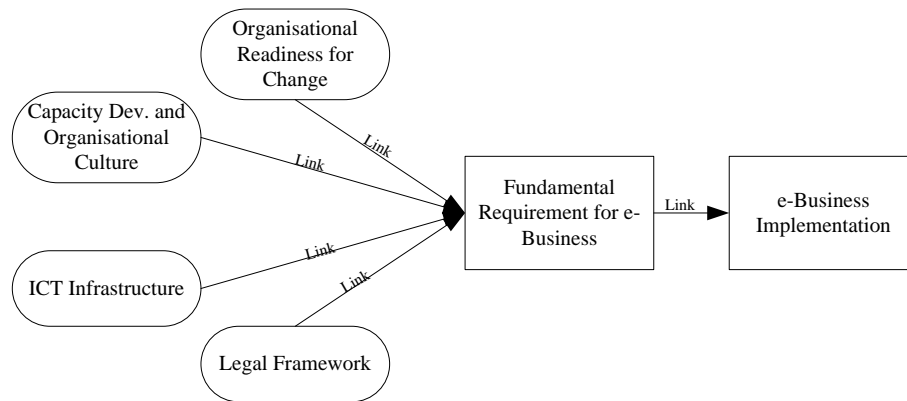


Figure 2-3 Fundamental requirement discussion model

2.12.1 Organisational readiness for change

As a result of increasing dynamism in the business environment, firms are continually confronted with the need to adopt new technologies which require changes to business process, structure, and culture (Susanto, 2008). From the context of this research, e-Business Technology Transfer (eBTT) to the Ghanaian construction industry utilising Foreign Direct Investment (FDI) where collaboration is encouraged between foreign and local firms and drawing from the contextual issues from literature. It is inadequate to think that adopting e-business technology (eBT) may not in its entirety require changes to the existing business processes within these firms that are in collaboration with foreign construction firms in Ghana. As a matter of fact, changes are required at each level of these firms to make the firms more effective in the process of adopting any new technologies. In this context, this section discusses the process of e-business technology transfer premising the discussion on four main pillars which are considered fundamental to e-business technology transfer (see Figure 2-3).

In today's competitive business world, change has become a constant norm, change management strategies such as business process re-engineering (BPR) and business process improvement (BPI) have been embraced by many organisations seeking improvements in their competitiveness, productivity and performance (Cheng *et al.*, 2004). Several writers, practitioners and change experts noted that organisational readiness for change is a critical precursor to successful change implementation (Weiner *et al.*, 2008). This implies that organisation can only initiate changes when it is ready, in today's global "*environment, changes are compulsory for an organisation in order to survive and stay competitive*" (Susanto, 2008). While the change process that many organisations espouse seems to provide additional benefits and good working environment, employees may be reluctant to embrace the new work practices that they are confronted with (Cheng *et al.*, 2004). However, Ian Smith (2005), posited that readiness is not automatic and it cannot be assumed. The writer further argued that, "It is people who make up organisations and it is they who are the real source of, and vehicle for, change. They are the ones who will either embrace or resist change. If organisational change is to take hold and succeed, then organisations and the people who work in them must be ready for such transformation". Susanto (2008), believed that readiness is something that has to reflect in the organisational members' beliefs, attitudes and intentions in line with the needed change and the capacity of the organisation to successfully undertake those changes. Love *et al.* (2000), conversely argued that changing work process can transform organisations old and outdated work practices into a new and effective ones, which can be used to improve organisation's competitive advantage within the global business setting. In contrast to much of the literature on the topic, Weiner *et al.* (2009), conceptual definition offered that, organisational readiness should be interpreted as a shared team property, that is, a shared psychological state in which organisational members feel committed to implementing an organisational change and confident in their collective abilities to do so. Furthermore, experts and scholars broadly discussed additional conditions that affect organisational readiness for change. For instance, some are of the view that an organisational culture that embraces innovation and risk-taking has been observed to support organisational readiness for change of business process (Ingersoll *et al.*, 2000, Jones *et al.*, 2005). In promoting organisational readiness, other writers stressed the significance of organisational policies and procedures together with good organisational climate (Eby *et al.*, 2000, Lehman *et al.*, 2002).

From the general discussion and understanding, drawing from the literature, organisational readiness for change has clearly been articulated to mean that employees, process together

with organisational culture are key factors to consider whenever changes are being planned. Quite clearly, for the purposes of this research, organisation's readiness is explained as how an organisation or firm is able to adjust and reorganise its core business processes and culture to meet the requirements of adopting e-business technology.

The following section discusses business process in the context of this research together with the impact of organisational culture and related issues within the context of culture.

2.12.1.1 *Perspective of business process*

It should be noted that this research, e-Business Technology Transfer (eBTT) to the Ghanaian construction Industry utilising FDI is partly premised on the understanding that the transfer of this technology can succeed and be improved upon when organisational processes are reorganised and improved to meet the demands of the new technology. It can, therefore, be understood that improving *organisational processes* for the purposes of eBTT can serve as an enabler to eBTT. In this regards, this section explores a conceptual understanding of business process improvement (BPI) as it applies to organisational process change and readiness to take up e-business technology (eBT) as part of their core processes. Process change initiatives (PCIs) have been called various names, for example, business process redesign and business process reengineering. For the purposes of this research, process improvement is preferred; the reason is that in the context of this research, the terminology process improvement encompasses developing new strategies, mapping out the required activities, and the implementation of the various thematic areas within the strategies. It is significant to understand 'process' independently and its application in this context of improving business process.

From a process view of the business a key aspect of process represents a revolutionary change in perspective; it amounts to turning the organisation on its head, or at least on its side (Davenport, 1993). Further, process orientation to business involves elements of structure, focus, measurement, ownership, and customers. Process is therefore, defined as a structured, measured set of activities designed to produce a specified output for a particular customer or market (Davenport, 1993). Conversely, a process can be seen as a cohesive sequence of activities which add value to input and transform it to output (Harmon, 2007). When this concept is applied to a commercial organisation, the term "business process" is used (Adesola and Baines, 2005). The transformation of inputs into outputs; the inputs can be resources or

requirements, while the outputs can be products or results. The outputs may or may not add value and could be an input to another process (Harrington, 2005). A business process is therefore, the combination of a set of activities within an enterprise with a structure describing their logical order and inter-dependence with the objective to produce a desired result (Aguilar-Savén, 2004). Similarly, Davenport and Short (1990), define business processes as a set of logically related tasks performed to achieve a defined business outcome. A business process is an ordered set of related, structured activities, linked by precedence relationships, which express how the work is done within an organisation across time and place (Shtub and Karni, 2010). Arguably, the term business process is defined differently as put forward by many authors; there is enough evidence from literature to suggest that similarities can be deduced from the definitions. With respect to this, Shaw *et al.* (2007) and Griesberger *et al.* (2011), argued that as business process is performed by human beings and machines, it can be seen within the business environment as a socio-technical system. In the context of this research business process may imply a strong emphasis on how work is done within an organisation currently and how future work will be done after acquiring knowledge and technology to support core business processes. For a business process to achieve what it is intended for, it is of vital significance to constantly transform existing processes by improving on key business processes.

2.12.2 Capacity and capability in view of e-business technology transfer

According to Otoo *et al.* (2009), most official definition of capacity and capability development are very broad which essentially covering different spheres of human development. To explain capacity development better OECD (2006), noted that capacity is “understood as the ability of people, organisations and society as a whole to manage their affairs successfully”. Further, it is noted that capacity is essential because of its relationship to the performance of organisational tasks and its future development strategies. Therefore, capacity is about the question of organisation’s ability to employ staff who can receive training and continuous professional development in order to improve performance within their organisations (Vincent, 2008, ECITB, 2013). With reference to this research, which sought to improve construction related activities through the proposal of e-business technology transfer to the Ghanaian construction industry utilising Foreign Direct Investment (FDI) in the Ghanaian construction industry as a medium, the process of e-business technology transfer has to be based on a well-informed workforce within the industry. Therefore, capacity in the context of this research refers to the mechanism where training

schemes are rolled out to equip staff with skills to plan and manage organisational strategies. Improving the skills base of staff is critical in achieving the organisation's goal, for example, in the implementation of e-business. For construction firms in Ghana to succeed in improving their performance through the use of e-business, the recipients (staff) ought to improve upon their skills in management and ICT in order for them to harness the benefits of e-business. That is to say that capacity development in the context of local construction firms in the Ghanaian construction industry reflects a key strategy in improving moreover the organisational culture. Conversely, capability integrate the acquired skills and knowledge (technical, business and professional expertise) that staff brings to perform their work (Gann, 2001). Therefore, in respect of this research, it can be referred that, capability within the organisation has to do with the ability to get things done efficiently by utilising available competencies within an organisation (Vincent, 2008). When capacities and capabilities are aligned to the organisation's goal, it improves the image and moreover enhances the organisational culture.

2.12.2.1 *Organisational culture in view of e-business technology transfer*

Organisational culture gives identity to an organisation (Cheung *et al.*, 2011). Organisational culture is industry specific hence; it is defined in many ways in the literature. There is no doubt that different organisations develop different cultures. However, organisational culture sometimes, it is fragmented and extremely difficult to read from outside (Rameezdeen and Gunarathna, 2012). According to Martins and Terblanche (2003), perhaps the most commonly known definition was implemented by Lundy and Cowling (1996), "*the way we do things around here*" this is further explained that an organisation's culture is the manifestation in the typical characteristics of the organisation. Martins and Terblanche (2003), then defined organisational culture as a set of basic assumptions that worked so well in the past, they are accepted as valid assumptions within the organisation. Organisational culture has been linked to the 'people factor' by many authors and researchers. For example, Ruikar *et al.* (2008b), believe that culture at the workplace takes into account the attitude, outlook, feelings and capacities and capabilities of staff within an organisation. They further argued that a well-educated and resource people make organisation and therefore, are significant to its success. On a similar note, Claver *et al.* (2001), noted that people are one of the organisation's most significant components. The notion of organisational culture as a general term describing "how things are done in a corporation" is linked to that of the working system an organisation has, this explains how people behave in the face of their working method. Within the

“construction industry culture is about the characteristics of the industry” and in many perspectives the approaches adopted for work and this encompasses people who work within the industry (Nifa and Ahmed, 2010). Culture can only be relevant to an organisation if only it contributes to the development of the organisation. This support the views expressed by Rameezdeen and Gunarathna (2012), that “culture tend to emerge as organisation discovers, invents, or develops solution to issues that it confronts”. Organisational culture is a vital element in Technology Transfer (TT) particularly e-Business Technology (eBT) to the Ghanaian construction industry. It can affect the organisational culture in many ways, because introducing a new technology like e-business would require changes as to how work is done generally within the firm. Therefore, it is significant to understand the organisational culture and the readiness of the staff in accepting to use the new technology (e-business). It is equally significant to ascertain whether the firm’s operational structure is adequate to support e-business technology adoption and use in the area of construction works procurement and management processes in the Ghanaian construction industry.

2.12.3 Technology – ICT infrastructure as a fundamental requirement for e-business technology transfer

One of the major fundamental requirements for the transfer of e-business technology is the availability of ICT infrastructure at the contractor firm level. From the work of Ruikar *et al.* (2006), they argued that the “technology factor covers all aspects related to Information Technology (IT) and communications technologies (e.g. Internet technology), which include both the hardware and software usage and its availability within a company, department or workgroup”. They further explained that it is not only about the availability of the technology; however, what is moreover significant are the “aspects related to the performance of the technology - thus, even if the technology infrastructure is adequate and available, it is of no consequence, if it cannot efficiently perform the required functions”. The trust of the issue here is about efficient use of the system. For example, a firm that has the Internet linked to computers but cannot send files; this may mean that the system is not efficient enough to perform such functions, this may reflect on the chain as e-business technology is largely designed to allow project teams to communicate and exchange project data in collaborative environment (Ruikar *et al.*, 2006). It is, therefore, imperative to consider technology issues in assessing e-business as any ill-equipped firm in the chain can affect the performance of the entire chain.

In the context of this research, and based on the work of PPA (2013), ICT infrastructure is explained to mean such related activities covering availability of the Internet and connectivity, data centre, local and wide area network (LWAN) infrastructure, Furthermore to significant ICT devices such desk top computers, uninterrupted power supply (UPS), other multi-functional devices such reprographic machines and availability of electricity supply. It has already been established in e-business literature that ICT together with the Internet has the potential of coordinating different project activities both within and without organisations and moreover across industries and different geographical regions (Issa *et al.*, 2003, London and Bavinton, 2006). With the help of ICT infrastructure construction firms can reduce their transaction and document processing costs and time (Ruikar *et al.*, 2008b). In the same way ICT infrastructure can help streamline organisational processes making them efficient. However, all these benefits cannot be realised if adequate ICT infrastructure is not in place and made available to the people in the firm who are the ultimate end-users (Ruikar *et al.*, 2006).

2.12.4 Legal framework in support of e-business technology transfer

Legal issues, consider another significant aspect of the digital environment especial in an attempt to establish a national framework intended to provide e-business environment. It is, therefore, significant to note that a comprehensive legal framework is required for the establishment of e-business activities. When such a legal framework is established, it provides confidence in the system; it provides the boundaries and limitations that may be required within the laws. As e-business activities are not limited in nature, it is understood that it goes beyond the national boundaries; therefore, adequate legal and security framework gives confidence to people and firms to transact businesses in legally secured system. For instance, in Ghana, PPA (2013), reported that, this has been taken care of by the passage into law the Electronic Transactions Act, 2008 Act 772. According to PPA (2013), as part of Ghana government's initiative of providing a well-defined legal regime for e-business transactions in different sectors of the economy, the Public Procurement law of 2003, Act 663 is currently being amended to include e-business aspects such as e-tendering which previously was not in the Act 663. This is expected to provide the necessary legal regime for e-business transactions, in particular, in the construction sector of the Ghanaian economy.

2.13 Technology transfer

In line with the aim of this research, which is to develop a framework for e-business technology transfer to the Ghanaian construction industry, this section examines the general concept of technology transfer, followed by the type of technology transfer. Finally, the section explored technology transfer to construction firms in developing countries.

2.13.1 Concept of technology

Transferring an appropriate technology in diverse ways has been a topic of discussion in the areas of international trade and development. Although, this topic has generated growing interest across the global business environment, relatively few models have been implemented to investigate strategic factors underlying the process of technology transfer (Marjit, 1990, Wang and Blomström, 1992). Bozeman (2000), expressed difficulties in defining the term *technology transfer* (TT) simply because TT is used in varied disciplines. In an attempt to resolve these controversies Ofori (1994a), defined Technology as the application of the existing body of knowledge (science) to the production of goods and services. Further to earlier definition, Streeten (1991), defines technology as ‘the relationship between inputs of all conditions and factors of production, , including skills, attitudes, organisation and investment, and outputs. Moreover, it covers specification and designs of products’. Technology in this context encompasses equipment, tools, techniques, materials, system processes, information, the goods and services produced and their use (Streeten, 1991). It is significant to put forward the understanding of technology first and foremost in order to put the technology transfer process into a proper discussion for the purposes of this research.

Explaining this further by giving it a better relevance, Hoekman *et al.* (2005), refers to technology transfer as any “process by which one party gains access to a second party’s information and successfully learns and absorbs it into his production function”. Literature abundantly made it clear that technology transfer takes place more effectively within one country most especially in the implemented countries. However, globalisation and trade protocols in recent time are encouraging firms from developed economies to extend their businesses to other jurisdictions. The trust of the issue remains that transfer of technology means the transfer of managerial capability to a firm or firms and this process can take place in firms in one country to firms in another country. Again, the understanding is captured in

the direction of this research in the sense that the benefits of technology transfer is being understood in the context of developing country's construction industry particularly Ghana.

2.13.2 Channels of technology transfer

Generally, technology transfer can take place at three (3) different levels. First, Technology transfer can take place between countries (for example, from implemented country to developing country) where multinational businesses are located. This mode of technology transfer is referred to as international technology transfer (ITT). Second, technology transfer (TT) can take place between firms (i.e. From firm to firm) this method of technology transfer is described as the process of moving technological knowledge between organisations. The third form of technology transfer takes place between people within or outside work environment (i.e. Person to person). For the purposes of general discussions, Hoekman *et al.* (2005), identified three major channels through which ITT occurs. Additionally, WACC (2006), identified two forms which ITT occurs. These channels are summarised in Table 2-3.

Table 2-3 Channels of international technology transfer

Channel	How it Occurs
Trade in goods and services	All exports bear some potential for transmitting technological information. Imported capital goods and technological inputs can directly improve productivity by being used in production processes.
Foreign direct investment	Multinational enterprises generally transfer technological information to their subsidiaries, some of which may 'leak' into the host economy
Direct trade in knowledge via technology licensing	This may occur within firms, joint ventures, or between unrelated firms
Horizontal technology transfer	Technology transfer consists of the movement of an established technology from one operational environment to another (i.e. From one firm to another)
Vertical technology transfer	This refers to the transmission of new technologies from generation during research and development activities in science and technology organisations

Source: Hoekman *et al.* (2005) and WACC (2006)

2.13.3 Elements of technology transfer

According to Khabiri *et al.* (2012), previous studies and models suggested that, technology transfer may be influenced by various elements and factors and mechanism of technology transfer can be one of the most significant one. Hong (1994), reproduced the work of Naito (1989), four key elements of technology transfer were identified. These elements shown in Table 2-4 include human resource, information, equipment and capital.

Table 2-4 Elements of technology transfer

Item	Elements of Transfer	Method of Transfer	Mechanism
1	Human resources	Technician exchange Technician dispatch	Know-how training Administration training
2	Information	Patents, Design Technological books or materials Administrative books or materials	Design and development skills Production and administrative Skills Manufacturing technology Marketing skills
3	Resources	Trade of machinery and equipment Trade of research equipment and material Trade of production material	Methods of development and experiment Methods of production
4	Capital	Joint venture/Foreign direct investment Industrial co-operation	Share of ownership Complying with the contract

Adapted from Hong (1994)

Table 2-4 provides essential elements which can be considered as strategic themes for e-business technology transfer like any other technology transfer (TT) activity. Even though Naito (1989) implemented this guide as a general approach to TT, it is considerably relevant to this research because this research is being undertaken within the domain of TT. Item one (1) human resource (HR) is a significant element of TT the understanding is that TT goes beyond providing physical objects in the form of machinery. Arguably, capacity development

is considered as a key component of this element. This considerably fits directly into the context of this research where capacity development of the local firms remains an essential component of e-business technology transfer to the Ghanaian construction industry. Item two (2), information element; in terms of this element, it is significant for information to be made available to the parties involved in TT activities. This is to say exchange of information between transferor and transferee is equally significant for successful TT engagements. Information flow between transferor and transferee concerning the development or design of the technology, production and administrative skills, manufacturing skills and marketing skills is relevant. In terms of item three (3) resources element, Hong (1994) argued that it is not enough for the transferor to provide the technology, it is significant to teach the transferee the know-how and moreover provide maintenance capabilities to the transferee. Finally, technology like e-business can be transferred via item four (4) capital elements. A capital element of TT can be accomplished through joint ventures (JV) or foreign direct investment (FDI) and industrial co-operation. The significance of this form of transfer is the compliance with the agreements and the share of ownership by both parties. For the purposes of this research, all the four (4) elements of TT are significant, but most significant are human resources and capital elements as they fall directly within the context of this research.

2.14 Technology transfer to construction firms in developing countries

Literature revealed the significant role of technology transfer within construction firms, especially in developing countries. Technology transfer as defined is widely considered to be a potentially powerful source of innovation, which can provide construction firms with new technologies that can, appropriately, transform and complement current technologies to create and sustain better levels of performance (Nonaka and Takeuchi, 1995, Sexton and Barrett, 2004). From the case study research conducted by Sexton *et al.* (2006), it was noted that small construction firms absorb and use technology, which can contribute to the business in a quick, tangible, fashion, and which can be dovetailed into organisational capabilities they already possess, or which can be acquired or “borrowed” through their supplier and business network. Buckley (1997), established three success factors in international technology transfer (ITT). The evidence from the study suggests that small and medium-sized enterprises (SMEs) will not, in aggregate, be the major suppliers and transferors of technology in the world economy, but they can fill crucial niche roles. Second, the success of these niche roles will be “*partly determined by the key relationship between firm size and industry size*” and by SMEs being able to ride the dynamic of the industry. Third success factor is the skills of management in

SMEs being able to spot and take opportunities in situations where resources are scarce and information is expensive. In contrast, the technological situation of developing countries, in particular, in Ghana, where this research is situated remains largely a debatable issue for many, including writers. Notable studies UNIDO (1980); UNCTAD (1990) and Stewart (1991) cited in Ofori (1994a), demonstrates that, by any of the proxies used to measure a country's technological development, i.e. a number of research and development (R&D) personnel, aggregate R&D expenditure, volume of manufactured exports, share of high-technology services and number of international patents owned, there are great and widening disparities between industrialised and developing countries.

Developing countries are technologically dependent on industrialised ones; they import elements of a wide range of technologies (Ofori, 1994a). The construction industry in developing countries could be one such entity that depends on technology from implemented countries. Technology transfer to developing country's construction industries involves many things, but most significantly is the human resource (Simkoko, 1992, Devapriya and Ganesan, 2002). These include individuals at various levels within the construction firm such as top management, middle management and operational levels (Bakar, 2006). In technology transfer in construction, according to Bakar (2006), the technology transfer process in industrial projects differs somehow from construction projects. However, both sectors undergo more or less similar phases in their realisation. From the work of Bell & Hoffman (1981) the evidence of similarity in life-cycles of the industrial and construction projects is seen in the following project phase grouping in construction: conceptualisation (i.e. Conception, feasibility studies and inception); implementation (design, engineering and construction). Bakar (2006), noted that in the construction delivery process, the capacities and capabilities are provided concurrently in the sense that construction techniques are employed in the project execution, while the know-how and managerial skills, and experience act as necessary inputs on the construction techniques. Thus, integration of both the local and foreign technological and managerial capabilities in the project delivery process can facilitate the transfer of technological capabilities to the developing countries (Bakar and Tufail, 2012).

The above discussions show that with the appropriate technological know-how particularly with the exploitation of ICT elements and capacities and capabilities development local construction firms can perform better. However, from developing country perspective, Ghana in particular ICT systems such as e-business technology have been undervalued and under implemented. Therefore, this research aimed to develop a conceptual framework to facilitate

the development and transfer of e-business technology to local firms in the Ghanaian construction industry.

Based on this, the following section discusses the medium of technology transfer, in particular, in construction narrowing down to the appropriate medium for this research.

2.15 Medium for technology transfer in construction

This section examines the type of technology transfer medium that is appropriate for this research. Based on this, the section explored key technology transfer instruments within construction. Joint venture (JV) and foreign direct investment (FDI) were identified and discusses in subsequent sections (Deok-Ki Kim and Seo, 2003, Osabutey *et al.*, 2014).

2.15.1 Type of mediums for technology transfer

McCullough (2003), argued that to maximise the potential that technology transfer (TT) has to offer, a particular attention must be paid to creating the right ‘transfer environment’. The success rate of technology transfer depends on the transfer medium adopted, the stage at which transfer is contemplated and the successful blending of both ‘hard’ and ‘soft’ systems. TT is premised on different approaches depending on the purposes for which it is sought. There are several approaches as demonstrated in Section 2.13.2, additionally; it is significant to note that the recipient sector plays an influential role in determining the mode of transfer to adopt. This is because, it is significant to understand the long term implication of any such technology transfer mode and its future improvement. Pertaining to this, the debate about utilising Joint Venture (JV) or Foreign Direct Investment (FDI) for the purposes of economic improvement, managerial skills development and TT is still ongoing (Killing, 2012). The intensity of the debate depends on the particular sector in focus. For the purposes of this research, the focus is on developing country’s construction industries particularly Ghana. With reference to this, it is significant to establish which of these TT mediums are suitable for local construction firms in developing country’s construction industries like Ghana. Therefore, the next sessions discuss JV and FDI.

2.15.1.1 Joint Venture, benefits and limitations

Kogut (1988), who has done many studies within the domain of joint venture (JV) describes JV as follow: it occurs when two or more firms pool a portion of their resources within a common legal organisation. Conceptually, JV is a selection among alternative modes by which two or more firms can transact legal business (Zhao *et al.*, 2013). Conversely, Norwood and Mansfield (1999), identifies JV as the commercial agreement between two or more companies in order to allow greater ease of work and cooperation towards achieving a common aim, through the manipulation of the appropriate resources. In the views of Lyons (1991), joint ventures are co-operative forms of organisation between independent parties who could otherwise engage in competition or have a competitive potential. Ho *et al.* (2009), provides a clearer meaning of JV. They argued that JVs have multiple meaning, both in literature and for practitioners in different industries. JV sometimes refers to a very general form of alliance, but sometimes moreover refers to a more specific type of alliance that involves the formation of a new entity. When JV is referred to the general form of alliance, it is often categorised into “equity JV” and “non-equity JV” in the governance structure of JV. Hennart (1988), explained that equity JV arises whenever two or more sponsors brings assets to an independent legal entity and are paid for some or all of their contribution from the profits earned by the entity, or when a firm acquires partial ownership of another firm. The term “non-equity JV” describes a wide array of contractual arrangements, such as licensing, distribution, and supply agreements, or technical assistance and management contracts. JV is used for the transfer of organisationally embedded knowledge which cannot be easily blueprinted or packaged through licensing or market transactions (Kogut, 1988). According to Ozorhon *et al.* (2007), international joint venture (IJV) is a form of JV involving two organisations contributing their equity and resources and at least one partner establishing its headquarters outside the country in which the joint venture operates. Therefore, this demonstrates that a joint venture can be considered as a legal agreement between the participating organisations.

The motivations for JV are many and cut across different industry. For example, one such motive for the adoption of JV is about improving technological capabilities and managerial competence which fit well within developing countries perspective (Richards and De Carolis, 2003). It is therefore, suggestive that JV can significantly influence organisation’s capacity in developing management competencies and acquisition of new technologies. In this context Ofori (1994a), noted that JV provides an environment for local and foreign firms to

collaborate for the purpose of technology transfer. Gale and Luo (2004), stated that one significant benefit of JV that can improve cooperation is, for instance, the foreign firm can provide on the job training in management and technology. Furthermore, the local firm can provide local specific knowledge about markets, infrastructure and the political environment (Beamish and Banks, 1987). For the purposes of developing technological capabilities, JV can contribute in that respect, most especially the technologies that are useful but hard to develop by local firms (Chalos and O'Connor, 2004). JV has offered opportunities to firms, including those within the construction sector to undertake alliances and collaboration within internal and external markets. Globalisation extended this opportunity for international construction firms/organisations to enter into construction markets to compete on the basis of creating international business relationships (Osland and Cavusgil, 1996, Han *et al.*, 2005). In the construction industry, JV offers direct and indirect benefits that include, but are not limited to, reduced risk, improved quality, diminished cost, timely completion of a project, technology transfer and capacity building. JV is moreover critical to large or complex national or international construction projects because complementary resources can be better pooled or integrated to complete a project, especially for the global projects whose host countries do not have enough capacity or required technology (Ho *et al.*, 2009, Killing, 2012).

Despite the fact that JV has numerous mutual benefits, it has moreover some limitations and risks which have to be shared among JV partners. The introduction of many complexities by the association of two or more firms or organisations resulting in business failure or a fundamental instability in governance management (Ahiaga-Dagbui *et al.*, 2011). According to Ozorhon *et al.* (2007), failure rate in IJVs is higher as compared to domestic joint ventures because of greater challenges involved. Reasons identified by Han *et al.*, (2005) for failure in international joint ventures are (i) inadequate business plan development (ii) initial stages of the venture lack of commitment of top management (iii) inadequate development of strategies for international market (iv) inadequate recognition of demand in a cross cultural environment, because no two cultures have the same values (v) failures in weighing foreign requirements with respect to their political, social, and legal and government procedures. In Ghana, the formation of JVs is regulated by the Companies Act, 1963 (Act 179) and Ghana Investment Promotion Centre (GIPC) Act, 2013 (Act 865) respectively.

The above is a general discussion of joint ventures. This discussion demonstrates that IJV and JV imply that companies pool resources together for the purposes of undertaking a project or equity takeover. It moreover provides a strong basis for the exploitation of transfer of

technology, knowledge and managerial skills development. Furthermore, a JV can be used as a medium in developing countries to facilitate technology transfer (TT). However, the formation of a JV requires that the parties contribute resources in the form of capital, technology, machinery and human resource.

2.15.1.2 Foreign direct investment, benefits and limitations

The literature demonstrated that FDI has played key roles in the improvement of the economies of many countries, this dovetailed in the belief of policymakers that FDI as a catalyse to improving productivity and promote development in the host countries (Deok-Ki Kim and Seo, 2003, Antwi and Zhao, 2013). According to Djokoto (2011) and Moran (2012), FDI occurs when a corporation in one country creates a business operation in another country, through setting up a new wholly-owned affiliate, or acquiring a local company, or forming a collaboration in the host economy. This in many ways attracted developing countries through several economic adjustment programmes that sought to provide different policies on incentives primarily to attract FDI in order to enhance economic growth. The link between FDI and economic growth has been studied widely among developing countries; these studies have established direct and positive impact in relation to the growth of the host countries (Balasubramanyam *et al.*, 1996, Zhang, 2001, Choe, 2003). Although de Mello (1999), has a slight contrary view of FDI influence on economic growth, Abdulai (2005), posited that the positives outweigh the negatives. To further understand the discussion under FDI, Mallampally and Sauvart (1999), explained that FDI is known as at the act where multinational foreign enterprises invest in foreign countries with the aim to take control of asset and manage production activities in the host countries. Meaning FDI has the ability to deal with major obstacles such as financial resources, technology skills and employment; these capabilities of FDI have made it the centre of attention of policymakers in low-income countries (Asiedu, 2002, Abdulai, 2005). According to Abdulai (2005), FDI principally helps by adding resources available for investment and capital formation; the transfer of technology, skills, innovative capacity and organisational and management practices between countries is moreover enhanced; and helping the host country access international marketing networks. Certainly one of the fundamental benefits associated with FDI is the potential for foreign firms, in particular multinational corporations (MNCs), to transfer technology to local firms in the host countries (Osabutey *et al.*, 2014). According to Chung *et al.* (2003), FDI could affect the performance of local firms in two ways. First, it could be a source of new technology, especially for firms in developing economies (Insah, 2013). Accordingly, when the

multinationals enter an emerging market, they bring in advanced technology, as well as managerial practices, production methods, along with other tacit and codified know-how by which a firm modifies inputs into a product (Manuel and Ricardo, 2000, Blalock and Simon, 2009). Foreign firms may well transfer technology to local firms that they select as local collaborators (Chung *et al.*, 2003, Blalock and Simon, 2009). According to Blalock and Simon (2009), this new technology may come in a variety of forms, including employee training, quality control, inventory management, as well as new product and process technology. Second, the new business opportunities created by FDI may influence a local firm's productivity even if it does not become a collaborator to an entering multinational. That is in particular the case in developing countries which happen to be lagging behind the technology frontier (Pack and Saggi, 1997). According to Lim and Liu (2001), FDI is a conduit for transferring advanced technology to host countries. In the view of Damijan *et al.* (2003), FDI can provide the basis for cheaper means of technology transfer, being that the recipient firm may not have to spend financial resources in the acquisition of new technology. Yet Pack and Saggi (1997), advised that just because such inflows as well as the domestic capabilities to harness them are complex, considerable effort and time to promote assimilation is necessary. The attributes of local firms, with particular emphasis on their absorptive abilities and varying capabilities, are essential determinants of effective technology transfers (Girma, 2005, Gooderham, 2007, Spencer, 2008, Blalock and Simon, 2009). Technology transfer, for example, needs continuous and thorough interaction between the beneficiary and the provider (Sanna-Randaccio and Veugelers, 2007, McDermott and Corredoira, 2009). Local firms conversely must moreover overcome existing limitations in order to improve their absorptive capacity (Eapen, 2012). FDI literature further revealed that, there are several arguments in respect of the possibility of utilising FDI to reduce poverty. Abdulai (2005), argued that it depends on the sector that benefit from the FDI inflow and how the gains from FDI are distributed. Theoretical perspectives of FDI have moreover been widely discussed and presents in the FDI literature (Tsikata *et al.*, 2000, Mmih and Owusu-Frimpong, 2004). However, it is significant to point out that, the focus of this discussion is rather premised on utilising FDI to promote technology transfer, in particular, e-business technology from foreign firms to local firms in the Ghanaian construction industry. This is consistent with the argument put forward by Deok-Ki Kim and Seo (2003), which stated that developing countries prefer FDI as a medium of technology transfer to any other available mediums. The discussions of FDI within the context of developing countries reveal limitations that can have a negative impact on the development and growth of local firms. In this regard, it can be established that the entry of big foreign firms can cause small firms in the local economy to be

displaced (Ekholm *et al.*, 2007). It further demonstrates that because of their financial strength they turn to take over the sector they invest in, this reflect in technology infrastructure, machinery, wages and human resources better than their local counterparts (Görg and Greenaway, 2003, Ekholm *et al.*, 2007).

2.15.2 Synthesis of JV and FDI

From the discussions in Sections 2.15.1.1 and 2.15.1.2, it can be seen that JV and FDI are similar in terms of technology transfer to developing country although there are a few differences in concept. While JV is premised on firms that are large enough to contribute resources and share risk, FDI requires no risk elements and local small firms can collaborate with large foreign firm without resources contribution. As pointed out in Section 2.15.1.1 in construction, the most appropriate instrument for technology transfer to developing country's construction industries, it is a JV arrangements (Ofori, 1994b). For the purposes of this discussion, JV refers to the situation where two or more companies agree to pool resources together purposely to accomplish a specific task. For the purpose of this research, this type of agreement can occur between foreign firms on one hand and local firms on the other hand. A JV between local and foreign firms operating in developing country's construction industries suggested by many writers and researchers as an effective means of TT (Ofori, 1993, Ahiaga-Dagbui *et al.*, 2011). Carrillo (1996), argued that international joint ventures (IJVs) between foreign contractors and local contractors of developing countries are recognised as a potential means of enhancing construction expertise of developing countries. This confirms recent suggestion by Adzroe and Ingirige (2013), that IJV schemes have the potential to transfer ICT elements to spearhead improvement in the Ghanaian construction industry. In scope, JV is arranged on the basis that the partners contribute resources in terms of technological capabilities, machinery, capital and human resources towards the establishment of the JV. These demands are hard to be met by local contractors who are less resourceful. As discussed in Section 2.17.4, local firms within the Ghanaian construction industry constitute 90 percent (90%) of small firms who belong to classes D3, D4 in the general building works category, K3 and K4 in civil works category and A₃B₃ and A₄B₄ in the road contractor category (see

Table 2-7). With reference to the understanding from the JV discussion and the composition of local firms within the Ghanaian construction, it can be said that JV is not the appropriate route to be used for e-business technology transfer with respect to the local firms in the Ghanaian construction industry. Conversely, Osabutey *et al.* (2014), moreover, confirmed that the majority of local firms in Ghana are small-medium sized entities which lack resources as a result are neither willing to collaborate with each other nor large enough to meaningfully collaborate with foreign firms through JVs. This is why Deok-Ki Kim and Seo (2003), insisted that developing countries prefer FDI as a medium of technology transfer to any other available mediums. This is consistent with the argument advanced by Borensztein *et al.* (1998), over a decade ago, that FDI is an significant vehicle for technology transfer, contributing more to economic growth than domestic investment in respect to developing countries. In this context FDI is referred to foreign firms establishing directly in the local economy and has created the opportunity for local firms to collaborate with them without any demands in terms of technological capabilities, machinery, capital and human resources on the local firms. Damijan *et al.* (2003), explained that FDI provides the basis for cheaper means of technology transfer, being that the recipient firm may not have to spend financial recourses in the acquisition of new technology. This explains why it is a lot more convenient for local firms to opt for FDI collaboration than to enter into JV which requires parties to contribute resources which are not available to local firms.

It has been established from the above discussions that FDI is the most preferred medium for technology and knowledge transfer to the construction industries of developing countries. Therefore, in the context of this research, FDI has been selected as the medium for e-business technology transfer to the construction industry in Ghana. Furthermore, the following sections discuss FDI in the context of Ghana showing that it is relevant to the construction industry in Ghana.

2.15.2.1 FDI experiences in the Ghanaian economy

Section 2.15.1.2 established the key roles of FDI in the economies of developing countries particularly Ghana. Abdulai (2005), provided Ghana's efforts in attracting foreign direct investors in the economy of Ghana. Abdulai (2005), reported that the need to attract foreign direct investors into the Ghanaian economy has been a major policy objective of Ghana's Economic Recovery Program (ERP), which commenced in 1983 under the guidance of the World Bank (WB) and International Monetary Fund (IMF). Encouraging foreign investor into

Ghana was demonstrated by the Ghana government through investment missions abroad and hosting international events focusing on foreign direct investment in Ghana. Apart from investment missions and international event, the government undertook privatisation of state-owned enterprises in the early 1990. According to Abdulai (2005), this program resulted in the sale of 300 state-owned enterprises, majority of which were acquired by foreign investors with few local investors partnering their foreign counterparts. Furthermore, the government in 2011 approved the National Policy on Public Private Partnership (NPPPP) as part of the economic reform agenda that aims to increase private sector involvement in infrastructure and public service delivery (BEBA, 2013). Further to boost investor confidence of investors, new investment law was enacted – Ghana Investment Promotion Centre (GIPC) Act, 2013 (Act 865). The law sought to encourage foreign investment as well as private sector participation through tax holiday incentives, investment guarantees, import duty exemption on machinery and equipment and many others. Act 865 governs investments in all sectors within the Ghanaian economy; this is done in conjunction with sector specific laws, additionally, the law made provision for capacity development, most significantly, technology transfer from foreign to firms to their local counterpart, this is captured in Technology Transfer Agreements Legislative Instrument (LI) 1574. There is enough evidence to suggest that improving the investment climate in Ghana has culminated in foreign firm's activities within the Ghanaian economy. Statistics on FDI in Ghana confirmed previous statements about the positive impact of FDI on the host country's growth. For example, GIPC (2014), reported that FDI inflow into Ghana in 2012 accounted for 8.09% of total Gross Domestic Production (GDP). Available recent figures demonstrated the trend in FDI flows across the various sectors in the Ghanaian economy, details of which are presents in Table 2-5. The period 2001–2009 as shown in Table 2-5 indicated a total of \$ 12,421.13 million FDI inflow, averaging about \$1,380.13 million per annum.

Table 2-5 Cumulative sector breakdown of FDI

Sector	Cumulative January 2001 – December 2009			
	Total Projects	(%)	Total investment cost (US\$M)	(%)
Manufacturing	516	26.86	7,446.90	59.95
Service	513	26.70	853.91	6.87
Tourism	186	9.68	146.12	1.18
Building & construction	154	8.02	2,442.65	19.67
Export trade	77	4.01	28.71	0.23
Agriculture	109	5.67	451.49	3.63
General trade	366	19.05	1,051.36	8.46
Total	1,921	100.00	12,421.13	100.00

Source: GIPC (2009)

Although the figure turned out by GIPC in terms of FDI (see Table 2-5) within the various sectors in the Ghanaian economy are quite significant to support economic growth as indicated previously, the main concern to this research has to do with the implementation and monitoring of ‘*Technology Transfer Agreements*’ (TTA) LI 1574.

The following section discusses FDI within the Ghanaian construction and the role of FDI in influencing capacities and capabilities of local firms within the Ghanaian construction industry.

2.15.2.2 FDI in the Ghanaian construction industry

The discussion in this section sought to establish the link between FDI in the Ghanaian construction industry and the development of capacities and capabilities of local firms in e-business technology. It could be recalled that the discussions and literature synthesis on the Ghanaian construction industry revealed that the local construction firms are suffering from; *financial constraints, low management skills and a lack of implemented technology* with specific reference to the use of ICT (see Section 2.17.4). It is moreover evident from the FDI literature (see Section 2.15.1.2) that FDI is a vehicle for improving managerial skills and technology. As highlighted in Table 2-5 during the same period, the construction sector which is the focus of this research witnessed a significant volume of FDI inflow amounting to \$2,442.65 million during the period 2001 – 2009 averaging about \$271.41 million with a corresponding estimated employment figure of 18,197 Ghanaians of different professional backgrounds (GIPC, 2009). These statistics agreed with Moran (2012), who established that FDI in infrastructure (energy, transport, telecommunications, water & sanitation) affect prospect of economic development in many ways in developing countries. Within Ghana, construction appears to have been the fastest growing industry sector throughout the last decade (Anaman and Osei-Amponsah, 2007). The above statement was recently confirmed by Sutton and Kpentey (2012), who explained that the construction industry has the potential to further record higher growth. Further, the growth and expansion of the construction industry have been confirmed and translated to represent the second most significant contributor to industrial output after manufacturing (GSS, 2011). Productivity growth (related to industrial output) is additionally driven by technological change (Fu *et al.*, 2011, Osabutey *et al.*, 2014). Furthermore, construction operations are multidisciplinary with both technical and managerial constituents and lend itself to project level analysis which is of interest in this research. Within Ghana, the construction industry is noted to have played significant role in national

development on account of its linkages with different sectors in the larger economic growth in Ghana (Giang and Sui Pheng, 2011, Ofori, 2012). This underlined the relevance of the construction sector to different sectors in the economy.

According to Osabutey *et al.* (2014), there is abundant literature that points out that Sub-Saharan African (SSA) countries needs rapid infrastructure development, in particular, Ghana to overcome its developmental demands for its middle income status and in actual fact the attraction of foreign investments in the construction sector. Having said this, in particular, in the construction sector, local firms lack capacities as well as capabilities to participate along with foreign firms for infrastructure development projects (Debrah and Ofori, 2006). For example, Ofori (1994a), noted that the majority of the local professionals lacked the requisite skills within the construction industry in Ghana this situation resulted into the total reliance on foreign construction firms for construction of strategic economic infrastructure. This implies that in Ghana, local firms moreover lack key resources, capacities and capabilities to undertake elaborate construction projects (Assibey-Mensah, 2009, Laryea, 2010). The state of the construction industry in Ghana generally is characterised by under development due to lack of capacities and capabilities on the part of local firms in the industry. Hence, the reliance on foreign construction firms for the delivery of complex and strategic economic infrastructure through FDI and JV initiatives. FDI activities within the construction industry offer capacities and capabilities development opportunity to local firms mostly in the areas of technology transfer and project management skills development. Ofori (2012) and Osabutey *et al.* (2014), observed that most local firms in the construction industry in Sub-Saharan Africa (SSA) faces challenges similar to Ghana this is a confirmation that Ghana's construction industry shares characteristics of construction industries in developing countries.

The arguments advanced by Asiedu (2002) and Abdulai (2005), which stated that FDI has the ability to deal with major obstacles such as financial resources, technology and skills and employment has been confirmed earlier. These capabilities of FDI have made it the centre of attention of policy makers in low-income countries. This is relevant and fit into the focus of this research which aims to develop a framework for e-business technology transfer using FDI in construction as a medium. Elevating the discussion to policy perspective Osabutey and Debrah (2012), suggested a model which linked education and human capital development, industrial and technology development, technology transfer and trade and FDI policy, supported by private sector development with emphasis on local firms. The suggestion provided by Osabutey and Debrah (2012), can be summarised to include capacities and

capabilities development through training, provision of technological infrastructure and provision of regulation and security most especially when it comes to e-business technology which is the focus of this research. An integrated policy of this nature would ensure that the presence of foreign firms can lead to adequate technology transfer. The implication for the construction sector in Ghana according to Osabutey *et al.* (2014), is that, the sector would improve on contract administration, project management, human resource management, financial management, quality and resource management, procurement and plant & equipment management, business development and strategic management.

Utilising FDI as a medium to transfer e-business technology to the construction industries in developing countries, in particular, Ghana encompasses more than e-business transactions within the construction industries in developing countries as it demands a review and redefinition of business strategies and a greater use of ICT to maximise improvement to these construction industries. This would normally require that construction firms or organisations to review existing processes, develop new skill sets, modify corporate culture, accept a new level of risk taking, acquire new technologies and establish new business relationships (Stewart, 2001). Similarly, Ismail and Kamat (2008), argues that e-business application in construction, for the full benefits to accrued there is the need to undertake restructuring in order to rake in efficiencies in the construction processes in developing countries. In view of this, for e-business to thrive within the construction industry in Ghana utilising FDI projects, there is the need to premise this discussion on organisational readiness which encompasses three main fundamental requirements, namely: capacities and capability development, technology and legal/security framework (see Section 2.12).

The following section presents a brief economic outlook of Ghana with the view that the construction industry has contributed significantly to the economic development of Ghana. This is then followed by the discussions of the various developmental stages and particularly the role foreign contractors and experts support to the Ghanaian construction industry with particular attention on pre-colonial and post-colonial eras in skills development and technology transfer.

2.16 Brief economy overview of Ghana

Ghana soon after emerging from colonial rule experienced strong economy and the highest Gross Domestic Product (GDP) on the continent as a result of the exploitation of its natural

resources, , including gold, diamonds, manganese ore and timber, before an economic crisis in the late 1970s (OECD, 2008, AEO, 2012). It recovered after launching one of the first and more stringent economic recovery programmes about two and half decades ago. The economic gains again was eroded due to falling prices of Ghana's major foreign exchange, commodities and rising prices for petroleum import led to further deterioration of the economy principally due to inherent weaknesses like severe infrastructural weaknesses (energy, transport and telecommunications) (GTZ, 2011). Through the International Monetary Fund (IMF) and World Bank (WB) assisted macroeconomic programme, Ghana made a robust economic recovery and achieved stable macroeconomic environment (Anvuur *et al.*, 2006). According to AEO (2014), Ghana's economy has maintained commendable growth trajectory with an average annual growth of about 6.0%. Growth in 2013 decelerated to 4.4%, considerably lower than the growth of 7.9% achieved in 2012 due to budget deficit following an expenditure overrun in 2012 to the tune of 12% of GDP (AEO, 2014). Over the medium term to 2015, the economy is expected to register robust growth of around 8%, bolstered by improved oil and gas production, increased private-sector investment, improved public infrastructure development and sustained political stability (Heritage, 2014). Growth has, however, been broad-based, driven largely by service-oriented sectors and industry, which on the average has been growing at a rate of 9.0% over the five years up to 2013. For example, in 2012 the service sector share of GDP stood at 50.0%, followed by industry 27.3% and agriculture 22.7% (GSS, 2013). Further analysis demonstrated that construction alone in the industry sector contributed 11.2% to the national economy in 2012 making it a higher contributor to the economy. The construction industry has made significant contributions to both industrial output and overall GDP over the years (Osei, 2013).

2.17 Structure of the Ghanaian construction industry

This section presents the discussions on the development of the Ghanaian construction industry, tracing it from the pre-colonial era through to its current state.

2.17.1 The development of the construction industry in Ghana

The development of the construction industry in Ghana can generally be described to be as old as Ghana. The construction industry generally constitute different organisations which provide different tasks in a contracting arrangement and this may come in the form of construction materials supply, labour, equipment and general services necessary for the

construction of a particular project (Laryea and Mensah, 2010, Dogbegah *et al.*, 2013). In this regard, these firms form the core structure of the construction industry. Therefore, it is imperative to understand that the strength and viability of the construction industry largely depend on the total capabilities of the construction firms operating within the industry (Ampadu-Asiamah and Ampadu-Asiamah, 2013). Due to the economic significance of the construction industry, it is significant to draw an understanding by exploring the evolution of the construction industry particularly in Ghana where this research is situated (Osei, 2013). This is expected to provide a chronological development of the construction industry in Ghana and the support received from expatriate experts and foreign construction firms in the development of the construction industry in Ghana.

While the evolution and development of general contracting or contractor is well documented in implemented jurisdictions, countries such as the United Kingdom (UK) in studies such as a historical overview of the evolution of professional system in the construction industry in Britain conducted by Winch (2000) and moreover a historical overview of technological change in the construction industry (Hughes and Hillebrandt, 2003). The same cannot be said about Ghana. According to Laryea and Mensah (2010), the evolution and development of the construction industry in Ghana and consequently the local indigenous construction firm development is not recognised as a subject that is adequately articulated in the literature therefore, there is the need to set the basis to further explore this development. However, in examining the development of the construction industry in Ghana, Assibey-Mensah (2009), gave credence to the dominance of big foreign construction firms that started business in Ghana long before independence in 1957. This could be argued that the indigenous construction firms at the time does not have the capability to undertake physical infrastructure development projects that could be created by the construction industry to support Ghana's economic development and growth (Twumasi-Ampofo *et al.*, 2014). Understandably, foreign construction firms have been part of the Ghanaian construction industry and have supported the development of the construction industry in Ghana as indicated in the literature (Ofori, 1994a). The following section discusses foreign contractor support to local or indigenous entrepreneurial development and the general development of the construction industry in Ghana, where issues concerning basic skills and technological knowhow transfer to the indigenous construction firm are highlighted.

2.17.2 The role of foreign contractors in capacity development

As clearly indicated earlier foreign contractors have been instrumental in the development of capacity in terms of management skills and technological know-how of the indigenous construction firms before and after independence in 1957. Laryea and Mensah (2010), recently studied the evolution of the indigenous Ghanaian contractors operating in the construction industry. Accordingly, this study Laryea and Mensah (2010), sought to provide an initial idea about the development of the construction industry in Ghana and by this to position general contracting in Ghana in the context of general contracting in a wider and international sense. This study provides a sound basis for the discussion in this section therefore, this section is grounded in this study. For the study conducted by Laryea and Mensah (2010), long before independence (colonial time), there was a colonial government department of works which was responsible for construction related activities; these included engineering, design and the actual construction works. Largely, the department of works was responsible for all public works, electricity supply, road construction and water supply. This department was moreover responsible for the recruitment of local or indigenous artisans. According to the findings of the study conducted by Laryea and Mensah (2010), there were training centres dotted around the country where structured skills development trainings were conducted purposely to develop skills and technological knowledge of these artisans engaged by the colonial department of works. This was considered as an intensive apprenticeship scheme principally used for training and categorisation of labour within the department (Asamoah and Decardi-Nelson, 2014). Ofori (1994b), explained that training activities were mostly facilitated by the expatriate staff of the department of works. From the discussions above the construction activities were largely controlled by the colonial department of works. Clearly there were no private entrepreneurs or contractors to conduct government construction works. To sum up, this department played the role of private entrepreneurs and moreover provided skills development and technological knowhow to the artisans to support the works of the department at that time.

Consequently, shortly before World War Two (WW2) the construction industry started shaping up where there was the sudden emergence of private contractors in the then Gold Coast (now Ghana). This is as a result of the availability of trained artisans and skilled construction workers previously employed by the colonial department of works. To clarify, the contractors that emerged were foreign contractors of Italian origin. According to Laryea and Mensah (2010), the nature of the alliances in WW2 carried implications for the Italian

builders in the construction industry in the Gold Coast (now Ghana) after WW2. WW2 was organised into two opposing military alliances: the Allies and the Axis. The Allies of WW2 comprised of nations, including the British Empire, the Union of Soviet Socialist Republics, and the United States of America. The Axis powers of WW2 comprised of nations, , including Germany, Japan and Italy. Ghana, then known as the Gold Coast at the time, was by then a British colony and territory. Naturally in theory, meant that Ghana was part of the Allies in WW2 through British colonialism.

The study further established that as a result of the start of WW2, the Gold Coast (now Ghana) colonial masters (Britain) were convinced that Italians in the Gold Coast might hold allegiance and sympathies for their home government and act as spies for their home government and feed it with information about British Empire activities on the Gold Coast. For this reason, the majority of Italians who originally came into the Gold Coast as master craftsmen in building construction were imprisoned by the British colonial government in the Gold Coast. Soon after WW2, the British colonial government in the Gold Coast noticed the devastation and destruction that had occurred. Therefore, the British colonial government in the Gold Coast decided to use the Italian prisoners during WW2 as master craftsmen for rebuilding of infrastructure destroyed during WW2 in the Gold Coast. The British colonial government provided them with the capitalisation needed to achieve the objective of employing them for developing infrastructure in the Gold Coast. “This, in essence, may be considered as the real start of general contracting in Ghana” and the development of the construction industry.

As the Italian craftsmen took the lead in the post war infrastructure development in the Gold Coast together with their indigenous or local collaborators, some of these local collaborators started to develop the entrepreneurial capacity and capability to undertake construction works as their collaboration with their Italian counterparts provided them with the opportunity to learn management and technical skills that they needed and moreover the technological knowhow. See, for example, Figure 2-4 for specific foreign contractor’s role in technology transfer. Laryea and Mensah (2010), discovered that apart from the Italian craftsmen who dominated the construction business in the Gold Coast, there were several well established British and Swiss construction firms, operating in the Gold Coast as major contractors. As a matter of fact, unlike the Italian contractors who implemented their construction business in the Gold Coast together with their indigenous or local counterparts, these British and Swiss firms came into the Gold Coast as an “offshoot firms from their parent firms in Europe”. Hence, they were already recognised as big contracts with well-defined organisational

structures quite different from their Italian competitors, which were implemented locally in the Gold Coast. Since the art of construction business was transferred to the indigenous entrepreneurs by their Italian counterparts, the local contractors implemented their firm structures adopting the Italian model.

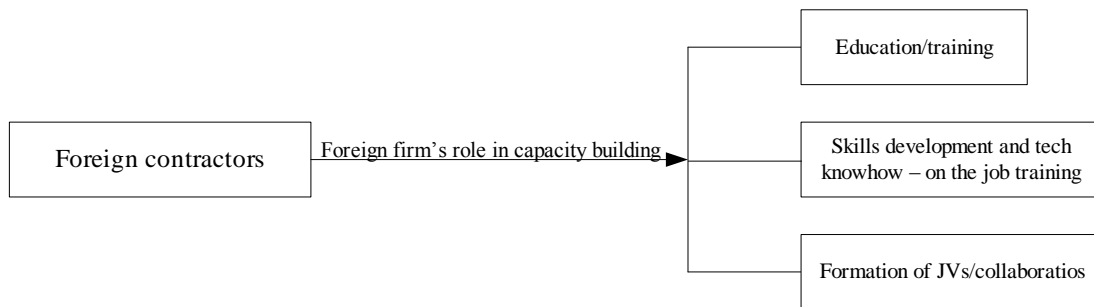


Figure 2-4 Foreign firm's role in capacity development

2.17.3 The construction industry after independence

From the discussions in Section 2.17.2 the construction sector skills development has been greatly influenced by foreign contractors and expatriate government workers with the colonial department of works. This has contributed to the development of the capacity of the artisans who started private construction businesses in Ghana. Based on the skills and construction, technological know-how that was transferred to the Ghanaian artisans, the new Ghanaian government transformed and created new state construction sector organisations with the primary goal of constructing roads, housing, electricity supply, water supply in the most cost effective and efficient ways. These public sector institutions have grown in capacity in terms of construction skilled workers and operatives (Assibey-Mensah, 2009, Laryea and Mensah, 2010).

From the study of Laryea and Mensah (2010), it was reported that soon after independence the new government encouraged local entrepreneurs to go into construction business. This largely was due to the availability of a huge number of skilled workers that was turned out as a result of the trades training provided by the then colonial experts and foreign firm collaborations. It was further revealed that some employees of these state institutions who were mostly master craftsmen and technical supervisors took up the challenge by setting up their own construction firms (Djokoto *et al.*, 2014). Although there were indications of government's support for this indigenous construction firm, professionals such as engineers, architects and quantity surveyors did not venture into this business because of the good pay package from the government (Asamoah and Decardi-Nelson, 2014). Therefore, the private

construction business was largely dominated by craftsmen and technicians who had many years of experience and know how in physical construction activities. In contrast, the majority of these local or indigenous contractors did not have the skills such as estimating and general management and to some extent they did not have sufficient capital to engage the services of professionals to support their work and growth within the construction industry (Dadzie *et al.*, 2012). From this point, the construction industry began to experience difficulties in project delivery most especially in the areas of tenders for jobs and other procurement related challenges.

Laryea and Mensah (2010), further indicated that as the indigenous construction firms operating within the construction industry in Ghana began to grow bigger in size, it became extremely significant to put adequate organisational management structures in place in order for them to be viable. This is to say, they needed to employ professionals, staff like engineers, quantity surveyors and administrators to properly establish their construction firms (Twumasi-Ampofo *et al.*, 2014). The study further noted that skilled construction professional were in short supply to the construction industry as a result, they were expensive to employ hence indigenous contractors were unable to afford their services (Ahadzie, 2011). Therefore,, most indigenous contractors did not have the services of these professionals and for this reason could hardly perform creditably on construction projects (Amoah *et al.*, 2011). This in particular has impacted negatively on the capacities and capabilities of indigenous or local construction firms in project delivery. With reference to this, the government quickly initiated several activities to arrest the overgrowing construction skills shortage by establishing training institutions purposely to provide basic training for the consumption of the construction industry in Ghana.

To further strengthen the structure and institutional regulatory framework for the construction industry in order to provide the needed economic infrastructure that the nation required, the government sets up supervising agencies primarily to supervise the activities of the construction industry and moreover enforce construction related regulation in the form of laws, byelaws and legislative instruments (ILs). Some of these agencies can be identified as Ministry of Water Resources, Works and Housing (MWRWH) and Ministry of Roads and Highways (MRH) several other technical divisions can be found under these ministries.

2.17.4 Current outlook of the Ghanaian construction industry

The nature of demand within the economy has changed quite significantly and that has put pressures on the construction industry to be highly dynamic as a result and its operating environment, industry structures and product characteristics to change at an ever-increasing pace (Dansoh, 2005). Unfortunately, the current status of the construction industry is unable to cope with the demands of the economic resurgence in the country. The general issues fraught within the construction, such as low productivity, lengthy pre-contract award procedures, corruption, and delays resulting in time and cost overruns and unsatisfactory quality of work are moreover affecting the local firms quite considerably (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 largely, of foreign firms that have opened up branches in Ghana, while the small firms are mostly Ghanaian Indigenous Businesses (GIBs). According to van Egmond and Erkelens (2007), out of a total of 7095 construction firms registered in Ghana, 90 per cent (90%) are small contractors who belong to classes D3 and D4 (see Table 2-7 as per Ministry of Water Resources, Works and Housing (MWRWH) and Ministry of Roads and Highways (MORH) contractor classification and categorisation. This category of contractors undertakes less complex construction jobs with tender sums up to one million dollars (Eyiah and Cook, 2003, van Egmond and Erkelens, 2007). This has recently been confirmed by Amoah *et al.* (2011) in their work. Ayarkwa (2010), claimed that the total amount of work executed by these contractors ranges between 10% and 20% of the total construction output. Ayarkwa *et al.* (2010), noted that the capacities and capabilities of the construction firms are crucial in managing all forms of recourses as they are responsible for planning, designing and constructing facilities for commerce and infrastructure needed to provide basic services, such as energy, water and transportation. Industry reports indicated that the majority of Ghanaian contractors operating within the construction industry do not have sufficient funds and credit facilities and moreover lacks appropriate technological capabilities, plant and equipment as well as key personnel to handle construction projects properly (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 across developing countries construction industries. Obviously, with the current outlook of GIBs arrived at through synthesis of literature makes it difficult for them to develop without support. One way such

development can be achieved is through working together with foreign firms through which they can improve on their capacities and capabilities (Back and Sanders, 1998).

2.17.5 Economic significance of the construction industry in Ghana

Lange and Mills (1979), described the construction industry as a group of firms with closely related activities involved in the construction of real estate, buildings, private and public infrastructure. “It can be regarded as a mechanism of generating employment and offering job opportunities to millions of unskilled, semi-skilled and skilled work force” (Khan, 2008). Available figures in Ghana demonstrated that, the construction industry has had an estimated employment figure of 2.3% of the economically active population since 2002 (Amankwa, 2003). The construction industry deals with all economic activities directed to the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature and other such engineering constructions such as roads, bridges and dams (Anaman and Osei-Amponsah, 2007). This is further explained that construction firms irrespective of size are those directly involved in the physical development of infrastructure and supply of construction materials and other construction related activities. In Ghana like any other country, the construction industry is an significant one as it is considered to be the main channel through which physical infrastructure and facilities required for improved economic and living conditions are provided (Fugar and Agyakwah-Baah, 2010). In contrast, these facilities are relatively undersupplied (Eyiah, 2004). The construction industry in Ghana accounts for a significant share of GDP (GSS, 2013). Anaman and Osei-Amponsah (2007), in their study established the interdependence between the construction industry and the economy of Ghana and economic viability of the industry. Available statistics from GSS (2013) as in Table 2-6 demonstrates the economic contribution of the industry for the period 2008 – 2012.

Table 2-6 Construction sector contribution to GDP

Growth	9.8	9.3	2.5	17.2	11.2
Year	2008	2009	2010	2011	2012

Source: GSS (2013)

From 2008 to 2012, the Ghanaian construction industry has consistently provided an average GDP growth of 15.84% to the economy of Ghana (see Table 2-6). Table 2-6 demonstrates

that, the construction industry in Ghana as at 2008 had a GDP growth of 9.8%. The industry experienced declines in growth in 2009 by contributing 9.3% to the economy of Ghana a situation that can still be considered and compared with the argument by (Kenny, 2007). In 2010 the industry further declines recorded 2.5% GDP largely due to a 5% decline in the total production of cement in 2009 (GSS, 2009). However, in 2011 it had picked up again by recording 17.2% growth and then dropped marginally settling at 11.2% in 2012. It is estimated that the construction industry will have a consisted growth of 13% following the emergence of Ghana as an oil producing country ISSER (2008) cited in (Danso *et al.*, 2011). It is, therefore, anticipated that, the economic growth would further be enhanced with the participation of the local firms hence the need to support local firms to improve on their capacities and capabilities to fully participate in the development of Ghana is paramount.

2.17.6 Regulatory framework for contractor classification

As identified in Section 2.17.2 the government agency responsible for contractor registration (general building and general civil) is the Registrar General's Department (RGD) under the company registration laws Act 179 (1963). Contractor classification and categorisation (see Table 2-7) are done by Ministry of Water Resources, Works and Housing (MWRWH) and Ministry of Roads and Highways (MORH). Amoah *et al.* (2011), provided and discusses MWRWH guidelines for classification and categorisation. The guidelines according to them include the following: plant and equipment holding, financial standing, previous performance and technical expertise. Further, MWRWH has two (2) main classifications for building and civil engineering contractors: Category 'D' for general building works, whereas civil works are classified as 'K'. These categories as mentioned above are sub-divided into four (4) classes, ranging from class D₁, D₂, D₃ and D₄ for general building works, while civil work ranges from K₁, K₂, K₃ and K₄. Conversely, MORH classified road contractors as 'A' for roads and 'B' for concrete structures and road furniture ranging from A₁B₁, A₂B₂, A₃B₃ and A₄B₄. Contractors in each category are further grouped into financial classes in the following order, 1, 2, 3, and four as shown in Table 2-7.

Table 2-7 Contractor classification in Ghana

Financial Class	General Building Works	Civil Works	Road Contractor
1	D ₁	K ₁	A ₁ B ₁
2	D ₂	K ₂	A ₂ B ₂
3	D ₃	K ₃	A ₃ B ₃
4	D ₄	K ₄	A ₄ B ₄

Source: Discussions from Dansoh (2005); Laryea and Mensah (2010) and Amoah *et al.* (2011)

Classes D₃, D₄ and K₃, K₄ are considered or referred to as Small-scale Building Contractors (SSBCs) they constitute well over 90% of the job market in Ghana (Amoah *et al.*, 2011). Similarly, road contractors falling within classes A₃B₃ and A₄B₄ are referred to as small-scale road contractors (SSRCs). Conversely, D₁, D₂ and K₁, K₂, A₁B₁ and A₂B₂ classes are commonly referred to as big firms and the majority of these firms are foreign firms (Eyiah and Cook, 2003). According to Dansoh (2005), this regulation provided the platform for monitoring and control of activities within the construction industry in Ghana, further most private clients select contractors based on this classification.

The following section discusses the project procurement as provided within the legal framework in Ghana.

2.18 Project procurement

This section explores construction project procurement, first presenting a conceptual approach followed by the Ghanaian procurement environment as provided by law.

2.18.1 Procurement

Many authors have differently defined what constitutes procurement based on different parameters and thinking. The procurement process according to Egbu *et al.* (2003), is not solely the buying of goods and services but moreover incorporates buying strategy as services, procurement activities can be grouped and defined in three different ways: indirect procurement, direct procurement and sourcing (Minahan and Degan, 2001).

Procurement from many perspectives and consideration is considered an significant activity within the construction industry as it contributes largely to the success of projects. Lenard and Mohsini (1998), define procurement as a strategy to satisfy client's development and or operational needs with respect to the provision of constructed facilities for a discrete life cycle. This further underscores the fact that, primarily in construction; procurement is to determine how the building or civil engineering project will be obtained (Akbiyikli and Eaton, 2004). All these definitions appear to have projected some common elements, i.e. obtaining an externally provided product or service. In the work of Love *et al.* (1998), they sought to categorise and define the procurement system as an organisational system that assigns specific responsibilities and authorities to people and organisations, and defines the relationships between the various elements in the construction of a project. The Aqua Group (2001), conversely, argued that it is now almost goes without saying that the increasing rate, of change in the construction industry requires the constant updating of our approach to procurement. Therefore, it suggests that the major driving force behind a successful and efficient construction industry is the recognition of a well-implemented and proven construction project procurement regime. However, arriving at the most appropriate method of procuring a project requires an extensive consultative process and detailed assessment of the client's requirement. The selection of the most suitable procurement method has consequently been critical for both clients and project participants, and is becoming an significant and contemporary issue within the construction industry (Love *et al.*, 1998). Therefore, one of the key concerns of procurement selection is how to enhance objectivity (Cheung *et al.*, 2001). Masterman and Masterman (2003), articulated process leading to the selection of an appropriate procurement system. According to Masterman and Masterman (2003), the overall process consists of conducting a detailed assessment of the client's characteristics, the client's overall needs and objectives, identifying the specific primary and secondary objectives of the project, the risks inherent in the proposal, determining the environment in which it will be implemented and finally selecting the most appropriate method of procuring the project. It can ostensibly be argued that, the process of selecting a procurement system for a particular project must be of a great interest to the client.

2.18.2 Procurement methods

There are a wide variety of procurement routes or methods available to clients, each of which have relative merits and demerits for the participants in a project (Hardcastle and Tookey, 1998). Masterman and Masterman (2003), distinguished the following type of procurement

routes: traditional (design is separated from construction), design and build, management, and partnering methods. In recent times there have been new procurement paradigms like a public private partnership (PPP), public finance initiative (PFI) and alliance. It should be noted that procurement issues are of national interest therefore, these are treated based on a legal framework peculiar to a particular country.

2.18.3 Procurement as governed by law in Ghana

Ghanaian government's commitment to financial discipline, accountable, transparent and ethical conduct, effective management of public procurement to obtain value for state spending is paramount (Aduamoah and Campion, 2012). It is in this regard that the Ghanaian government in 2003 promulgated the Public Procurement Law (Act 663) to tackle public procurement corruption among other relevant objectives (Osei-Afoakwa, 2013). Further, the promulgation of the Public Procurement Law (Act 663) ostensibly was to deal with weak institutional arrangement with issues such as absence of rules governing the conduct of public procurement, lack of accountability, inappropriate institutional and administrative structures and arrangements, inadequate human resource capacity and lack of transparency (Osei-Afoakwa, 2013, Ameyaw *et al.*, 2012).

The Public Procurement Law (Act 663) provides the legal framework for all procurement in respect of goods, works and services obtained wholly or partially with public funds. The Public Procurement Law (Act 663) provides the legal framework in terms of procedures and processes by which public procurement takes place through the provision of sets of standard tender document, purposely to ensure transparency, probity and accountability. The Public Procurement Act (Act 663) moreover makes provision for set of procurement rules and provides a list of procurement methods applicable under the procurement law of Ghana and adequately provided for tendering procedure. However, the Public Procurement Law (Act 663) has been criticised by both procurement practitioners and academia for not promoting innovation and being silent on immerging procurement concepts such as a public private partnership (PPP) and private finance initiative (PFI) see, for example, (Osei-Afoakwa, 2013). Furthermore, it is instructive to explore technologies that can enhance the procurement process (Osei-Afoakwa, 2012, Essel, 2014). Although the PPA (2003), provides the legal framework for facilitation of procurement activities, Aduamoah and Campion (2012) and Osei-Afoakwa (2012), highlights issues of transparency and delays due to several compliance procedures such as requirement to have documents in writing. Transparency and employing

efficient communication and use of technologies to improve procurement practices seems difficult due to the provisions of the PPA (2003). Employing e-business technologies as part of the procurement process it would improve information flow, transparency and communication between various parties involved in the procurement process. Essentially, these under implemented technologies can bring about improvement and increase productivity through the elimination of delays in the process. e-Business technologies which are quite extensively used in implemented countries can potentially bridge they need to have the required compliance procedures while at the same time fulfil efficiency requirements. One major way by which this can be achieved is through effective collaboration between local firms and their foreign counterparts in FDI project environment (see Sections 2.15.1.2 and 2.15.2.2 in Chapter 2). This collaboration allows the parties to work within the existing procurement processes to undertake construction work so that the appropriate e-business technologies can be transferred from foreign firms to local firm's context with associated development in the capacities and capabilities of both government and private stakeholders.

2.18.4 Procurement methods provided by law

The PPA (2003), explained works to mean work associated with construction, reconstruction, demolition, repair or renovation of a building or structure or surface and includes site preparation, excavation, erection, assembly, installation of plant, fixing of equipment and laying out of materials, decoration and finishing, and any incidental activity under a procurement contract. The PPA (2003), provided the following procurement routes or methods for the purposes of procuring works and each method has a threshold that provides for expenditure limit, see explanation of the methods in Table 2-8.

Table 2-8 The procurement methods provided in the law

Procurement Method	Brief Description
International Competitive Tendering (ICT)	International Competitive Tendering is appropriate for high value or complex procurements, or where the works by their nature or scope, are unlikely to attract adequate local competition
National Competitive Tendering (NCT)	National Competitive Tendering is appropriate for lower value procurements, where the works by their nature or scope are unlikely to attract foreign competition, or where there are justifiable reasons for the Procurement Entity to restrict tendering to domestic contractors
Restrictive Tendering (RT)	<p>Restricted Tendering is a tendering process by direct invitation to a shortlist of pre-registered or known contractors, and is subject to a specific approval being granted by the Public Procurement Board: It is an appropriate method of procurement where:</p> <p>the requirement is of a specialised nature or has requirements of public safety, or public security which make an open competitive tender inappropriate;</p> <p>due to the urgent nature of the requirement, an open competitive tender is not practical;</p> <p>the number of potential contractors are limited; or</p> <p>an open competitive tender has failed to bring an award of contract.</p>
Two-Stage Tendering (TST)	Two-stage Tendering is an infrequently used procurement process in which a Procurement Entity invites tenderers in the initial stage to contribute to the detailed specification of the works. Following review and consultations, new detailed specifications for the works are prepared and a restricted tender issued in the second stage to all participants who were not rejected in the first-stage.
Single Source (SS)	<p>single source procurement may be appropriate when:</p> <p>the purchase is for urgently needed remedial works, provided this is restricted to the minimum requirement to meet the urgent need until a procurement by other methods can be fulfilled; or</p> <p>the works can only be provided by one source for physical, technical or policy reasons. e.g. requiring the use of proprietary techniques that are obtainable only from one source.</p>
Request for Quotations (RFQ)	This is also known as “shopping” and is based on comparing price quotations obtained from several suppliers, usually at least three, to ensure competitive prices

Source: PPA (2003)

2.18.5 Existing procurement processes in the Ghanaian construction industry

The main objective of the public procurement system to provide value for money to the government by ensuring that public funds are spent in a transparent, efficient and fair manner and comply with the procurement law. In accordance with provisions in the procurement law, all public entities are required to submit annual development plans together with technical specification, design and budget to the Public Procurement Authority (PPA) for approval as shown in Figure 2-5. The approval process is quite a long one as it may require additional input as many times as possible. Once approval is sought, consultants are procured to prepare

contract details and documentations moreover based on provisions in the procurement law. The first decision to make is invitation to tender immediately after contract documentation is complete, this is then followed by tender opening and evaluation and subsequently award of works and the execution phase of the works evoked (Figure 2-5). It is worth noting that, the award decision is based on one of the procurement routes provided by Act 663 PPA, (see Table 2-8) consultants together with the procuring entity have the responsibility to monitor the works and moreover take performance and progress reports until the works are completed and handed over to the procuring entity. The processes indicated in Figure 2-5 primarily affect all projects funded partially or wholly with public funds and mostly applicable to National Competitive Tendering (NCT) category (see Table 2-8) are lower value is required or the scope of works is unlikely to attract foreign competition.

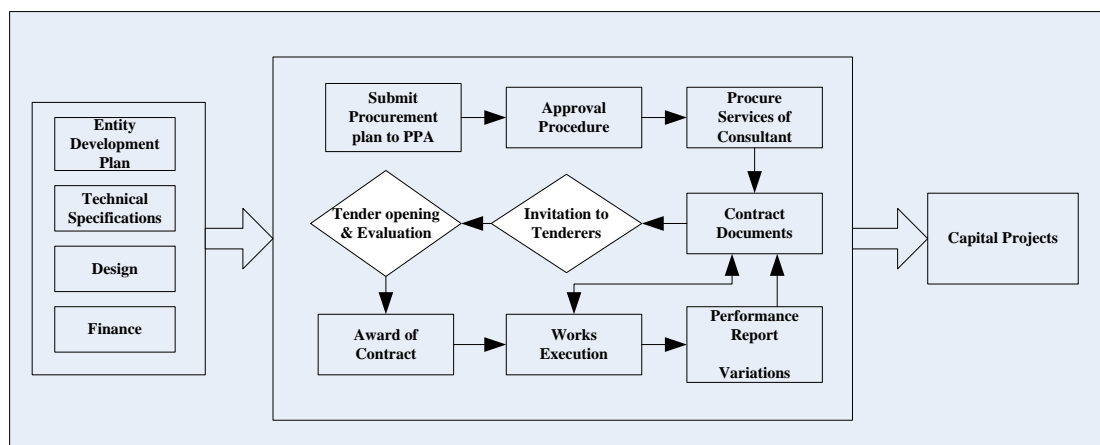


Figure 2-5 Works procurement process: Source PPA (2003)

However, foreign firms mostly fall into International Competitive Tendering (ICT) and Single Source (SS) categories, a situation which is far beyond the reach of local firms. It is, therefore, suggested that the procurement processes indicated in Figure 2-5 remains a preserve for local firms, while foreign and big firms follow different methods which are far apart from what is available to local firms. Understandably, the law naturally does not encourage an integrated environment for local firms and foreign firms to work together. There is no specific enforceable provision in the law that encourages collaboration between local firms and their foreign counterparts a situation likely to drag the development potentials of local firms operating within the Ghanaian construction industry, where it is accepted that foreign firms have a role in supporting capacities and capabilities of the local firms. The construction procurement method used in public work is the traditional method with design split from construction, meaning this type of works procurement conform to NCT route (Anvuur *et al.*,

2006). Ansah (2011), argued for a new direction in the procurement of works by employing emerging concepts like partnering and many others that promote effectiveness. Ameyaw *et al.* (2011), in a recent study in 49 District, Metropolitan and Municipal Assemblies (DMMA) in Ghana noted that 92% of project undertaken between 2009 and 2010 were delivered based on the traditional procurement system with open competitive tendering (this conform with NCT procurement route) and during the same period partnering accounted for only 8% of construction projects undertaken. This study highlights the popularity of the NCT route provided by the procurement Act 663. With respect to this, the national competitive tendering (NCT) is the most used procurement methods in public procurement of works in Ghana, with its much known adversarial relationship which is moreover known as a major barrier. Baodu *et al.* (2011), similarly identified that construction project procurement at the local governance level is done with or without any form of professionalism. They noted that as much as 69% of local government administrators have no training in contract administration and contract procurement procedures. Further, 99% of these administrators advocated for capacity building to enable them to overcome deficiencies inherited in the administration of infrastructural projects at local government level. The procurement method is entirely paper based transaction.

Works 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 socioeconomic 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). This notwithstanding, the implementation of the procurement law has been fraught with countless issues, some of which include: low capacity of procurement professionals, low interaction between procurement entities and PPA, ICT and e-business has the potential to resolve the interaction gap (Ameyaw *et al.*, 2012). Although Act 663 provides equal opportunity and a level field for industry players and procurement practitioners, the entire procurement process is manual based and this has led to practitioners calling for the establishment of ICT elements such as e-business in order to eliminate issues concerning delays and communication difficulties and to focus on organisational efficiency and value-adding processes in the works procurement process (PPA, 2010). Aduamoah and Campion

(2012), identified weak monitoring structure of the procurement system, which, according to them affect payment and other related issues. They recommended the establishment of e-tender submission of contract documents and evaluation process. The potential of ICT elements for improving the quality of procurement services in the construction industry is generally acknowledged (Oladapo, 2007).

Clearly, there is every indication that the economy of Ghana has the capacity to continue its growth. Construction as pointed out in the literature has a significant role in supporting the economic growth of the country. Unfortunately, the indigenous construction industry appears not to have the needed capacity and technological capacity to enable them to become efficient and effective in the project delivery process. In this regard, there is a need to cautiously approach these identified capacity improvement needs by rolling out programmes to raise the skills and capacity of both the various levels of professionals and firms or companies working within the construction industry thereby making the industry a lot more relevant to the local Ghanaian construction market and beyond. In line with this, this research is about bringing together ICT based systems (i.e. e-business) to improve effectiveness and efficiency of the construction project procurement process in Ghana.

2.19 e-Business previous research in Ghana

Most studies on e-business technology implementation in construction organisations have been conducted within the confines of implemented 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, arguing that the adoption of e-business practice has benefit for small Ghanaian exporters' organisational improvement. A framework for small firm exporter, e-business development was implemented. The framework identified four main activities, these activities include international triggers, macro triggers and micro trigger has been grouped and mapped to e-business technologies. The third section, e-business, organisational transformation centres, mentioned among other things, finance, marketing, strategy leverage capabilities and human resources management, this is then mapped to e-business value delivery section and finally to the output section namely, enhanced export performance.

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 usage patterns among internationalising Ghanaian non-traditional exporters and this gradually enter construction. For a better understanding of the tremendous benefits of e-business/e-commerce demonstrated in the literature, Iddris (2012), recently examined the need to identify and measure the perceived significance of driving forces and barriers in the adoption of e-commerce solutions in small and medium-sized enterprises in Ghana. Although, there is an acknowledgement that some amount of work has been done on e-business technology transfer to the construction industries in developing countries as indicated previously, 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. The discussion in this section explained that there is limited work on e-business research within the Ghanaian construction industry. Recent contributions to the body of knowledge within the Ghanaian construction industry by Adzroe and Ingirige (2013), Adzroe and Ingirige (2014a) and Adzroe and Ingirige (2014b), provides the basis for further research into the various facet of e-business within the Ghanaian construction industry. This research, in part, therefore,, attempts to address fundamental issues in furtherance to adding value to the existing body of knowledge in the area of e-business implementation in the construction industry in Ghana. This can be achieved using exploratory research techniques as it allows researchers to explore deeper through questions and surveys leading to the understanding of phenomena (Yin, 2003, Baxter and Jack, 2008, Elgrari and Ingirige, 2011).

2.19.1 e-Business readiness in Ghana

This section explored Ghana's readiness for electronic business (e-business). This largely has been achieved through a thorough relevant document review, which includes government policy documents and papers in respect of Ghana's e-business readiness. Several of the documents reviewed, , including NITA (2012b), NITA (2012c), NITA (2012a) and PPA (2013), revealed the vision of Ghana government to improve efficiency of government's business through the use of ICT. Accordingly, this resulted in the initiation of the e-Ghana project with funding support from the International Development Association (IDA) through the World Bank (WB). With a particular reference to e-Government Procurement (e-GP) several deliverable were earmarked among them include the development of an e-GP communication strategy and an e-GP strategy and action plan with the expectation to move government procurement activities and engagements to this platform. According to available

documents on the development and implementation of the e-GP, the linkage revolves around three thematic areas, IT infrastructure, Legal framework and Capacity development.

Under these key areas based on government documents, several specific activities have been undertaken or proposed to take place in order to achieve the aim of e-GP. The following are some specific activities undertaken under the three key areas as discusses in the sections below:

2.19.1.1 IT infrastructure for e-government procurement project

For the purpose of these specific activities, the documents NITA (2012a) and PPA (2013) identified IT infrastructure to mean Internet Connectivity, Data Centre, Local and Wide Area Networks (LWAN), Security, Desktop Computers, Uninterrupted Power Supply (UPS) and Multi-Functional Devices (MFDs). Under the watch of the National Information Technology Agency (NITA) the following specific activities have been undertaken:

- National backbone infrastructure to all districts in Ghana
- National data centre and a secondary data facility for disaster recovery capability
- Extended e-Government infrastructure Network to 1050 sites around the country base on fibre optic, VSAT and terrestrial networks for wireless etc.
- Deployment of 8000 LAN ports Furthermore to existing 6500 LAN ports in government offices
- Public Key Infrastructure (PKI) for a computerised form of a message encryption particularly for tender submission and opening security

The above point demonstrates specific activities undertaken in relation to IT infrastructure aspect of the e-GP implementation in Ghana.

2.19.1.2 Legal Framework with respect to e-government procurement project

It is significant to put in place a comprehensive legal framework to support the implementation of the e-GP and in this regard, the following are the specific activities undertaken revealed the following documents NITA (2012b) and PPA (2013):

- Enactment of electronic transactions law and amendment of existing laws (Electronic Transactions Act, 2008 Act 772).
- Amendment of Public Procurement Act, 2003 Act 663 to include electronic tendering, which was previously not taken care of by the Act.

The above points show specific activities undertaken in relation to a legal framework aspect of the e-GP implementation in Ghana.

2.19.1.3 Capacity development for stakeholder in respect of e-government procurement project

Key stakeholders have been identified and according to available documents, NITA (2012c) and PPA (2013), service providers (Suppliers, Contractors, and Consultants) and Procurement Officers are critical stakeholders in ensuring success in the implementation of e-GP. Based on the understanding of the critical role and influence of the identified stakeholders, the following are specific planned activities to be undertaken:

- Capacity development programmes have been planned for service providers to equip them adequately to respond to tenders on e-GP platform
- Sensitisation and training of service providers and procurement officers in government organisations.

The above point demonstrates specific activities undertaken in relation to a capacity development aspect of the e-GP implementation in Ghana.

Under e-business readiness in Ghana (see Section 2.19.1) the various activities necessary to bring about effective implementation of e-GP which eventually would translate into e-business application within the economy of Ghana are outlined. At this point, the process of developing fully e-business capability must be approached gradually and step-wise. The following section presents and discusses e-business technology capability development process based on the work of Skyrme (2002).

2.20 e-Business capability development process

According to Skyrme (2002), e-business is the culmination of series of stages and activities which most organisation go in developing their e-business capability and exploitation of the Internet. These typical sequential stages are shown in Figure 2-6.

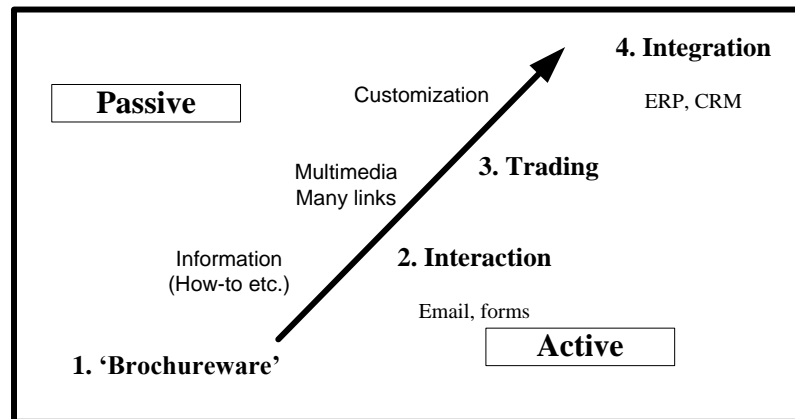


Figure 2-6 Road map for developing e-business capability (Skyrme, 2002)

The four (4) active stages include:

1. **Brochureware** – the first stage, organisations start the exploitation of the Internet by first of all developing a simple website that can transfer some basic marketing materials, such as brochures;
2. **Interaction** – the second stage, of the process allow two-way information flow with the organisation, usually through emails for enquiries;
3. **Trading** – the third stage, which is an advanced stage, deploys e-business facilities with the implementation of e-commerce tools for payments online. At this stage, web pages are enhanced through links to products and services;
4. **Integration** – the fourth stage provides full integration with the organisation's core business and beliefs. At this level, web pages can be customised; they can be generated 'on-the-fly' from databases; information flows seamlessly between the various systems.

Skyrme (2002), argued that organisations need to accelerate their process to developing e-business capability along the path provided in Figure 2-6 in order to transform the knowledge base of the organisation as each stage requires input of knowledge, perhaps from outside initially.

2.21 Key issues identified in the literature

This research sought to develop a framework for e-business technology transfer to the Ghanaian construction industry. On this premise, in-depth literature review was undertaken, first, in ICT and e-business in construction. This Chapter (Chapter 2) reviewed the literature on the development of the Ghanaian construction industry from pre-independence to its current state. The support of expatriate workers in the development of construction technology capacity in terms of skills development was uncovered. Although it was identified that the industry has contributed significantly to the Ghanaian economic development (see Section 2.17.5) it was moreover identified that the sector can perform better when industry player's capacities and capabilities are enhanced. Yet, the technological capacity and capability in the current outlook of the industry were not identified as the continuous development of the industry. Furthermore, findings from the literature identified specific gaps within the Ghanaian construction industry as low capacities and capability development among local firms (see Sections 2.17.3 and 2.17.4) to undertake construction projects successfully, inadequate technological infrastructure and legal/security framework to support the deployment of e-business technology within the construction industry. Whereas literature findings in Chapter 2 suggested that in developed countries, various initiatives and research into ICT in the construction have been undertaken leading to the discovery of ICT and e-business enablers such as: integration; collaboration and knowledge management; procurement; site management and process improvement (see Sections 2.4.2 and 2.4.3). To carry this research forward, the key findings from a synthesis of literature in chapters two was further explored through a questionnaire survey primarily to assess the capacity and capability of local construction firms in Ghana for e-business technology transfer. Furthermore, the questionnaire survey gauged the capacities of local contractors who participated in the survey in the type of e-business activities they undertake and the level of investment in e-business. The survey moreover seeks to measure the awareness level of local contractors through the identification of drivers, impact and barriers to e-business in construction. The findings of the survey are presented in Chapter 5 of this thesis.

2.22 Revisiting the research problem

This section sought to revisit the research problem presents in Section 1.3 in Chapter 1 following literature review. The literature review on the construction industries in both implemented and developing countries (see Sections 2.2 and 2.3) revealed that construction

the world over contributes significantly to GDP and employment. Although, this high point of construction industries has been established, it was further revealed that, there is a lack of meaningful integration among project partners within a project environment (see Section 2.2) a major impediment affecting the construction industries. Pertaining to this, using ICT and e-business to leverage performance within construction has been recognised in the literature, including key indicators of what ICT and e-business can be used to achieve within construction. The significance of considering the use of ICT and e-business within construction industries in developing countries, in particular, Ghana was highlighted in the literature. The need to improve capacities and capabilities of local firms as a precursor was underscored (see Section 2.3). This is in line with developing key skills in estimating which has an influence on *works procurement* activities in construction. Because local firms do not have the financial capacity to engage professionals, this has affected negatively their *management* capability (see Section 2.17.3). It is further shown in the literature that *improving capacities and capabilities* across local firms provide the basis to begin to understand the potentials of ICT and e-business in construction (see Sections 2.4.3 and 2.17.3). Previous research on the Ghanaian construction industry demonstrated the current state of the industry, it emerged that the issues facing the industry are of multi-dimensional, top of which include low *technological* capacity and *low level of trained personnel* resulting in low productivity in the industry (see Sections 2.17.1 and 2.17.3). While previous reports from elsewhere demonstrated the benefits of e-business, similar research reports within Ghana demonstrated that e-business can benefit small local businesses within the Ghanaian economy (see Section 2.19). However, knowledge about e-business in Ghana is scant therefore, developing e-business capability requires resources and infrastructure. Unfortunately, the resource base of local firms cannot support such investment therefore, *government intervention* is needed in this respect. Ghana government e-Government project initiative, similar to e-business (see Section 2.19.1) revealed that the success of e-business of *e-business implementation* depends on three key areas namely: IT infrastructure, Legal framework and Capacity development. Various documents related to this initiative demonstrated the criteria in these key areas (see Section 2.19.1.1 – 2.19.1.3). The need to further support efforts by the government to enhance the capacities and capabilities of the construction sector of the economy through making knowledge about e-business to local firms can be considered an significant step, in essence making them *ready for the uptake* of e-business. In this regard, there is need for in-depth research to address the problem through improving the technological capabilities of local firms by proposing a framework for e-business technology

transfer to the Ghanaian construction industry. To achieve this, the following research questions were raised leading to addressing the research problem:

1. To explore general ICT in relation to e-business, including drivers and barriers to construction e-business and the processes of e-business technology transfer through technology transfer principles;
2. To assess the structure, procurement practices and the influence of foreign contractors through FDI on the development of local skills in the Ghanaian construction industry;
3. To identify key fundamental requirements for implementing e-business technology within the construction industry in Ghana;
4. To develop a framework for the adoption of e-business technology in the Ghanaian construction industry to help improve communication performance;
5. To validate this framework within the construction industry in Ghana by utilising industry experts.

Following the establishment of the research questions, the next stage of this research is to develop a conceptual framework in order to help undertake the research effectively. Accordingly, the next Chapter presents the conceptual framework implemented in the research.

2.23 Summary and link

This chapter reviewed the literature on ICT development within the construction industry and its impact on the construction. This was followed by e-business with discussions based on theoretical considerations and its influences on the improvement of construction activities. This chapter, moreover clearly explained technology transfer and technology transfer mechanisms and how these principles can be used to achieve the aim of this research. It further focused on Ghana the main beneficiary of this research. The construction industry of Ghana was explored thoroughly in order to understand the development of the industry and challenges that faces it in order to establish the significance of this research. It clearly provided the development trend of the Ghanaian construction industry where this research is being conducted, and then linked the issues in e-business research initiative and Ghana's readiness to implement e-business based on e-Government Procurement (e-GP) initiated by the Ghana government. To further understand the processes for e-business technology transfer from organisational perspective a theoretical consideration was explored. It was identified that

information and knowledge about e-business within the local firms in the Ghanaian construction industry is scant. On this basis the research can be identified as valuable contribution and development of e-business within the Ghanaian construction industry. Following the establishment of the need for a detailed research into e-business technology transfer to the local firms within the Ghanaian construction which is in line with the aim of this research, the next chapter (Chapter 3) presents the conceptual framework showing the fundamental requirements which are seen as key influencing factors for e-business technology transfer to the local firms within the Ghanaian construction industry.

CHAPTER 3 DEVELOPMENT OF THE CONCEPTUAL FRAMEWORK

3.1 Introduction

As previously noted in Section 1.6.1 in Chapter 1, the aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI). As indicated moreover, in Section 2.19 in Chapter 2, there is still limited research being undertaken in e-business within construction especially, in the Ghanaian context. This implies that there is a limited knowledge about e-business especially, the potential benefits local construction firms can derive through the deployment of e-business. Therefore, this research sought to develop a framework depicting the fundamental requirements of e-business development and subsequent deployment within the local firms in the Ghanaian construction industry. The framework which seeks to address the need for improving e-business capability in the local firms is based primarily on synthesis of literature described in Chapter 2 of this thesis. The fundamental requirements for e-business technology transfer are assembled from further synthesis of literature in Section 2.12 in Chapter 2, organisational readiness for change (see Section 2.12.1), capacity and capability development in view of e-business technology transfer (see Section 2.12.2), ICT infrastructure as a fundamental requirement for e-business technology transfer (see Section 2.12.3) and legal framework in support of e-business technology transfer (see Section 2.12.4). Furthermore, Ghana government e-governance project, which include e-Government Procurement (e-GP) revealed in Section 2.19.1 in Chapter 2, similar requirements for e-business technology transfer. It demonstrates that IT infrastructure for e-government procurement (see Section 2.19.1.1), legal framework with respect to e-governance procurement project (see Section 2.19.1.2) and capacity development for stakeholders in respect of e-governance procurement project are key requirements for e-business technology transfer (see Section 2.19.1.3). The framework helps to increase the understanding within the Ghanaian construction industry as to what constitute the fundamental requirements in the context of e-business technology deployment, subsequently to support improvement in communication in the general construction management activities, including procurement. The framework provided an integrated environment where the fundamental requirements for e-business come together to offer e-business. This chapter of the thesis is structured by sections to show how the conceptual framework was implemented. Section 3.2 explains the conceptual framework

development process and the chapter concluded in Section 3.3 with a summary of the Chapter.

3.2 The need for a conceptual framework

Conceptual framework is of significance to a research as it provides a “sense of direction and focus” for the research to progress (Wedawatta, 2013). In the views of Easterby-Smith *et al.* (2012), conceptual frameworks are intended to provide a useful guide that seeks to align the research process so that the researcher remains focused throughout the research process. Jabareen (2009), defines conceptual framework as a network, or “a plane,” of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena. According to Miles and Huberman (1994), “a conceptual framework explains, either graphically or in narrative form, the main things to be studied, the key factors, constructs or variables and the presumed relationships among them”. They further categorised the framework under three (3) classifications, namely: rudimentary or elaborate, theory-driven or commonsensical, descriptive or casual. According to Miles and Huberman (1994), developing a conceptual framework, is about laying out the “key factors, constructs, or variables, and presumes relationships among them”. It is moreover of significance to note that a conceptual framework provides not knowledge of “hard facts” but, rather, “soft interpretation of intentions” (Levering, 2002). Therefore, a conceptual framework can be revisited and modified as the research progresses. According to Jabareen (2009), there are three key elements of a good conceptual framework. These elements are briefly described below:

- **Flexibility.** A conceptual framework is implemented “based on flexible conceptual terms rather than rigid theoretical variables and causal relations”.
- **Capacity for modification.** “Conceptual frameworks can be reconceptualised and modified as the research progresses according to the evolution of the phenomenon in question or as a result of new data and texts that were not available at the time the framework was first implemented. This is consistent with the basic premise that social phenomena are evolutionary and not static”.
- **Understanding.** “Conceptual frameworks aim to help us understand phenomena rather than to predict them”.

The conceptual framework for this research presents in Figure 3-2 has been implemented based on the fundamental requirements derived through synthesis of literature in conjunction with the key elements of conceptual framework suggested by Jabareen (2009). The main focus of this research is to develop a framework for the adoption of e-business technology in the Ghanaian construction industry to help improve communication in the general construction activities and procurement.

The following section discusses the development process of the conceptual framework.

3.2.1 Development of the conceptual framework for this research

This section of the thesis explains the processes involved in the development of the conceptual framework.

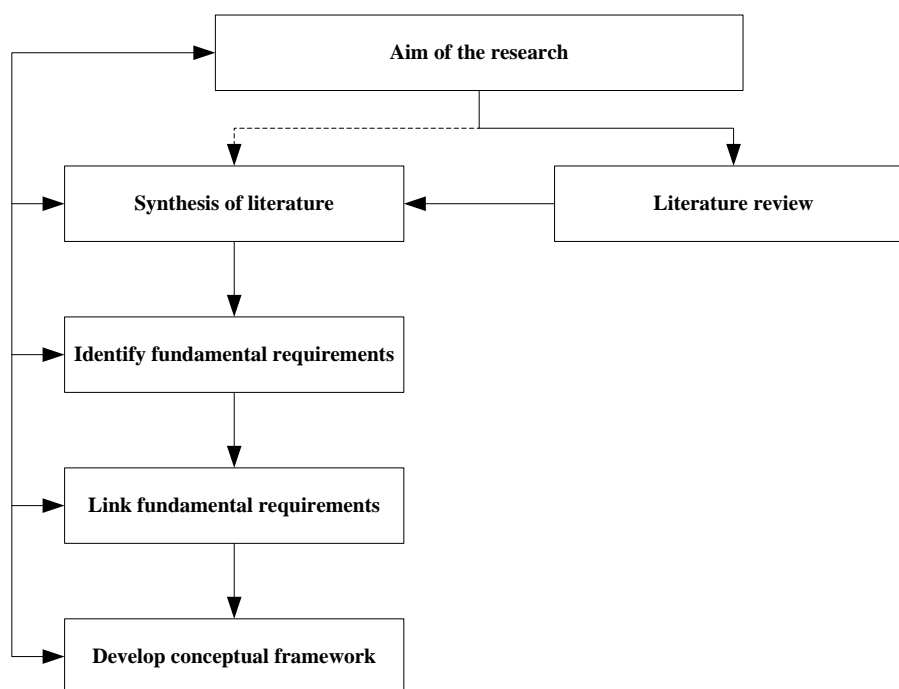


Figure 3-1 The conceptual framework development process

Figure 3-1 demonstrates the processes adopted for the development of the conceptual framework for e-business technology transfer in the context of the Ghanaian construction industry. First, the process starts by defining the aim of the research, and in respect of this research, the aim (see Section 1.6.1) is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI). Based on the aim of the research, the second process was a literature review. In this context, a

detailed literature review was conducted purposely to identify key concept and theoretical grounds for the development of the framework as the conceptual framework seeks to present the theoretical basis as how to address the research gaps identified for the research. Having identified the appropriate literature for the research, the third process as shown in Figure 3-1, synthesis of literature was conducted in order to narrow down to the most relevant issues focusing on the identification of the fundamental requirements separately as the process moved to the fourth level. The next process (fifth) is linking the fundamental requirements in order to form relationships between the fundamental requirements through requirement generation and capture processes. The sixth process is the development of the conceptual framework, in this process; the fundamental requirements are connected highlighting the main issues identified from the synthesis of literature in an integrated fashion.

The following section discusses how the conceptual framework proposed to address the research problem through the various components identified in the framework.

3.2.1.1 Using the conceptual framework for this research to address the research problem

This section focuses on the explanations of the various components of the conceptual framework implemented in this research, the section further explains how the various components came together to facilitate e-business technology transfer and expected changes within the Ghanaian construction industry. It is significant to point out that the process of technology transfer to developing countries, in particular, Ghana may involve a complex series of stages which requires a careful approach particularly when it is an industry specific, in this case construction. For a successful transfer of e-business technology to the Ghanaian construction industry, it is significant to develop a conceptual framework with a clear understanding as how the various components of the conceptual framework came together to facilitate the process of e-business technology transfer. By this, the conceptual framework explains the theoretical basis of key elements deemed necessary for e-business technology transfer within the Ghanaian construction industry.

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI). In this research e-business technology within the Ghanaian construction industry is presumed to be anchored on three main pillars linked in a triangular form; capacity and capability, technology and legal

framework (see Sections 2.12.1 - 2.12.4 in Chapter 2). These components represent fundamental requirement of e-business technology, and for the purposes of this research, this is facilitated within an FDI project environment (see Section 2.15.2 and 2.15.2.2 in Chapter 2). It is considered that a successful e-business technology transfer can occur within an FDI environment where training and interaction between foreign and local firms is envisaged (see Section 2.15.1.2 in Chapter 2). The first component of the framework is culture and it is considered to mean organisational outlook. This component is viewed in the context that for any new technology to be transferred and adopted by an organisation, especially in the developing country context, such as Ghana, it is significant to understand the dynamism of organisational culture (see Section 2.12.2.1 in Chapter 2) especially how the people factor affect the processes of technology transfer (Ruikar *et al.*, 2006). It is moreover envisaged that organisational culture can influence skilled workforce to take up new technologies. For example, it emerged from the literature that foreign firms have been instrumental in skills development in the Ghanaian construction industry (see Section 2.17.2). This was done to improve the capacities and capabilities of local contractors in their construction activities with a view to understand construction technology and its management procedures and processes. The second component of the conceptual framework is technology (see Sections 2.12.3 and 2.19.1.1). In technology transfer research, such as e-business, technology represents a major requirement. This element is moreover considered the most influential element as it defines the tools and processes within network computing and the web environment leading to the deployment of e-business capabilities. For the purposes of this research technology cover issues concerning Internet connectivity and devices such desktop computers representing the hardware aspect while the software aspect is taken care of by industry specific software. A detailed explanation of technology in the context of this research is discusses and presents in Sections 2.12.3 and 2.19.1.1. The third component of the conceptual framework is legal framework. These are regulatory issues to be addressed to support the deployment of e-business solutions within the construction industry in Ghana (see Sections 2.12.4 and 2.19.1.2). This bothers on a robust legal framework that provides trust and the secured business transaction environment. Previous literature discussions pointed out that legal framework provides confidence to people and firms to transact businesses in a legally secured environment (Ruikar and Anumba, 2008).

These three key components are interlinked in a collaborative environment where a strategic links of requirements generation and capture process (see Figure 3-1) is provided to ensure that any e-business technology transfer decision reached is appropriate to the context. In

essence, e-business technology transfer can only take place in an organisation that is ready to transform its processes and culture to conform to the requirement of any new technology. In summary, developing e-business capabilities within the construction industry in Ghana, FDI arrangements can influence the process. It is moreover pertinent to note that the three main fundamental requirement of e-business technology is the starting point most especially from developing country's construction industry perspective as demonstrated by writers and researchers , including Love *et al.* (2001) and Eadie *et al.* (2010b). This was further reinforced recently by Isikdag *et al.* (2011).

The conceptual framework provided the road map for conducting this research. This research was conducted within an FDI project environment (see Section 2.15.2.2). Figure 3-1 demonstrates the main elements to be considered within the limit of this research, with linkages between them, which is then mapped to e-business where issues concerning the Internet and connectivity, data centre, local and area network (LWAN) infrastructure together with desktop devices such as desktop computers put together for the purposes of providing an enhanced skill and transparent capital project delivery process within the Ghanaian construction industry.

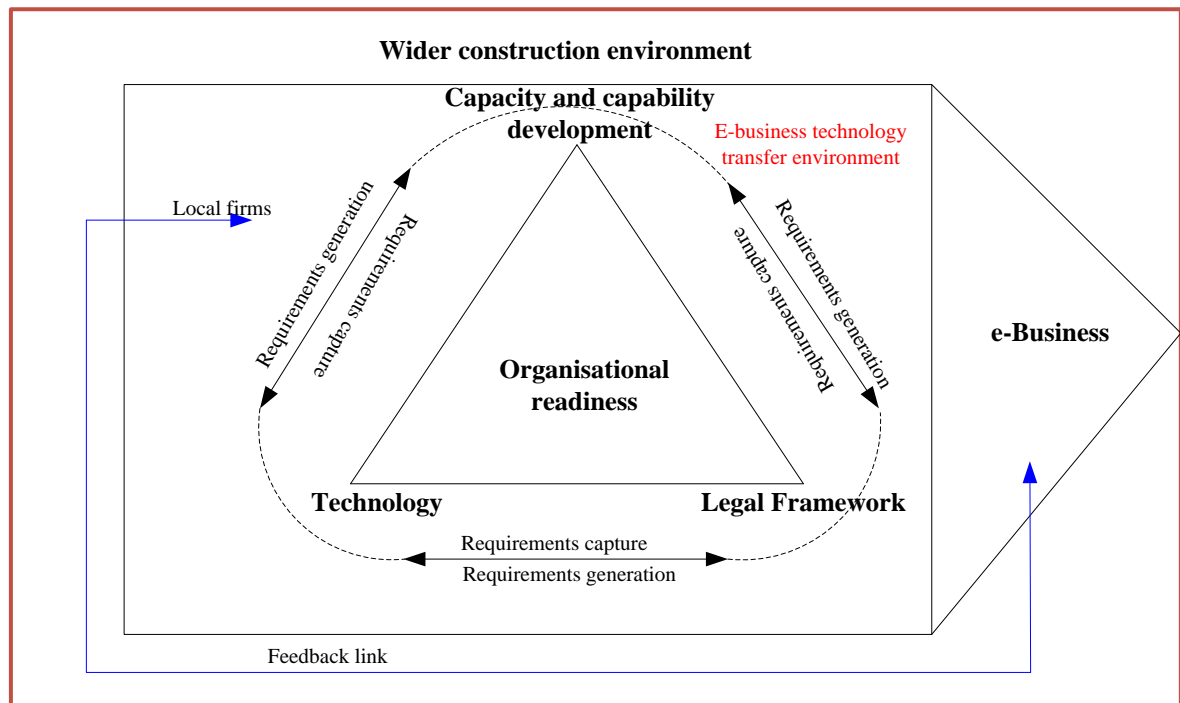


Figure 3-2 Conceptual framework

3.3 Summary and link

This chapter, based on literature synthesis (see Chapter 2) presents a conceptual framework for this research. The framework depicts what is considered as the key influential factors that can support e-business technology transfer to local firms in the Ghanaian construction industry. The framework can be represented as *what* to investigate further as part of the research process. Following the development of the conceptual framework for the research which sought to present a theoretical conceptualisation of the research problem and gap identified for the research, the next stage is to address *how* to undertake the research. In this regard, the next chapter (Chapter 4) discusses the methodology adopted for the research.

CHAPTER 4 : RESEARCH METHODOLOGY

4.1 Introduction

This chapter of the thesis establishes the methodological approach adopted to achieve the aim and objectives of this research (see Sections 1.6.1 and 1.6.2 in Chapter 1). It provides the basis for the design of research questions used in the data collection stage of this research. Chapter 4 of the thesis is structured as follows: First, the positioning of this research from a philosophical perspective presents. The research (Research onion) is presented. This model encompasses research philosophies, research approaches, research strategies, research choices and research techniques. The research, philosophical issues have been discussed in the thesis showing the processes and justifications regarding the philosophical stance through data collection and analysis. This is then followed by the presentation of validation processes and how triangulation was achieved.

4.2 Research Model

Grix (2001) explained that research methodology is concerned with the discussion of how a particular piece of research should be undertaken and can be understood. Methodology is therefore, referred as the choice of research strategy taken by a particular researcher. This in effect means that research methodology depicts the overall strategy purposely formulated to achieve research aim and objectives. Therefore, it is significant to explore further the understanding of research methodology employed in a particular research activity after reflecting upon alternative choices available to be adopted. In order to clearly explain the research methodology for this research the researcher adopted the research “onion” proposed by Saunders *et al.* (2009), which is similar to Kagioglou *et al.* (2000), research model. The researcher’s decision to follow the onion model stem from the orderly manner and clarity, it offered to the research process as illustrated in Figure 4-1.

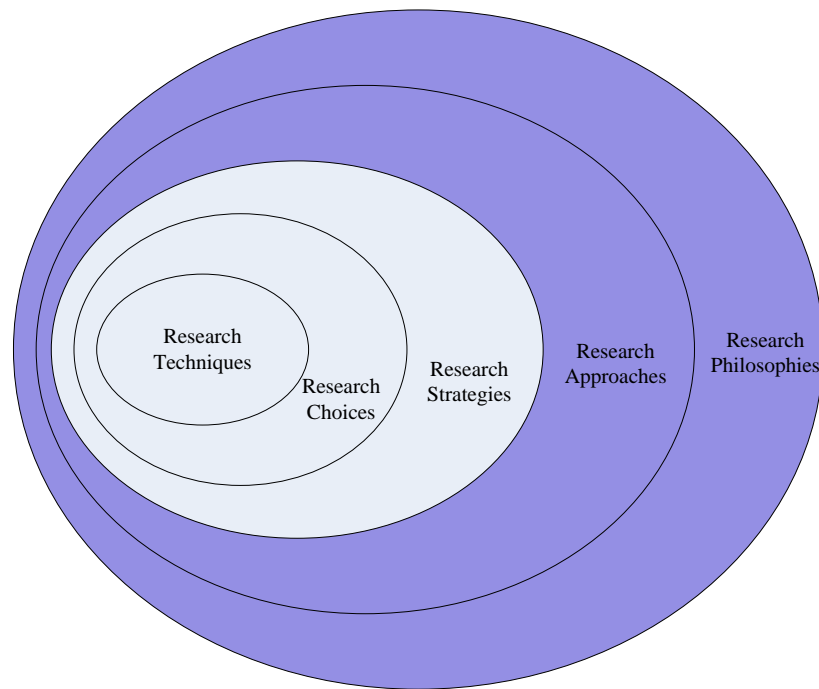


Figure 4-1 The Research ‘onion’ Adapted from Saunders *et al.* (2009)

The model outlines in the research process starting from the philosophical stance through to the very core, data collection and data analysis making it easier to understand and apply as the various layers are clearly defined, and it is presumed that every layer of the onion defines a particular research activity. However, one disadvantage that has been noted by researchers and writers about the research onion has been the argument that the onion is an inflexible research structure, implying that the various layers are adhered to strictly. Therefore, employing the onion research model, researchers are limited in their choices of how to approach their research activity as conveniently as possible. The rest of the sections explain the relevant research methodology areas beginning from the first layer.

4.3 Research Philosophy

The discussion in this section is in accordance with the aim of this research, which is to develop a framework for e-business technology transfer to the Ghanaian construction industry utilising Foreign Direct Investment (FDI) in construction as a medium (see Section 1.6.1 in Chapter 1). For a start, the general principles or theoretical foundation of the research philosophy was discussed in sections 4.3.1, 4.3.2 and 4.3.3 below. According to Saunders *et al.* (2009), research philosophy is an over-arching term that relates to the development of knowledge and the nature of that knowledge. Several authors argued that researchers must adequately understand research philosophies in order to apply them appropriately. Easterby-

Smith *et al.* (2002), noted that there are three reasons that underscore the understanding of research philosophical issues in management research. First, they pointed out that it can help to clarify research designs. This does not only involve considering what kind of evidence is required and how it is to be gathered and interpreted, but moreover how this will provide good answers to the basic questions being investigated in the research. Second, knowledge of philosophy can help the researcher to recognise which designs will work and which will not. This enables the researcher to avoid going up too many blind alleys and should indicate the limitations of particular approaches. Third, knowledge of philosophy can help the researcher to identify, and even create, designs that may be outside the researcher's previous experience. It may moreover suggest how to adapt research designs according to the constraints of different subject or knowledge structures.

Research philosophies are considered an significant aspect which has received several debates and arguments between contrasting views within the research community. Therefore, failure to think through philosophical issues in research design can seriously affect the quality of the research outcome (Easterby-Smith *et al.*, 2002). For the purposes of clarity and adequate understanding of the various philosophical positions, Saunders *et al.* (2009), in their work classified research philosophies into three main perspectives, namely; ontology, epistemology and axiology. The following sections provides summary of the identified research philosophical perspectives. These summaries intend to provide the basis for the clear description and understanding of the philosophical stance adopted for this research which aims to develop a framework for e-business technology transfer to the Ghanaian construction industry utilising Foreign Direct Investment (FDI) in construction as a medium (see Section 1.6.1 in Chapter 1). The sections below describe ontology, epistemology and axiology philosophies, this is then followed by synthesis of the research philosophies establishing how these philosophies impacted the entire research process.

4.3.1 Ontology

Ontology is a branch of philosophy that is concerned with the nature of reality, and this relates to the assumptions researchers have about the way the world operates and the commitment held to a particular view (Saunders *et al.*, 2009, Blaikie, 2011). This philosophical assumption makes claims about what kind of social phenomena do or can exist, the conditions of their existence, and the way in which they are related (Blaikie, 2011). Conversely, ontology is about the nature of reality and existence (Easterby-Smith *et al.*, 2012). Saunders *et al.* (2009),

highlighted two contrasting ends of the philosophical continuum of ontology i.e. objectivism and subjectivism. The first aspect of ontology is objectivism. According to Crotty (1998), objectivist argue that social entities exist in reality external to social actors. Or, in other words, Objectivist asserts that social phenomena and their meaning have an existence that is independent of social actors (Grix, 2001). The second aspect of ontology is subjectivism. Subjectivist hold the view that social phenomena are created from the perceptions and consequent actions of those social actors concerned with their existence (Saunders *et al.*, 2012). In furtherance Saunders *et al.* (2012), assets that social interactions between actors are a continual process, social phenomena are in constant state of revision, meaning it is necessary to study the details of a situation in order to understand what is happening or even the reality occurring behind what is happening.

4.3.2 Epistemology

Epistemology concerns what constitutes acceptable knowledge in a field of study (Saunders *et al.*, 2009). According to Grix (2001), epistemology, one of the core branches of philosophy, is concerned with the theory of knowledge, especially with regards to its methods, validation and the possible ways of gaining knowledge of social reality, whatever it is understood to be. This has recently been simplified by Easterby-Smith *et al.* (2012), they explained that epistemology is about the best ways of enquiring into the nature of the physical and social worlds. Eriksson and Kovalainen (2008), defined epistemology in four different perspectives, according to them epistemology:

- How knowledge can be produced and argued for.
- The criteria by which knowledge is possible.
- Gives structures to what kind of scientific knowledge is available, what are the limits of that knowledge.
- Offers an answer to the question of what constitutes scientific practice and process

From the work of Eriksson and Kovalainen (2008), they mentioned that in epistemology, there are two main contrasting philosophical positions, namely objectivist and subjectivist. While Grix (2001) and Saunders *et al.* (2009), classified them as positivism and interpretivism. The various philosophical positions identified generally have the same meaning. According to Grix (2001) a research using epistemological position, positivism advocates the application of the methods of natural sciences to the study of social reality and

beyond. Myers (2013), further explained that positivist researchers generally assume that reality is objectively given and can be described or explained by measurable properties, which are independent of the researcher and his or her instruments. Additionally, unlike interpretivist studies, positivist studies generally attempt to test theory in an attempt to increase the predictive understanding of phenomena. Typically, in practice, it is often assumed that the units of analysis which make up reality can be classified objectively into subjects and predicates; subjects are moreover often referred to as entities or objects (Myers, 2013). This is done by formulating prepositions that portray the subject matter in terms of independent variables, dependent variables, and the relationship between them (Saunders *et al.*, 2009, Myers, 2013). Saunders *et al.* (2009), pointed out that a researcher using positivism philosophy is concerned with facts rather than impressions and an significant component of the positivist approach to research is that the research is undertaken, as far as possible, in a value-free way. In furtherance of this, Easterby-Smith *et al.* (2012), underscore the fact that the key idea of positivism is that the social world exists externally, and that its properties should be measured through objective methods, rather than being inferred subjectively through sensation, reflection or intuition.

Conversely, interpretivism according to Bryman (2004), is predicated upon the view that a strategy is required that respects the differences between people and the objects of natural sciences and therefore, requires the social scientist to grasp the subjective meaning of social action. Interpretive researcher assumes that access to reality is only through social constructions such as language, consciousness, shared meanings and instruments (Myers, 2013). Research that adopts interpretivism philosophy does not predefine dependent and independent variables, rather focuses on the full complex of human sense making as the situation emerges (Eriksson and Kovalainen, 2008, Myers, 2013). Whereas positivist research or study attempt to test theory in an attempt to increase the predictive understanding of phenomena, interpretivist research or study attempt to understand phenomena through the meanings people assign to them (Orlikowski and Baroudi, 1990). The researcher seeks to listen to informants and to build a picture based on their ideas, this cannot be achieved by standing outside the subject matter looking at; rather the only way an interpretivist researcher can understand a particular social or cultural phenomenon is to look at it from the inside (Creswell, 1994, Myers, 2013).

4.3.3 Axiology

Axiology is a branch of philosophy that studies judgements about value (Saunders *et al.*, 2009). The role that researcher's value play in the entire research process is of great significance if the researcher wishes to present credible results. This tends to affect research administration as the philosophical approach is a reflection of the researcher's values, as well as choice of data collection techniques (Saunders *et al.*, 2009). As argued by Heron (1996) and cited in Saunders *et al.* (2009), values are the guiding reason of all human action, therefore, researchers demonstrate axiological skill by being able to articulate their values as a basis for making judgements about what research they are conducting and how to go about it. Comparison of research philosophies (ontology, epistemology and axiology) adapted for this research is summarised and shown in Table 7.

Table 4-1 Comparison of research philosophies

Philosophy	Definition	Positivism	Interpretivism
Ontology	The researcher's view of nature of reality	External, objective and independent of social actors	Socially constructed, subjective, may change multiple
Epistemology	The researcher's view regarding what constitutes acceptable knowledge	Only observable phenomena can provide credible data, facts. Focus on causality and law like generalisation, reducing phenomenon to simplest elements	Subjective meanings and social phenomena. Focus upon the details of situation, a reality behind these details, subjective meaning motivating actions
Axiology	The researcher's view of the role of values in research	Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance	Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view

Adapted from Saunders *et al.* (2009)

4.3.4 Synthesis of the research philosophies

This research sought to study how to utilise Foreign Direct Investment (FDI) in construction as a medium to transfer e-business technology capability to local construction firms in Ghana. Positioning the research in the appropriate philosophical stance is a key to eliciting relevant information from research informants. From the discussion in Section 4.3, Saunders *et al.* (2009), posited that research philosophy relates to the development of knowledge and the nature of that knowledge. Easterby-Smith *et al.* (2002), highlights three significant reasons which underscore the understanding of research philosophies and applicability to research activities; first, they pointed out that it can help to clarify research designs. Second,

knowledge of philosophy can help the researcher to recognise which designs will work and which will not. Third, knowledge of philosophy can help the researcher identify, and even create, designs that may be outside the researcher's previous experience. The discussion in Section 4.3 further established that, Saunders *et al.* (2009), in their work classified research philosophies into three main perspectives, namely; ontology, epistemology and axiology. Ontology (see Section 4.3.1) is concerned about the nature of reality, and this relates to the assumptions researchers have about the way the world operates and the commitment held to a particular view (Saunders *et al.*, 2009). While Epistemology (see Section 4.3.2) is concerned about what constitutes acceptable knowledge in a field of study (Saunders *et al.*, 2009, Grix, 2001). The third philosophical thinking is axiology (see Section 4.3.3) which is a branch of philosophy that studies judgements about value (Saunders *et al.*, 2009).

This research aims to develop a framework for the adoption of e-business technology via foreign – local FDI project collaboration in the Ghanaian construction industry. The processes of arriving at a suitable framework require the involvement of all stakeholders, including government agencies operating in the construction industry in Ghana with the understanding of using ICT systems to improve performance within the industry. This process will obviously provide different reactions leading to their ‘subjective’ perceptions about the subject matter and actions as a group ‘socially constructed’ expressing what constitute an ICT element, such as e-business technology ‘phenomenon’ and considering the nature of the research questions (see Section 1.6.3 in Chapter 1), it can be identified that this research takes a subjectivism stance in the ontological spectrum. Conversely, epistemology takes the view that knowledge is about positivism or interpretivism (Creswell, 1994, Saunders *et al.*, 2012). As identified in the ontological stance (see Section 4.3.1), this research largely deals with subjective issues as it is about understanding the phenomena through accessing the meanings that participants assign to them (Orlikowski and Baroudi, 1990). From the understanding implemented from the philosophical stances discussions in sections 4.3.1, 4.3.2 and 4.3.3, and the focus of this research which seeks to utilise FDI as a medium to transfer e-business technology capability to local construction firms in Ghana. Eliciting information from construction industry players in terms of their perception about e-business can best fit into a subjectivism stance in the ontology reasoning while it lies in the interpretivism stance in the epistemology spectrum. The research philosophy, interpretivism stance is relevant to this research as it emphasised that it is necessary for the researcher to understand differences between human roles as social actors. It brings to bear differences between conducting research among people with the meaning they assign to their action rather than about the objects which seek to quantify

occurrences (Saunders *et al.*, 2012). The third research philosophy which is moreover considered significant and necessary for this research is axiology. Axiology (see Section 4.3.3) is a branch of philosophy that studies judgements about value (Saunders *et al.*, 2009). The role that the researcher plays in the entire research process is of significance to the outcome of the research. Since the researcher's values affect the research techniques adopted and the entire analysis process, including the way the results are interpreted, it can be deduced that the research is more inclined to value laden. Figure 4-2 demonstrates the philosophical stance of this research.

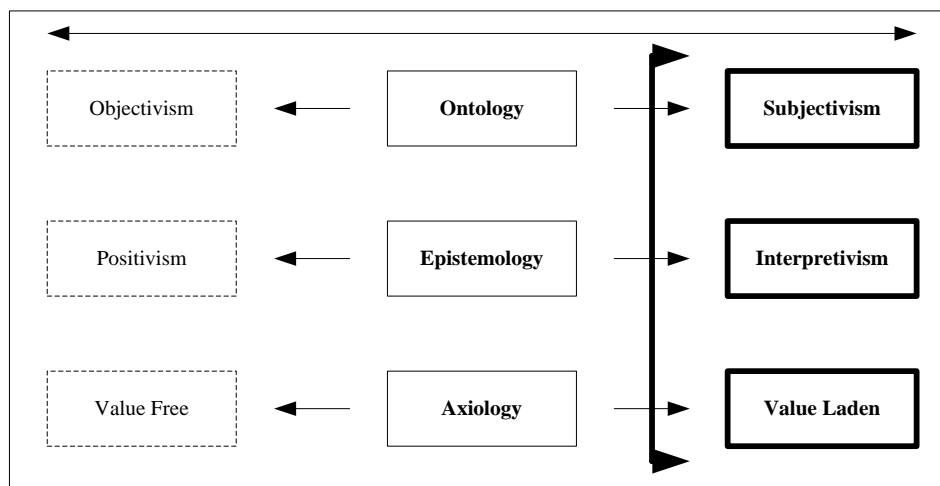


Figure 4-2 Philosophical stance of this research adapted from the discussions in Grix (2001), Easterby-Smith *et al.* (2002) and Saunders *et al.* (2009)

4.4 Research Approach

Generally, there are two alternative research approaches, namely deductive and inductive. Deductive approach to research leads the researcher to develop a theory and hypothesis (or hypotheses) and design a research strategy to test the hypothesis (Saunders *et al.*, 2009). According to Collis and Hussey (2003), cited in Saunders *et al.* (2009), deductive research approach is the dominant approach in the natural sciences, where laws present the basis of explanation, allow the anticipation of phenomena, predict their occurrence and therefore, permit them to be controlled. From a philosophical perspective deductive research approach lies at the objectivism end of the ontological tradition while on the epistemological perspective, it falls in the positivism end of the epistemological philosophy. Conversely, inductive research approach is the process where the researcher collects data and develops theory based on the analysis of data collected (Bryman, 2004, Saunders *et al.*, 2009). Saunders *et al.* (2009), found out that unlike deductive approach which enables a cause-effect

link to be made between particular variables without understanding of the way in which humans interpret their social world, inductive approach as has been consistently argued, provides a better understanding of the nature of the problem under investigation and developing such an understanding, is of course, the strength of inductive approach. From a philosophical perspective, inductive research approach lies in the subjectivism end of the ontological tradition while it fits into the interpretivism persuasion in the epistemological stance.

It is, therefore, understood that deductive is about developing a theory and hypothesis and using research strategy to test the hypothesis while inductive is about collecting data and then develops a theory based on the findings from the data collected. From the understanding of the discussion and in this research, both deductive and inductive philosophies were employed largely to deal with the aim of this research, which is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI) projects (see Section 1.6.1 in Chapter 1). At the literature review stage, deductive, approach was utilised to review key and relevant literature through which specific issues arrived at were explored in a questionnaire survey (see Appendix - **D**). Further, the specific issues arrived at were researched in in-depth study utilising inductive approach, which formed the major basis for data collection for this research (see Appendix - **E**). Although this research leans towards interpretivism philosophy (see Section 4.3.4) data collection for this research employed both deductive and inductive approaches, positioning data collection techniques of this research in the pragmatism philosophy. Bryman (2012) identified mixed method research to stand for research that “*integrates quantitative and qualitative research within a single project*”. Employing a mixed method in research improves the quality of the research evidence (Stake, 2010). Denscombe (2008), explained that mixed method research approach assumed pragmatic stance, hence “emphasis on practical approaches to research problem”. Utilising quantitative and qualitative approaches in combination provide a better understanding of research issues than either alone (Creswell and Clark, 2007). Researchers such as Wing *et al.* (1998), Love *et al.* (2002) and Dainty (2008), argued for methodological pluralism in construction management research, as it provides the basis to fully understand phenomena that influences performance in construction. Based on the above discussion, use of mixed method of this research was considered appropriate as it provides the tools for deeper knowledge and understanding of the research area, and moreover supports the call for a pragmatic approach in construction management research as opposed to the traditional approaches (Dainty, 2008, Wedawatta *et al.*, 2011).

4.5 Research strategy

According to Remenyi *et al.* (1998), research strategy “*provides the overall direction of the research , including the process by which the research is conducted*”. However, no research strategy is inherently superior or inferior to any other (Saunders *et al.*, 2009). Saunders *et al.* (2009), argued that choice of research strategy should be guided by research objectives and questions, the extent of existing knowledge, the amount of time and other resources available, as well as the researchers philosophical underpinnings. Yin (2003), provided five (5) different research strategies as follows: experiment, survey, archival analysis, history and case study. Saunders *et al.* (2009), moreover, highlighted action research, grounded theory and ethnography as addition to the research strategies list provided by Yin (2003). These strategies should not be thought of as being mutually exclusive (Saunders *et al.*, 2009). Yin (2003), noted that each strategy has its distinctive characteristic, however, there are large overlaps among them.

Yin (2003), pointed out that there are three conditions that determine when to use each of these strategies. These conditions comprise; the type of research question posed, as illustrates in Table 4-2. The extent of control an investigator has over actual behavioural events and the degree of focus on contemporary as opposed to historical events. From the above discussion on research strategies, this research adopts the case study research strategy as it is the most appropriate research strategy. The case study strategy as adopted for this research fit appropriately in the first and third conditions put forward by Yin (2003). The following section discusses briefly the case study approach and justification for selecting case study as against other research strategies.

Table 4-2 Relevant situation for different research strategies

Strategy	Form of Research Question	Requires Control of Behavioural Event?	Focuses on Contemporary Events?
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	No
Case study	How, why?	No	Yes

Adopted from Yin (2003)

4.5.1 Case study strategy

From the work of Yin (2003), case study as a research strategy is defined as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. According to Creswell (2007), case study research “involves the study of an issue explored through one or more cases within a bounded system”. Case study focuses on one or just a few instances of a particular phenomenon with a view to providing an in-depth account of events, relationships, experiences or processes occurring in that particular instance (Denscombe, 2008). The case study allowed the investigator to concentrate on specific instances in an attempt to identify detailed interactive processes which may be crucial, but which are transparent to the large-scale survey thereby providing a multi-dimensional picture of the situation under research (Remenyi *et al.*, 1998). Essentially, case study looks in-depth at one, or a small number of organisations, events or individuals, generally over time Easterby-Smith *et al.* (2012), and it is particularly valuable in answering “who, why, and how” questions in management research (Chetty, 1996, Remenyi *et al.*, 1998, Yin, 2003). Yin (2003), noted that case study is preferred to other research strategies because phenomenon and context are not always distinguishable in real-life situations. Further, Crowe *et al.* (2011), explained the relevance of case study as a research strategy or approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its natural real-life context. Case study, research strategy provides analysis of the context and processes which illuminate the theoretical issues being studied (Cassell and Symon, 2005). They further explained that the phenomenon under studies is not isolated from its context as in, say, laboratory research, but is of interest precisely because it is to understand how behaviour and processes are influenced. The explanation put forward by Easterby-Smith *et al.* (2012), identified case study as a flexible research strategy as it permits those who advocate single cases and those who advocate multiple cases; according to them those who advocate for single cases generally fall in interpretivist epistemology and those who advocate multiple cases usually fit with positivist epistemology. In contrast, Yin (2003), thinks otherwise. From the discussions, it demonstrates that the case study research strategy is capable of accommodating different research methods and techniques and suitable for conducting a research that requires in-depth investigation of understanding perceptions of a phenomenon.

4.5.1.1 *Justification for selecting case study strategy*

This research aims to develop a framework for the adoption of e-business technology in the construction industry in Ghana (see Section 1.6.1 in Chapter 1). The outcome of this research will provide a means of improving performance in the construction industry in Ghana. The phenomenon under research is a contemporary one which requires the participation of stakeholders in the Ghanaian construction industry in real-life context. This moreover requires in-depth understanding of the specific phenomenon of e-business technology in the context of the construction industry in Ghana. As mentioned by Yin (2003), in a case study situation, separating phenomenon and context is unlikely to produce the expected result of the research, this understanding distinguishes case study from other forms of research strategies. Therefore, this research seeks to use a case study to cover contextual conditions as it is found to be pertinent to the phenomenon under research. From the philosophical standpoint of this research (see Figure 4-2), it is inclined towards interpretivism, subjectivism and value laden and the research approach is inductive and qualitative (see Section 4.3.4). These philosophical stances support the use of case study research strategy. According to Chetty (1996), using case study in SMEs firms provide useful insights that would not have emerged through large survey. This is particularly relevant in the study of the Ghanaian construction industry as it emerged that 90% of the industry is comprising small firms (Ayarkwa *et al.*, 2010). Case study is the appropriate research strategy for this research as it permits the use of quantitative and qualitative data and several other methods for data collection and analysis techniques (see Section 4.5.1). As mentioned earlier, the nature of this research requires the understanding and perceptions about e-business technology in the construction industry in Ghana, this therefore, require the researcher to adopt a mixture of research techniques dwelling on the research strategies provided by Yin (2003) and Saunders *et al.* (2009). From the list of research strategies mentioned previously in Section Research strategy, a strategy like experiment is not suitable for this study as the researcher does not have control over the phenomenon being researched. Experimental studies are undertaken in a highly controlled context (Saunders *et al.*, 2009). Since this researcher does not have control over the phenomenon being studied, this strategy is not applicable to this research. Archival research strategy makes use of administrative records and documents as the principal source of data (Saunders *et al.*, 2009). The term archival may be misleading as it has historical connotations, however, it can refer to recent as well as historical documents. This research strategy can be partly applied to this research as case study utilises document review as one of its data collection techniques. With reference to historical research strategy, it is usually associated

with past events when no relevant sources are available to give report, even retrospectively. In this strategy, the researcher depends on primary documents, secondary documents, and cultural and physical artefacts as the main sources of evidence (Yin, 2003). Unlike the archival research strategy, the historical research strategy does not support this research as this research seeks to understand the phenomenon in real-life context in relation to the construction industry in Ghana. Survey research strategy is usually associated with the deductive approach (Saunders *et al.*, 2009). Situating it in the positivist philosophical reasoning or tradition (see Section 4.5), survey research strategy appears not entirely suitable for this research. As identified in earlier discussions this research is inclined towards interpretivism and adopted inductive approach (see Section 4.4).

However, an exploratory questionnaire survey was conducted prior the main semi-structured interview data collection technique employed in this research. The objective of the questionnaire survey was to provide further evidence to support emerging issues from the qualitative data (Amaratunga and Baldry, 2001). It is moreover pertinent to understand that as a technique the questionnaire survey was conducted to evaluate the local capacity for e-business technology transfer, hence the questionnaire survey has been selected and utilised as an integral part of the entire case study strategy adopted for this research (see, for example, Figure 4-4). These kinds of combination offer opportunities for complementary and synergistic data gathering and analysis, specific strengths in each method compensate for some particular weakness in the other (Leonard-Barton, 1990, Walsham, 2006). Ethnography is another research strategy that is rooted in the inductive research approach (Saunders *et al.*, 2009). In this strategy the researcher is required to immerse in a setting and become part of the group under study in order to understand the meanings and significances that people give to their behaviour and that of others (Easterby-Smith *et al.*, 2012). The researcher in this research is outside the context of this research, the construction industry in Ghana, ethnography research strategy is therefore, not applicable to this particular research. Grounded theory has been defined as the theory that was derived from data, systematically gathered and analysed through the research process (Bryman, 2004). In grounded theory, data collection starts without the formation of an initial theoretical framework. The theory is implemented from data generated through a series of observations. These data lead to the generation of predictions which are then tested in further observations that may confirm, or otherwise, the prediction (Saunders *et al.*, 2009). As mentioned earlier, this research seeks to understand the phenomenon in a real-life context in proposing e-business technology transfer framework for the Ghanaian construction industry. Generally, this research is not attempting to develop

theory from data, but essentially utilises available existing literature in the area of the study. Therefore, grounded theory is moreover not appropriate for this particular research.

From the above discussions and considerations, the case study research strategy considers the most appropriate research strategy for answering the research questions formulated for this research (see Section 1.6.3 in Chapter 1). The following paragraphs provide further discussion on case study designs and the one which is adopted for this research.

4.5.2 Case study design

According to Crowe *et al.* (2011), case study design may be approached in different ways depending on the epistemological standpoint of the researcher. This supported the fact that case study can be designed to meet certain research requirements, hence it can be a single case or multiple cases. When the case study design process is carefully undertaken and details within a particular case are given adequate consideration, it provides tools for researchers to study complex phenomena within their context (Baxter and Jack, 2008). Yin (2003), discusses four (4) types of case study design based on a 2x2 matrix that comprise single and multiple case study reflecting different design situations (see Figure 4-3). The following are the types of case study designs (1) single-case holistic, (2) single-case embedded, (3) multiple-case holistic (4) multiple-case embedded. According to Yin (2009), these classifications provides the liberty to select a case according to the nature of a particular research and can be adopted in advance before the commencement of research data collection.

	Single-case designs	Multiple-case designs
holistic (single – unit of analysis)	<p>CONTEXT Case Type 1</p> <p>Single – holistic Case study</p>	<p>CONTEXT Case Type 3</p> <p>Multiple – holistic Case study</p>
embedded (multiple units of analysis)	<p>CONTEXT Case Type 2</p> <p>Single – embedded Case study</p>	<p>CONTEXT Case Type 4</p> <p>Multiple – embedded Case study</p>

Figure 4-3 Basic types of designs for case studies adapted from Yin (2009)

According to Saunders *et al.* (2009), a single case is often used where it represents a critical case or, alternatively, an extreme or unique case. A single case may be selected because it is typical or because it provides an opportunity to observe and analyse a phenomenon that few have considered before. An significant aspect of using a single case is defining the actual case. In the same way a case study strategy can moreover incorporate multiple cases, that is, more than one case. Yin (2009), posited that single-case study is an appropriate design under several circumstances and in all five rationales have been adduced to support single-case design. These rationales have been briefly explained. The single case study is appropriate when it presents a critical case in testing a well-formulated theory. Satisfying all conditions for theory testing, single-case can confirm, challenge, or extend the theory. Further, it has been established that single-case can present a significant contribution to knowledge and theory building. Additionally, single case can be effectively utilised where the case represents an extreme case or a unique phenomenon. Conversely, the third rationale put forward for single case by Yin (2009), is that, single case can be representation or typical case where the objective is to capture circumstances and conditions of an everyday commonplace situation. Moreover, single-case study can be a revelatory case. This type of study is undertaken when the researcher has an opportunity to observe and analyse a phenomenon which previously was inaccessible to social science inquiry. It is, moreover, acknowledged that, a single - case study can be longitudinal when the same single case is being studied at two or more different points in time. Despite the compelling reasons for single case design that can be found in Yin (2009), it has emerged strongly from literature that single case turns to produce study samples that are often extremely limited and such results are therefore, quite hard to generalised to the benefit of a larger population. This, however, has been addressed by multiple case designs. To improve robustness and generalisation of case study results, multiple case study design is preferred to single case study design. Multiple case studies provide credibility to research results and reduce substantially criticism and scepticism that usually are associated with case study, thereby producing an even stronger effect on the outcome of the research (Yin, 2009). As a matter of fact, conducting two cases begins to ‘blunt’ these criticisms and scepticism, therefore, having more than two case studies, research produces a stronger effect on the research process (Yin, 2009). In the light of this, Yin (2009), advised that having at least two cases should be the researcher’s goal. According to Amaratunga and Baldry (2001), multiple cases strengthen the results by replicating the pattern matching, thus increasing confidence in the robustness of the research process. Therefore, the selection of two or more cases falls within direct replication logic (Yin, 2009). One of the strengths of multiple case study approach is that it allows the researcher to use a variety of sources, a variety of types of data

and a variety of research methods as part of the investigation (Denscombe, 2008). More significantly, the analytic benefits from multiple case studies may be substantial if there is the possibility to have direct replication (Yin, 2009). From the discussions, multiple cases provide clear and compelling credibility to the research process, as it has been provided, research involving multiple case study are regarded as more robust as compared to single case study. Therefore, in this perspective, multiple case studies provide an opportunity to the researcher to gain access to a variety of data from a wider spectrum. This enables the researcher to adequately explain the understanding of the phenomenon being studied.

Considering the various rationales that have been espoused in respect of case study design for the purposes of qualitative data gathering, this research adopted a multiple case study approach. In the context of this research multiple case study design is the most appropriate approach since the phenomenon being studied does not present a critical, extreme or the unique case situation. Again, the phenomenon under study is not typical, neither revelatory nor it is to be studied as longitudinal case. Therefore, single case study design is not suitable for conducting this research. However, multiple-holistic case design (CASE TYPE 3) as per Figure 4-3 has been adopted for conducting this research, principally because there is only one unit of analysis that required to be studied in order to identify the process of e-business technology transfer to the Ghanaian construction industry. As pointed out by Baxter and Jack (2008), multiple case studies allow the researcher to analyse settings within each case and across settings and moreover understand processes and relationships. In the context of this research, the researcher has the opportunity to understand the phenomenon in real-life of the processes of transferring e-business technology to the local contractors by their foreign counterparts within the construction industry in Ghana.

4.5.3 Case study design protocol

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI). In respect of this research, the case study design protocol (CSDP) in Figure 4-4 depicts the step by step approach adopted in conducting this research, as shown in Figure 4-4 three steps are defined in the CSDP. The first step is about designing the study and this initial stage consists of a literature review and conceptual framework development and then followed by designing data collection instruments. The second step; prepare, collect and analyse comprise conducting the identified cases through to analysis of the individual cases. This step moreover encompasses

expert interview and questionnaire survey. The expert interview sought general perspective about the research area while questionnaire survey gauged the capacity of local construction firms for e-business technology transfer. Finally the third step, CSDP provides for analysis and conclusion. At this stage, cross case analysis is conducted, followed by a review of the conceptual framework implemented earlier in the research after which validation of the framework is undertaken and finally a conclusion and recommendations provided.

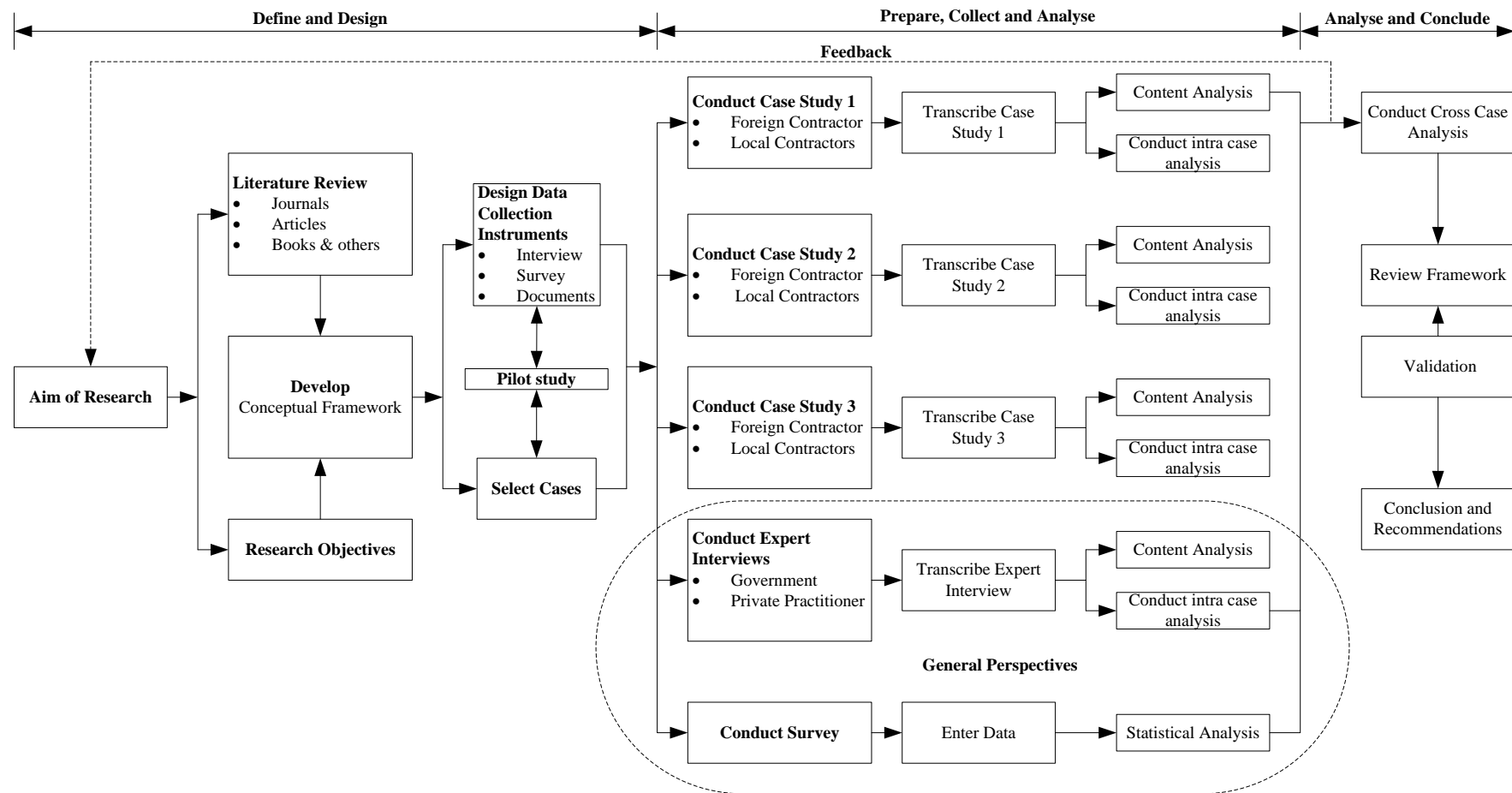


Figure 4-4 Case study design protocol adapted from Yin (2009)

4.5.4 The unit of analysis

As posited by Baxter and Jack (2008), while you are considering what your research question will be, you must moreover consider what the case is, by extension determining what the unit of analysis (case) is. Miles and Huberman (1994), defined the case as, “a phenomenon of some sort occurring in a bounded context. The case is, in effect, your unit of analysis” (p. 25). Therefore, the "case" was taken to be *foreign firm participation within the Ghanaian construction industry*, and in the context of this research, the unit of analysis was defined as "the process of e-business technology transfer to local firms via Foreign Direct Investment (FDI) projects". This unit of analysis is selected ostensibly to draw a clear understanding of the processes of transfer of this technology to the local firms in partnership or collaborating with foreign firms on the identified projects. The discussion moreover encompasses details of sustaining the acquired technology by the local firms through appropriate strategies, including skills and capacity development. In the light of this research, therefore, adopted multiple-case study design (CASE TYPE 3) as shown in Figure 4-3 as the most appropriate strategy as it falls well into the holistic single-unit of analysis. The research questions of this research (see Section 1.6.3 in Chapter 1) largely represent the requirement of a technology transfer process study at the various firm levels. This, therefore, leaves processes as the main unit of analysis.

4.5.5 Case study selection

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI). Therefore, the decision on how to select the case(s) to study is a very significant one that merits some reflection, especially during the design phase, case(s) should be selected not because they are representative of other cases, but because of their uniqueness, which is of genuine interest to the researcher (Crowe *et al.*, 2011). Stake (1995), agreed that the first criterion to consider when selecting a case should be to maximise what can be understood and learnt by the researcher. Therefore, for the purposes of this research, multiple case design (see Section 4.5.2) was adopted as the research approach after careful consideration of other case study design types. It is expected that this research approach would give the researcher the opportunity to adequately explore details within and between cases selected for this research. Case study researches are considered rich, empirical descriptions of particular instances of a phenomenon based on a variety of data sources (Eisenhardt and Graebner, 2007, Yin, 2009). To enrich the research process, three (3) FDI construction projects as cases were selected in

the city of Accra, Ghana. The objective is, Accra is the national capital of Ghana, it is considered the most significant city in Ghana, where the majority of economic activities are located, including construction activities involving foreign contractors. The selected projects have foreign construction firms as the main contractors and local construction firms as FDI collaborators in the execution of these projects. The cases are selected to reflect the most vibrant sectors within the construction industry in Ghana, these sectors include: road; housing and general building works. The purpose is to achieve adequate representation of the construction industry and to allow possible direct replication. Additionally, to maximise the utility of project information from these cases as they are selected on the basis of expectation about their rich information content which may be relevant for this research.

To further understand and have different perspectives into the relevant issues in the context of this research, two (2) expert interviews were conducted as part of the main case study interview (see Section 4.8.1.1). Additionally, prior to the conclusion of the case study interviews, a questionnaire survey was conducted ostensibly to assess the capacity of the local contractors for Technology Transfer (TT). For the purposes of this research these project cases shall be referred to as CS1, CS2 and CS3. As previously stated, this research largely focuses on e-business technology transfer from foreign construction firms to their local counterparts. Therefore, it is expected that there should be some level of relationship between these firms to enable the initiation of processes to facilitate the transfer of this technology (e-business). This relationship is grounded in Ghana Investment Promotion Centre (GIPC) Law of 2013, Act 865 with specific reference to LI 1574 Technology Transfer Agreements. For the purposes of this research, and to achieve the aim (see Section 1.6.1 in Chapter 1) formulated for this research, the following criteria establish in Table 4-3 should be met by the researcher.

Table 4-3 Case studies selection criteria

Item	Criteria	Case Requirements	Research Requirements
1	The case should be an ongoing construction project in Accra, Ghana	The project is located in Accra, the capital city of Ghana, and it is an on-going project, in the road sector, housing sector and or general building sector.	A project must provide the opportunity for purposes of research. Provide input of experts. Provide government level input.
2	Main contractor should be a foreign firm	The contractors identified for the purposes of this research are foreign construction firms (originally not from Ghana). Registered under the laws of Ghana, either as wholly foreign owned or with Ghanaian participation.	Foreign firms are engaged in a particular project under the Ghana government, bilateral arrangement, or foreign direct investment as a result of good economic environment
3	Local firms in collaboration with a foreign firm	Indigenous Ghanaian construction firms registered to do business in Ghana under the laws of Ghana and are in FDI collaboration with foreign firms on a specific project identified for the purposes of this research and the projects are in Accra, Ghana.	Indicate a clear process of engagement with a foreign firm. Show clear relationship and process of engagement in acquiring e-business technology and skills development in the FDI collaboration arrangement. Show strategy of sustaining acquired knowledge and improve upon it even when collaboration/joint venture was over.

4.5.6 Background of the case studies

4.5.6.1 Case study 1 (CS1)

Case Study 1 (CS1) represents a foreign construction firm which entered the construction industry in Ghana in 2005 and went through registration formalities and certificate to commence business was issued in November 2006 as established by the laws of Ghana under the company code 1963 (Act 179). CS1 is a Foreign Direct Investment (FDI) with Ghanaian participation. CS1 presence in Ghana is as a result of response to the Ghana government request for foreign direct investment in the country and upon checks CS1 confirmed that there are good economic indicators and potentials for continuous economic growth. Bases on the aforementioned checks and economic indicators, CS1 decided to invest in Ghana specifically in the construction industry with the objective to contribute to the future and continued growth of Ghana. CS1 since incorporation undertook several strategic projects intended to further contribute to the economic growth of Ghana. CS1 is currently undertaking an 18 (18) month duration strategic road project and the client is the Ghanaian government. The project is under Ghana government road sector development initiative. This particular project is a 12km long first class road project and the project entails the construction of a three (3) lane dual carriageway northbound and southbound and the construction of 2no overpasses and 1no

underpass. Additionally, pedestrian foot bridges located at four (4) different locations will be constructed. This project is situated within a busy district in Accra, therefore, CS1 is determined to complete on schedule. This has necessitated project specific collaboration between the main contractor, a foreign firm and some indigenous Ghanaian construction firms (local firms) as mandated by GIPC Law of 2013, Act 865. CS1 in respect of this research demonstrated to have the capacity to use e-business technology and moreover, demonstrated a commitment to support their local counterparts to acquire e-business capability.

4.5.6.2 Case study 2 (CS2)

Case Study 2 (CS2) is a foreign construction firm with an interest to expand the business beyond its place of origin. This was a strategic policy decision which is termed a “growth strategy”. CS2 viewed Africa as a potential business destination, principally as a result of the democratisation waves that have been seen across the entire Region in the past and indeed recently. “And to add to this, if you intended to do something like this, naturally you may need a base where you can comfortably establish and then start further potential market exploration and that is what exactly CS2 did in 1996 when it arrived in Ghana”. CS2 is a registered construction firm in Ghana as wholly foreign owned firm under company registration laws of Ghana. CS2 presence in Ghana is as a result of diversification of CS2 business with the intention to create new business opportunities across Africa. CS2 business strength is largely centred on heavy civil engineering, mining, and construction services. Additionally, CS2 is in luxury residential housing development and CS2 has done this since its arrival in Ghana. Currently CS2 is undertaking a multi-million luxury apartments that are being implemented as a new complete community. The project currently is running its first phase with a total number of 56 high rise luxury apartments in Accra. The entire project consists of different types and levels of a total package of 500 luxury apartments which is split into three project phases. This when completed would have a modern shopping centre, hospitals, schools, - all the modern social amenities that can be thought of in a modern community. The magnitude of this project required CS2 to engage in collaboration with some indigenous Ghanaian construction firms to deliver portions of this project as mandated by GIPC Law of 2013, Act 865. CS2 in respect of this research demonstrated to have the capacity to use e-business technology and moreover demonstrated a commitment to support their local counterparts to acquire e-business capability.

4.5.6.3 Case study 3 (CS3)

Case Study 3 (CS3) is a registered Foreign Direct Investment (FDI) with Ghanaian participation under Ghana investment law and the company registration code. CS3 started business in Ghana in 1993 as largely building contractors after going through the necessary legal procedures as per the laws. At the time of registration, CS3 was one of the few foreign construction firms on the West Coast of West Africa. The company has transformed itself into a leading construction company in Ghana just over two decades. It is committed to improving the quality of life of people with the use of appropriate, sustainable infrastructure development solutions. Timely and quality delivery is the hallmark of CS3. CS3 is currently constructing a technology park facility for the Ghanaian government. The project, the first phase of which has taken off involving a land area of 7, 25 hectares, it is situated in the Free Zones Enclave in Tema and is being funded by the World Bank's International Development Association and is scheduled for completion in 15 months. The project comprises the installation of external lighting, roadworks, associated footpaths & cycle tracks, electrical and telecommunication services and associated ducting. This project Furthermore to the main joint venture partner, engaged moreover indigenous Ghanaian construction firms largely to undertake portions of the project. Therefore, this project provides an significant input to this research, in particular, the processes of transfer of e-business technology to the local firms involved in this project. Table 4-4 highlighted details of the cases selected for the purposes of this research.

Table 4-4 Details of case studies selected for this research

Identified Cases	Current Project	Project Location	Year of Registration	Type of Firm
CS1	Dual Carriage Road	Accra, Ghana	2006	FDI with Ghanaian Participation
CS2	56no. high rise luxury apartments	Accra, Ghana	1996	FDI with Ghanaian Participation
CS3	Information Technology Park project	Accra, Ghana	1993	FDI with Ghanaian Participation

4.5.6.4 Pilot study

A pilot study is an significant aspect of any research. As noted by van Teijlingen *et al.* (2001), the term pilot study “*refers to mini version of a full scale research as well as the specific pre-testing of a particular research instrument such as questionnaire or interview guidelines*”. van Teijlingen *et al.* (2001) and van Teijlingen and Hundley (2001), provided a range of

different reasons for conducting pilot studies in social science. Significantly, De Vaus (2002), indicated that pilot studies provides the basis of assessing the reliability of the data collection instrument. Additionally, it is an significant step in improving the quality of the case study research through developing and testing the adequacy of data collection instruments (Easterby-Smith *et al.*, 2002). From a procedural perspective Yin (2009), argued that pilot studies help in refining data collection protocol and procedure to follow in analysing data. Prior to conducting CS1, CS2 and CS3 (see Sections 4.5.6.1, 4.5.6.2 and 4.5.6.3) a pilot study was conducted purposely to improve the reliability and testing the adequacy of the data collection instrument. The pilot study was conducted utilising three construction professionals, including one expert from the government entity responsible for public procurement and e-Government Procurement (e-GP) project. The pilot study provided the basis for trailing and testing the data collection instruments used and the same of the practicalities of the instruments used for the research. Based on this, the final research instrument was designed to reflect finding from the pilot study. The following section examined the research choices for data collection and analysis in respect of this research.

4.6 Research choices

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI). Therefore, the appropriate research choice(s) is an significant aspect of achieving the research aim. The term research choices refer to the combination of quantitative and qualitative techniques and procedures for analysis (Saunders *et al.*, 2009). The terms, quantitative and qualitative are frequently used in business and management research to differentiate both data collection techniques and data analysis procedures (Saunders *et al.*, 2009). They further argued that quantitative and qualitative techniques do not exist in isolation. Researchers can select from either single data collection technique and corresponding analysis procedure, this is referred to as *mono method* or use more than one data collection techniques and analysis procedures to answer research questions, this is known as *multiple methods* (Saunders *et al.*, 2009). Saunders *et al.* (2009), explained that mono-method represents single data collection technique and its corresponding analysis procedure. The mono-method combines either a single quantitative data collection technique, such as questionnaires, with quantitative data analysis procedures or a single qualitative data collection technique, such as in-depth interviews, with qualitative data analysis procedures. It is applicable for quantitative and qualitative techniques. Similarly, the multiple-methods refer to combinations where more than

one data techniques are used to answer research questions. This method is further broken down into two forms; namely multi-method and mixed-methods. Multi-method refers to the combinations of more than one data collection technique with its associated analysis techniques, but restricted within either a quantitative or qualitative research environment. This means that the researcher can choose to use quantitative techniques by using questionnaires and use quantitative analysis techniques, this approach is known as *multi-method quantitative study*. Alternatively, a researcher can choose to collect qualitative data using in-depth interviews and analyse these data using qualitative procedures, this is known as *multi-method qualitative study*. Further, if multi-method is adopted, the researcher cannot mix quantitative and qualitative techniques and procedures. Whereas the mixed-methods approach uses quantitative and qualitative techniques and analysis procedures are used either at the same time or one after the other but does not combine them. This method tends to base knowledge claims on pragmatic grounds (Creswell, 2003). With respect to this research, and to understand and better grasp the perceptions of industry practitioners utilising systems such as e-business technology in the construction industry in Ghana, this research as previously discusses falls partly into mixed-methods data collection and analysis techniques category; this has provided the clearest possible grasp of the issues being researched.

The following section of the research methodology explains the techniques for data collection and analysis adopted for this research.

4.7 Research techniques

Research techniques can come from a combination of techniques, such as combining qualitative and quantitative input into data generating activities (Hussey and Hussey, 1997). The purposes of research techniques are to use logical approaches to obtain information about a specific subject being studied and research techniques can be applied to a broad range of topics or areas of research. Therefore, data can be collected using structured questionnaires, observation, structured or unstructured interviews or any other technique (De Vaus, 2001). In the context of this research, which is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI), the research techniques adopted comprise combination of qualitative, quantitative and documents for data collection and data analysis techniques applied to each of the techniques used for data collection (Clifford *et al.*, 2010). This section is established to discuss the research techniques adopted for this research and data analysis techniques.

4.7.1 Data collection techniques

According to Easterby-Smith *et al.* (2002), data collection techniques are applied vastly but most significantly it depends on the nature and environment the research is being undertaken. Yin (2003) identified six sources of data collection for case study research; documents, archival records, interviews, direct observation, participant-observation, and physical artefacts. As provided in Figure 4-5, this research employed these techniques to collect data. Questionnaires have been used in this research to collect initial relevant data at the firm level; the data were quantitatively analysed. The questionnaires were distributed largely to local contractors through the offices of the Association of Building and Civil Engineering Contractors of Ghana (ABCECG) and were supported by postal services. This was followed by interviewing some major stakeholders in the construction industry in Ghana. Yin (2003), observed that interview is one of the most significant sources in case study research. The interview provides means of finding out from people what they do and what they think about any prevailing condition. This research employed, semi-structured interview technique to collect data for qualitative analysis; this permits collection of relevant information from identified stakeholders in the construction industry in Ghana. Finally, as part of the qualitative data collection techniques adopted for this research Ghana government policy document on ICT systems were reviewed during the data analysis stage of this research. Yin (2003) and Creswell (1994), recommends multiple sources for data collection for case study research, but converging on the same set of findings and this will increase the quality of the research substantially. Figure 4-5 highlighted data collection and analysis procedures adopted for this research. Descriptions of the techniques adopted for data collection for this research are provided in Sections 4.7.1.1 – 4.7.1.3.

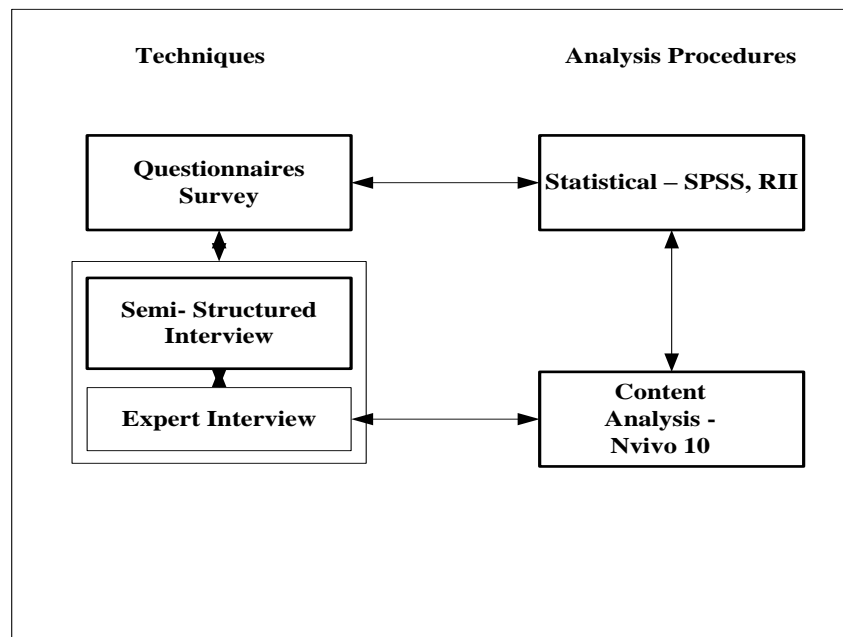


Figure 4-5 Data collection techniques and analysis procedures

4.7.1.1 Questionnaire survey

Questionnaires are known to come in two forms, open or closed. Open questionnaires are generally designed to allow respondents to provide answers in full whereas closed questionnaires provide a set of closed questions as determined by the researcher. The work of the social science researcher requires a significant amount of information and in most cases raw data. Questionnaires are predominantly used in the social sciences to ascertain subject's attitude and opinions (Black, 1999). Several research techniques such as interview, questionnaire and observation have been employed by researchers to collect information and data, in particular, for any research engagements (Tashakkori and Teddlie, 2003). It is a common knowledge that questionnaires are the most used research technique in the social science environment (Bryman, 2012). According to Naoum (2013), questionnaires of high reliability are perceived to offer relatively high validity of the results because of their wide geographic coverage. However, valid questionnaires enable researchers to collect accurate data (Saunders *et al.*, 2009). De Vaus (2001), based on the work of Marsh (1982), argued that questionnaires for the purposes of quantitative research, can provide significant information and explanation that are adequate for interpretation. In essence, it provides the basis to count and measure the extent and distributions of the subject matter under investigation (Berge and Lune, 2012).

Questionnaires have been utilised extensively as a data collection technique within construction sector research. Questionnaire survey provides a faster means of gathering basic information for large or small sample size from a wider geographical area (Bryman, 2012). With respect to this research, which is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI) and as a precursor to the main research, a questionnaire survey was conducted to evaluate the capacity of local contractor for e-business technology transfer (see Appendix - **D** for questionnaire survey template).

4.8 Reliability testing in respect of questionnaire survey instrument

Reliability of the questionnaire survey instrument is significant in providing accurate result. In this regard, the reliability of the data collected for quantitative studies is checked thoroughly to eliminate errors in the data. Reliability is about assessing the internal consistency of questionnaire survey instrument (Williams, 2003, Sarantakos, 2013). Variables from the questionnaire survey instruments are declared to be reliable only when they provide stable and reliable responses over a repeated administration of the test (Santos, 1999). There are a number of methods available for measuring the reliability of questionnaire survey data. Some of these methods are Factor Analysis, Test-retest reliability, Parallel Forms, Split Half Reliability and Cronbach's alpha coefficient. However, the most commonly used for internal consistency of a questionnaire survey is Cronbach's alpha coefficient (Pallant, 2010). It is suitable for multiple Likert questions in a questionnaire instrument that forms a scale and to determine the reliability of the scale. It is acceptable to obtain a result ranging from 0 to 1 when using Cronbach's alpha for reliability testing, where zero means completely unreliable result and one means completely reliable result (Hilton *et al.*, 2004, Fellows and Liu, 2008). According to Pallant (2010), Cronbach's alpha coefficient of .70 is acceptable level while .89 is considered good value and greater internal reliability. To establish the reliability of the questionnaire data for this research, the Cronbach's alpha coefficient test was conducted on the questionnaire data collected. The result, as shown in Table 4-5 suggests that Cronbach's alpha value of .931 is a good value, meaning the questionnaire has good internal consistency reliability.

Table 4-5 Result of reliability test

Cronbach's Alpha	Cronbach's Alpha Based on Standardised item	N of Items
.931	.931	20

4.8.1.1 Interviews

Interviews are the major methods for collecting factual information or data as well as opinions. It is a face-to-face interpersonal role where an interviewer asks interviewees questions designed to elicit answers pertinent to a particular research (Naoum, 2013). According to Zhang and Wildemuth (2008), interviews are a widely used tool to access people's experiences and their inner perceptions, attitudes, and feelings of reality. The interview is considered one of the effective means of qualitative data collection, representing one of the most common methods in qualitative research (Drever, 1995). The interview is a form of interaction between an interviewer and interviewee or a respondent purposely to solicit fact or enquire about something of a particular interest (Wengraf, 2001). The use of interviews for data collection can help the researcher to gather valid and reliable data that are relevant to the research questions and objective (Saunders *et al.*, 2009). Yin (2009), noted that interviews are one of the most significant sources of case studies data gathering. As it provides in-depth variety leading to the social actors meanings and interpretations to their account of the social interaction in which they have been involved (Blaikie, 2011). Moreover, Kvale (1983), asserts that, "technically the qualitative research-interview is *semi-structured*, it is neither a free conversation nor a highly structured questionnaire. It is carried through following an interview-guide, which rather than containing exact questions focuses on certain themes". However, the main task in undertaking interview is to understand the meanings and expressions of the interviewee (Kvale, 1996). Furthermore, Britten (1995), argues that interview data collection technique addresses different research questions from those addressed by quantitative research and qualitative research. Meaning, interviews are associated with positivism and interpretivism philosophies.

According to Fontana and Frey (2005) and Clifford *et al.* (2010), there are three types of interviews and can be explained as follows:

- **Structured interview**

The structured interview follows a predetermined and standardised list of questions. In this technique, the questions are always asked in almost the same way and in the same order in which the questions are prepared. Structured interviews are useful when a clarification of certain questions are required or if there are likely to be literacy or numeracy issues with the respondents (Gill *et al.*, 2008). According to Gill *et al.* (2008), by

the very nature of structured interviews, they only allow for limited participant responses and are, therefore, of little use if ‘depth’ is required.

- **Unstructured interview**

Unstructured interview conversely, represents a form of conversation that is actually directed by the interviewee rather than the set of questions. Unstructured interviews are most useful when you want to gain an in-depth understanding of a particular phenomenon within a particular cultural context (DiCicco-Bloom and Crabtree, 2006). This type of interview technique is mostly applicable in ethnographic studies.

- **Semi-structured interview**

According to Clifford *et al.* (2010), semi-structured permits the interviewer to prepare a list of predetermined questions that help to facilitate the interview in a conversational manner, offering participants the chance to explore issues they feel are significant. Semi-structured interviews focus on specific themes, but cover them in a conversational style; it is often considered the best way for learning about the motivations behind people’s choices and behaviour, their attitudes and beliefs, and the impacts on their lives of specific policies or events (Noor, 2008). Furthermore, semi-structured interviews often provide valuable information that was not anticipated by the researcher (Raworth *et al.*, 2012). Gill *et al.* (2008), based on the work of Britten (1995), explained that semi-structured “*interviews comprise several key questions that help to define the areas to be explored, but moreover allow the interviewer or interviewee to diverge in order to pursue an idea the interviewee in more detail*”. Bryman (2004), noted that semi-structured interviews provide a flexible environment leading to further questions in response to what are generally seen as significant replies.

The above discussions highlight the usefulness of interviews in qualitative research and from the continuum of types of interviews for qualitative data collection. Based on the discussions above, semi-structured interview techniques are the most appropriate technique for this research, because it provides the most flexible environment to explore the most relevant topical areas of interest to this researcher. With respect to this, semi-structured interview was used as the main method for data collection (see Appendix - E). Employing semi-structured technique enables the researcher to explore issues in more details by asking key questions in a

flexible interview environment possibly varying questions to clear ambiguities in offering answers (Silverman, 2011). As this research is being conducted within the confines of exploratory case studies, the semi-structured interview is the most appropriate within the time available to complete this research. Additionally, it provides respondents or interviewees courage to express their own opinion based on their experiences within the Ghanaian construction industry, most especially in the area of capacity for e-business technology transfer.

In respect of this research, which is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI) semi-structured interviews were conducted within three (3) identified FDI projects in Ghana. These cases are referred to as CS1, CS2 and CS3 (see sections 4.5.7.1, 4.5.7.2 and 4.5.7.3). The interviewees were selected by their firms to provide responses based on the participant information sheet and invitation letters presents to these firms (see Appendices **A** and **B**). The interviewees have different and varying background ranging from position in the firms for the number of years working in that position in the firm; this is captured in Figure 4-6. To further gain multiple perspective concerning issues being explored, two (2) expert opinions or views were sought, one from the Public Procurement Authority (PPA) and the other from a foreign private consultancy who has participated and procured FDI projects in the last 12years in Ghana and other parts of Africa. After identifying the appointed managers for the interviews for this research, they were contacted and issued with a research participant consent form as required by the University of Salford research regulations (see Appendix - **C**). As soon as any of them confirmed participation, the appointment for the interview was made. Before the interview started the participant consent form was read out once again. All the interviews were conducted in English and were recorded as per the contents of the participant consent form. A total number of 11 (11) interviews were conducted. Considering the argument that interviews for data collection depends on several factors, most especially the industry and subject under research (Baker and Edwards, 2012). In respect of this research, considering the difficult nature of eliciting information within the construction industry, the number of total number of 11 interviews is quite appropriate as it was used in combination with a questionnaire survey. For example, Elgrari and Ingirige (2011), used nine interviews in a qualitative technology transfer research within the construction industry. To further justify the appropriateness of using 11 interviews combined with a questionnaire survey for this research, Wedawatta (2013) completed a Ph.D. thesis in construction management utilising a mixed method approach, a combination of six interviews and a questionnaire survey.

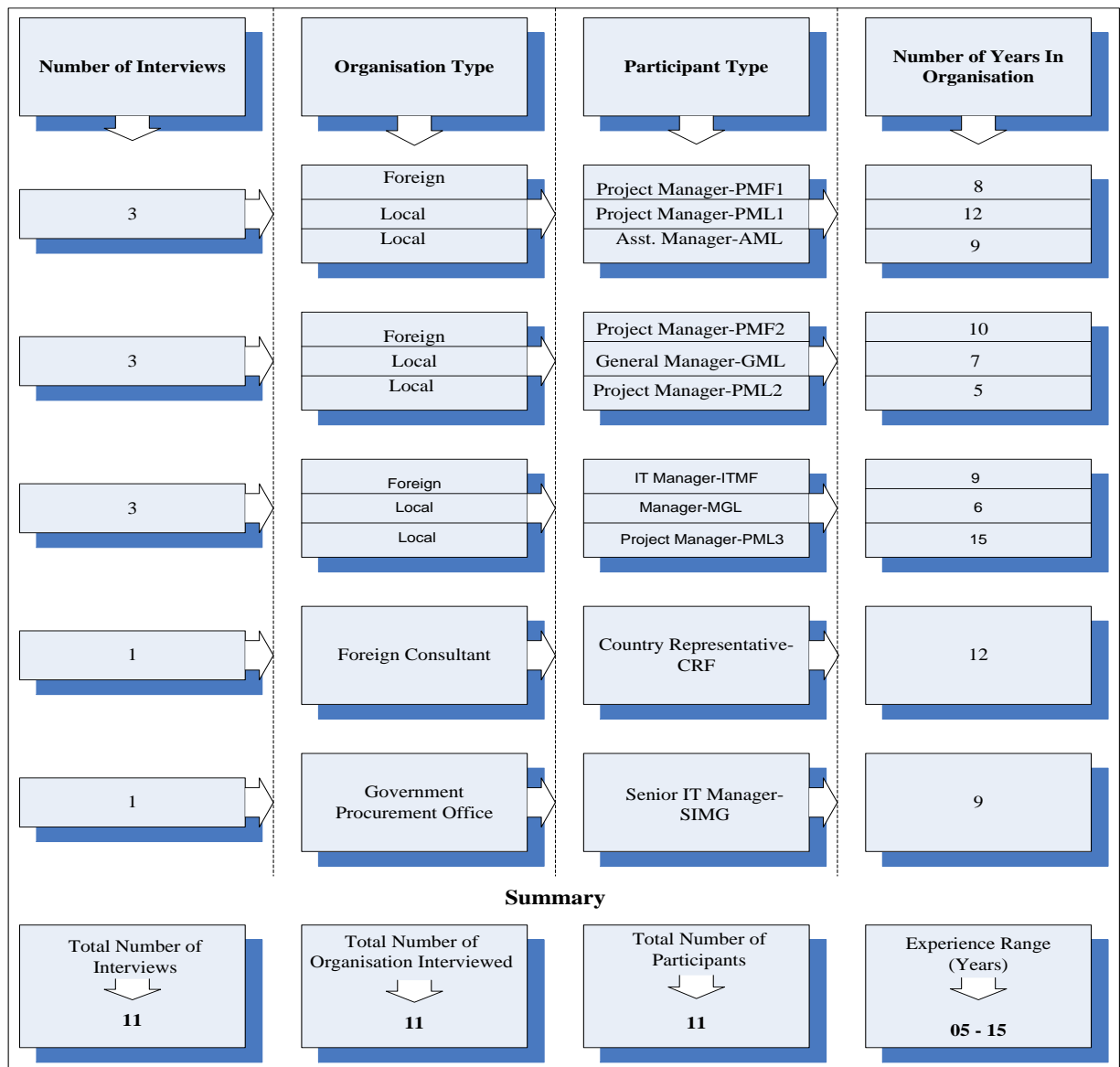


Figure 4-6 Profile of interviewees

The content of the interviews were translated (see Figure 4-7) verbatim to maintain the originality of the thoughts and ideas expressed by the respondents. As outlined in the consent form, the translated text was returned to the respondents to verify the content of the transcripts in order to confirm if the contents were the true reflection of their thoughts and ideas as expressed during the interviews.

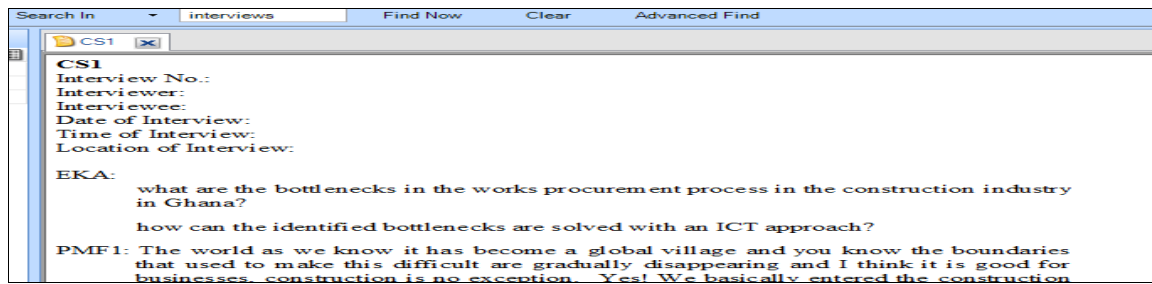


Figure 4-7 Verbatim translation of interview

4.8.2 Criteria for data collection

Figure 4-8 highlighted the data collection criteria adopted for this research. The selection of participants for the data collection was based on a number of criteria as indicated in Figure 4-8 i.e. number of years in operation in the construction industry, FDI projects undertaken and the use of e-business in the procurement and project management processes. The rationale is to get to the actual participants within the industry who have engaged in FDI activities and are familiar with the operations of FDI particularly in the area of technology transfer.

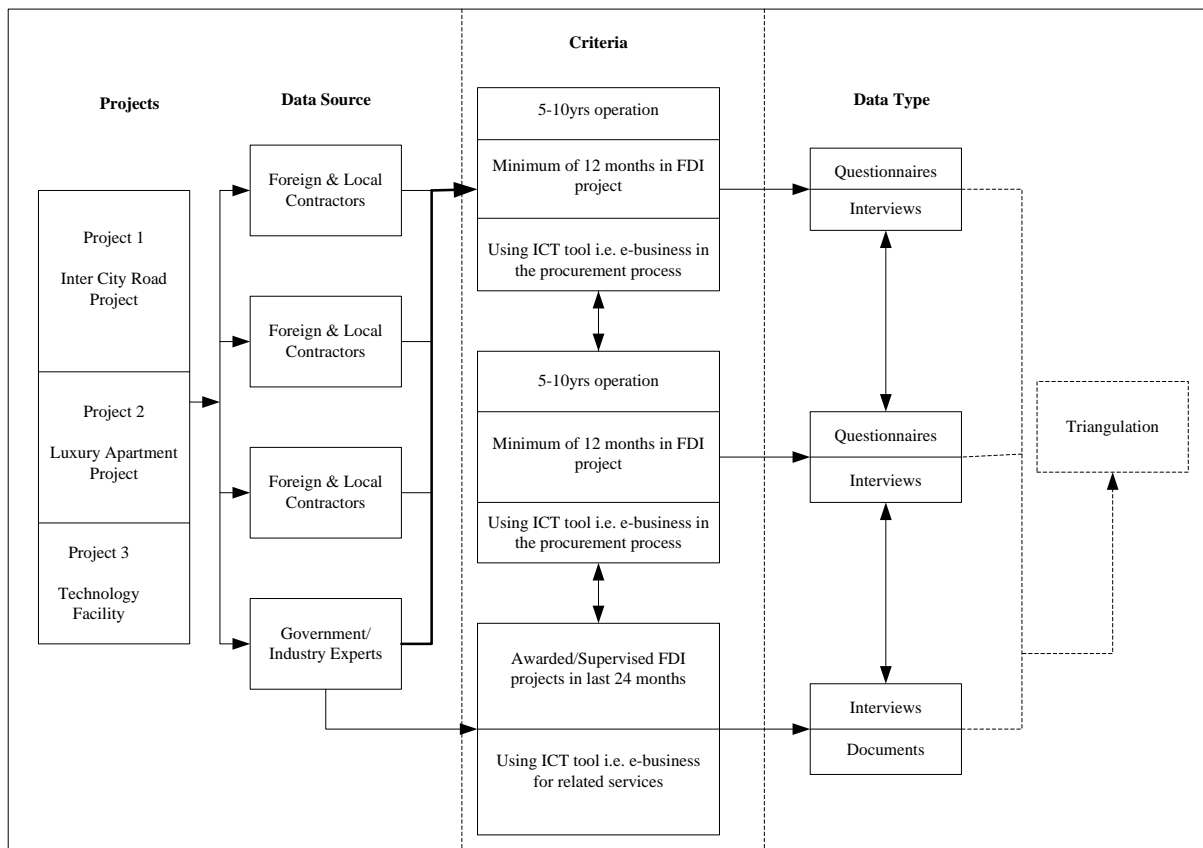


Figure 4-8 Data collection criteria

4.8.3 Data analysis

4.8.3.1 Questionnaire data analysis

Two sets of analysis methods were employed, descriptive and Relative Importance Index (RII). First, descriptive statistics were used to analyse the 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 Furthermore to simple to understand graphs. Moreover, it provides what the study demonstrates (Najimu, 2011). Descriptive statistics were adopted to provide a clear understanding of the trend of e-business usage in the Ghanaian construction industry. Second, the answers to some of the questions were gathered utilising a four-point Likert scale, in such cases Relative Importance Index (RII) was used based on the work of Gündüz *et al.* (2013), to evaluate the comparative significance of the questions/items from the respondent organisation’s perspective. RII is calculated for each factor in the equation:

$$RII = \frac{\sum W}{A \times N}$$

Where RII = relative importance index; W = weighting given to each factor by respondents (ranging from 1 – 4 for this research); A = highest weight (i.e. 4 in this research) and N = total number of respondents. RII value had a range of 0 to 1 (0 not inclusive); the higher the RII, the significant the factor.

4.8.3.2 Qualitative data and content analysis

Data collected from the interviews was analysed using qualitative analysis tools such as content analysis as identified with the assistance of computer software package NVivo 10. According to Bryman (2004), contents analysis is an approach to the analysis of documents and texts that seeks to quantify content in terms of predetermined categories and in a systematic and in replicable manner. Silverman (2011), moreover explained that content analysis is a tool that a researcher can utilise to establish categories for further analysis. This method was used to do in-depth analysis of key issues identify both in the semi-structured interview stage and documents review stage (Ahmad and Ali, 2003). This technique was used by the researcher to gain in-depth understanding of perceptions of individuals working in the construction industry in Ghana and identify emerging issues from the interview data. The

qualitative data collected were analysed using qualitative computer software package NVivo 10 which permits analyses of data using qualitative analysis procedures in order to identify concepts. As provided by the principles of using Nvivo 10, the analysis started with the coding of the data from a general perspective and then narrowed down through the merging of similar identified themes, concepts, ideas, topics, phrases and terms within the research area to enhance reliability and validity of the data. These concepts, themes and ideas were transferred and recorded within Nvivo ten software packages as free nodes, as shown in Figure 4-9. It can be seen from Figure 4-9 that the nodes provide the basis for further analysis utilising NVivo to merge concepts derived from the free nodes. The above coding system is illustrated in Figure 4-9 below.

Thematic Coding - CS1	
Name	Sources
Procurement law	3
Institutional framework	2
Lack of skilled personnel	4
Time consuming	3
Lack of basic technology	4
Lack of monitoring	3
Quality of firms	3
Government	3
Strategy to promote e-business	3
Long term business relationship	2
Construction business environment	2
Pressure from foreign firms	2
Efficiency of business process	3
Acquisition of new skills	3
Managerial Expertise	2
Barriers to e-business	5
Benefit of e-business to firm	4
Staff orientation and training	3
Organisation structure	3
Organisational culture	4
National ICT Infrastructure	3
Legal and regulation system	3
Organisation's ICT infrastructure	4
Existing capacity of firms	3
Managing construction activities	2
Utilising ICT elements	3
Investment and technical solutions	2

Thematic Coding - CS2	
Name	Sources
Procurement law	3
Lack of skilled personnel	3
Time consuming	2
Lack of basic technology	4
Quality of firms	4
Government	3
Strategy to promote e-business	3
Long term business relationship	2
Construction business environment	2
Pressure from foreign firms	4
Existing capacity of firms	4
Efficiency of business process	4
Acquisition of new skills	4
Barriers to e-business	4
E-business activities	2
Benefits of e-business to firms	5
Benefits of e-business to government	1
Staff training	4
Organisation culture	3
National ICT infrastructure	3
Legal and regulation system	3
Organisation's ICT infrastructure	5
Lack of technical expertise	4
Government intervention in ICT skills development	2
Foreign firms collaboration	4

Thematic Coding - CS3	
Name	Sources
Foreign firms Collaboration	3
Procurement law	3
Lack of skilled personnel	3
Time consuming	2
Lack of basic technology	4
Quality of firms	5
Government	4
Promotion of technology	0
Strategy to promote e-business	3
Long term business relationship	3
Construction business environment	3
Pressure from foreign firms	2
Existing capacity of firms	4
Efficiency of business process	2
Acquisition of new skills	4
E-business barriers	4
Managerial skills	3
E-business activities	2
Benefits of e-business to firms	5
Benefits of e-business to government	1
Staff training	3
Organisational culture	2
National ICT infrastructure	4
Legal and regulation system	3
Technical solution	2
Organisation's ICT Infrastructure	3

Figure 4-9 Free node screens of CS1, CS2 and CS3

The free nodes themes were further filter and carefully sorted through the merging of the themes into nine main tree nodes, namely: construction works procurement; political context; management; skills development; implementing e-business; business strategy by foreign firms; improving capability; organisation readiness and technology and environment as shown in Figure 4-10.

Tree Nodes - CS1		Tree Nodes - CS2	
Name	Source	Name	Sources
Construction Works Procurement	0	Construction Works Procurement	0
Procurement law	3	Procurement law	3
Institutional framework	2	Lack of skilled personnel	3
Lack of skilled personnel	4	Time consuming	2
Time consuming	3	Lack of basic technology	4
Lack of basic technology	4		
Lack of monitoring	3	Political Context	0
Political Context	0	Government intervention in ICT skills development	2
Government	3	Strategy to promote e-business	3
Strategy to promote e-business	3	Government	3
Skills Development	0	Management	0
Acquisition of new skills	3	Quality of firms and performance	4
Managerial Expertise	2	Efficiency of business process	4
Utilising ICT elements	3	Skills Development	0
Implementing e-Business	0	Acquisition of new skills	4
Barriers to e-business	5	Implementing e-Business	0
Benefit of e-business to firm	4	Barriers to e-business	4
Business Strategy by Foreign Firms	0	Benefits of e-business to government	1
Long term business relationship	2	Benefits of e-business to firms	5
Construction business environment	2	Lack of technical expertise	4
Improving Capability	0	E-business activities	2
Pressure from foreign firms	2	Business Strategy by Foreign Firms	0
Existing capacity of local firms	3	Long term business relationship	2
Organisation Readiness	0	Construction business environment	2
Staff orientation and training	3	Improving Capacity	0
Organisation structure	3	Pressure from foreign firms	4
Organisational culture	4	Existing capacity of firms	4
Technology and Environment	0	Foreign firms collaboration	4
National ICT Infrastructure	3	Organisation Readiness	0
Legal and regulation system	3	Staff training scheme	4
Organisation's ICT infrastructure	4	Organisation culture	3
Investment and technical solutions	2	Technology and Environment	0
Management	0	National ICT infrastructure	3
Quality of firms	3	Legal and regulation system	3
Managing construction activities	2	Organisation's ICT infrastructure	5
Efficiency of business process	3		

Tree Nodes - CS3	
Name	Sources
Procurement law	3
Lack of skilled personnel	3
Time consuming	2
Lack of basic technology	4
Political Context	0
Government	4
Strategy to promote e-business	3
Management	0
Quality of firms	5
Efficiency of business process	2
Skills Development	0
Acquisition of new skills	4
Managerial skills	3
Implementing e-Business	0
E-business barriers	4
Benefits of e-business to firms	5
Technical solution	2
E-business activities	2
Business Strategy by Foreign Firms	0
Long term business relationship	3
Construction business environment	3
Improving Capacity	0
Pressure from foreign firms	2
Existing capacity of firms	4
Foreign firms Collaboration	3
Organisation Readiness	0
Staff training and development	3
Organisational culture	2
Technology and Environment	0
National ICT infrastructure	4
Legal and regulation system	3
Organisation's ICT Infrastructure	3

Figure 4-10 Tree node screens of CS1, CS2 and CS3

To simplify the process of identifying key issues through discussion and analysis of factors under the parent themes as displayed in Figure 4-10, the tree nodes screens were further grouped in accordance with the research questions set in Section 1.6.3 in Chapter 1 as a guide to the detailed case study discussions presents in Chapter 6 of this thesis.

4.9 Validity and reliability

Despite several advantages of case studies research, its validity and reliability has been subjected to criticism (Shenton, 2004). Test to establish the validity and reliability of quality of data are significant to determine the stability, credibility and quality of the data obtained (Voss *et al.*, 2002, Riege, 2003). Validity depends on measuring instrument for accurate result which is closely related to positivism philosophical orientation (Easterby-Smith *et al.*, 2002, Patton, 2002, Golafshani, 2003, Heale and Twycross, 2015). Silverman (2003), posited that validity is another word for truth. However, it has been argued that the validity of qualitative research is affected by the researcher's perception (Creswell and Miller, 2000, Riege, 2003). Conversely, Silverman (2011), refers to reliability as the degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions. According to Yin (2014), validity and reliability of case study research can only be achieved by following the test of construct validity, internal validity, external validity and reliability (see Table 4-6). For a quantitative studies Heale and Twycross (2015), discusses two validity tests, namely, content validity and criterion validity (see Table 4-6). Some of These tests are applicable in the context of this research as discusses below. Table 4-6 is established to demonstrate how this research sought to achieve validity and reliability.

Table 4-6 Case study tactics for achieving validity and reliability in this research

Tests	Case study tactic used in this research	Stage tactic occurred in this research
Construct validity	<ul style="list-style-type: none"> • Use of multiple sources of evidence • Establish a chain of evidence • Key informants review draft case study report (verify the content of the transcripts) • Use of an appropriate research methodology 	Data collection Data collection Composition of report
Internal validity	<ul style="list-style-type: none"> • Do pattern matching • Do explanation building • Address rival explanations • Use logic models 	Data analysis Data analysis Data analysis Data analysis
External validity	<ul style="list-style-type: none"> • Review of relevant literature • Use of replication logic (multiple case studies) • Use of questionnaire survey to represent an accurate population of firms in the Ghanaian construction industry. 	Research design Research design (see Figure 4-3)
Content validity	<ul style="list-style-type: none"> • Detailed literature search to establish key issues • Adapted CIB questionnaire template to ensure content validity. 	Data collection
Criterion validity	<ul style="list-style-type: none"> • Use of a questionnaire instrument based on the adapted CIB questionnaire template 	Data collection
Reliability	<ul style="list-style-type: none"> • Use case study protocol (see Figure 4-4) • Develop case study database (multiple sources of evidence) 	Data collection Data collection

Adapted in Yin (2014)

4.9.1 Construct validity

As previously pointed out in Section 4.9, Yin (2014), outlines and discusses four tests to achieve validity and reliability; construct validity, internal validity, external validity and reliability. However, three tests are found to be relevant to this research and discusses accordingly. Construct validity according to Yin (2014), relate to establishing the appropriate or correct operational measure for a particular research. Yin (2014), advocated for multiple sources of evidence in case study research. Construct validity was achieved in this research through literature review; questionnaire survey and semi-structured interview (see Table 4-6) which is based on the establishment of an appropriate research methodology. Furthermore, key informants, including experts were engaged for the purposes of this case study research. Consequently, interview transcripts were transmitted to interviewees for verification to ensure that their views and ideas were captured accurately (see Table 4-6). These research activities are in line with Yin (2014), definition of construct validity.

4.9.2 Internal validity

According to Yin (2014), internal validity seeks to establish a causal relationship, where certain conditions are believed to lead to another conditions. This test largely use for explanatory or causal research only not for descriptive or exploratory research (Yin, 2014). The questionnaire survey stage of this research was primarily exploratory, while the case study was descriptive in nature. Following the argument advanced by Yin (2014), the test of internal validity does not apply to this research.

4.9.3 External validity

According to Yin (2014), external validity refers to the extent to which a research finding can be generalised. In this research, the test of external validity is achieved through review of key literature and utilisation of multiple case studies which comprises questionnaire survey and semi-structured interview (see Table 4-6). The questionnaire represents the accurate population of firms in the Ghanaian construction industry, in order to help obtain population generalisation. Furthermore, literature findings were compared at different stages of the questionnaire and case study findings and further in cross-case analysis.

4.9.4 Content validity

Content validity is about the extent to which a questionnaire survey instrument adequately cover all aspect of the research area (Heale and Twycross, 2015). In this research content validity was achieved through detailed literature which established the key issues to be explored through a questionnaire survey. Additionally, to make sure the content of the questionnaire is adequate to enable an accurate measure of the research area, CIB e-business in construction assessment survey template was adapted, since the template cover key areas in assessing e-business usage in construction.

4.9.5 Criterion validity

According to Heale and Twycross (2015), criterion validity in quantitative studies is about the extent to which a questionnaire survey instrument is related to another instrument that was used to undertake similar research. In this research, criterion validity was archived through the

design of the questionnaire survey instrument based on the adapted CIB template which was previously used to assess e-business usage in the construction industry.

4.9.6 Reliability

Reliability relates to the ability to demonstrate that the operation of research, i.e. data collection procedures of a research can be repeated with the same result (Yin, 2014). To enhance reliability, Yin (2014), recommends the use of case study protocol and development of case study database. These techniques were adopted in this research (see Figure 4-4) in order to enhance reliability.

4.10 Triangulation

Triangulation represents the use of more than one method or sources of data in case study research with the aim to corroborate the same fact (Yin, 2003, Bryman, 2004). According to Bryman (2004), triangulation offers the prospect of enhanced confidence. Yin rejects single source of evidence in case study research as it does not permit addressing research questions with a broader view. In this research, multiple sources of evidence have been employed as indicated in Figure 4-5. This is in line with Creswell (1994) and Yin (2003), recommendation of utilising multiple sources of data in order to provide much more convincing and accurate findings. Conversely, Denzin and Lincoln (2000), distinguishes four forms of triangulation as follow: data triangulation, investigator triangulation, theoretical triangulation and methodological triangulation. For the purposes of this research triangulation was achieved as follow:

- I. **Data triangulation** – the researcher utilised questionnaire survey and semi-structured interviews.
- II. **Theoretical Triangulation** – the research explored literature in different key areas that are relevant to this research. For example, areas such as the construction industries in implemented and developing countries, foreign direct investment concept, technology transfer and e-business technology.
- III. **Methodological triangulation** – although this research is premised in the interpretivism methodology, the researcher used moreover a questionnaire survey technique which falls within the positivism stance.

4.11 Ethical approval

In accordance with the University of Salford ethic policy, ethical approval must be obtained by all postgraduate research students (PGRs) prior to starting research with human subjects, animals or human tissue. Accordingly, the researcher applied for ethical approval in line with the application guidelines provided by the University of Salford to the College of Science and Technology Research Ethics Panel (CST). After thorough scrutiny of the application, CST granted the application (see Memo reference number CST12/33 in Appendix - **H**).

4.12 Summary and Link

This chapter discusses and presents the research model adopted for this research. The research methodology adopted for this research is based on Saunders Research Onion. The elements discussed within the research model include: research philosophies, research approaches, research strategies, research choices and research techniques. This provided the basis upon which the research strategy used in this research which is a case study strategy. The next Chapter presents findings and discussions of a questionnaire survey of this research.

CHAPTER 5 : FINDINGS AND ANALYSIS OF QUESTIONNAIRE SURVEY

5.1 Introduction

This chapter of the thesis presents findings and analysis of a questionnaire survey conducted in accordance with the research methodology established in Chapter 4 in respect of this research. As explained in Sections 4.4 and 4.5.1.1 in Chapter 4 a questionnaire survey was conducted ostensibly to determine the available capacity of local Ghanaian construction firms for e-business technology transfer, in order to inform the case study part of this research. The findings of the questionnaire survey are analysed and discussed. This is then discussed further in Chapter 7 together with the findings of the case study presents in Chapter 6. The approach for analysis and discussions in this chapter is organised based broadly on the structure of the questionnaire survey instrument (see Appendix - D).

5.2 Data presentation findings, analysis and discussion

5.2.1 Emerging issues from questionnaire survey

In line with the data collection techniques adopted for this research, (see Section 4.7.1 in Chapter 4) questionnaire survey and semi-structured interview were adopted for the purposes of data collection for this research. The following sections present, analysis and discussion of the findings of the questionnaire survey and the implications for the construction industry in Ghana.

5.2.2 Questionnaire design in respect of e-business activities within the Ghanaian construction industry

The aim of the questionnaire survey is to assess the capacity of local Ghanaian construction firms for e-business technology transfer. To help achieve the aim of the questionnaire survey, the questionnaire was designed with relevant questions grouped into six (6) main sections: Background Information, e-Business in Respondent Organisations, IT Investment Advice and e-Skills Development, Drivers, Impact and Barriers to e-Business, Improvement of e-Business and Future of e-Business in Respondent Organisations. The survey questions were designed in line with the philosophical stance of this research (see Section 4.3.4 in Chapter 4), in this context, the questions comprise both close-ended and open-ended, which offer the

opportunity for respondent organisations to freely provide additional information which may be relevant but not found in the questions see Appendix D for questionnaire sample used for data collection.

5.2.3 Questionnaire distribution within the Ghanaian construction industry

In view of the small nature of the construction industry in Ghana, local firms do not spread evenly across the ten (10) administrative regions of Ghana (see Figure 3-1 in Chapter 3). For this reason, the country was divided into three (3) zones based on the advice and assistance offered by the Association of Building and Civil Engineering Contractors of Ghana (ABCECG). Each of these zones provides a significant amount of concentration of local firms that are considered active within the construction industry in Ghana. These zones are Northern (zone 1); Central (zone 2); and Southern (zone 3). The questionnaires were administered through the offices of ABCECG. This support was extended to the researcher, first due to the interest shown in the research by ABCECG and second, the difficulty in accessing the various zones and office locations of the local contractors identified in each zone. To obtain an adequate view of the subject matter, a total number of 105 questionnaires were distributed through the offices of ABCECG to the three (3) zones to contractors and other professional groups identified in Table 5-1 who were randomly drawn from each of the three (3) zones. A total number of 67 questionnaires were returned. Out the 67 returned, 10 were incomplete, therefore, not suitable to be used for analysis. 57 questionnaires representing 54% were found accurately filled and complete, hence useful for analysis. This response rate is considered appropriate considering the difficulty in obtaining questionnaire responses from the construction industries (Black *et al.*, 2000, Hoxley, 2008).

5.3 Background information about respondent organisations within the Ghanaian construction industry

The first section of the questionnaire deals largely with general information in respect of respondent organisations. Table 5-1 demonstrates the breakdown of organisations that participated in the questionnaire survey exercise and the response rate in percentage. The first category provided four (4) main type of construction based organisations followed by work specialisation. This section outlines the various specific works that best described the type of work the organisation engages in. Any of these specific areas may fall under any option in the first category. The third section provides for an area of work which is linked directly to work

specialisation meaning each of the work specialisation falls within a particular area of work as provided in the third section. As indicated in Table 5-1 the last section provided details of the size of the organisations that participated in the questionnaire survey. For the purposes of analysis, work specialisation category was used. As shown in Table 5-1 a total number of 16 building contractors, 10 architectural firms, 5 building material supplier, 7 property developers, 5 civil engineering contractors and nine quantity surveying firms and five maintenance contractor allowed staff at different management levels as indicated in Table 5-1 to participate in the questionnaire survey.

Table 5-2 demonstrates the details of the respondents that got permission from their organisations to participate in the questionnaire survey. As shown in Table 5-2, a total number of 18 senior management staff (SMS), 34 middle management staff (MMS), 1 junior staff (JS) and four support staff (SS) participated in the survey on behalf of their respective organisations.

Table 5-1 Percentages of respondent organisations and response rate

Category of Respondent Organisations											
Type of Organisation	No	%	Work Specilisation	No	%	Area of Work	No	%	Size of Organisation	No	%
Consultant	19	33.3	Building Works Contractor	16	28.1	Building Work	22	38.6	1-9	11	19.3
Main Contractor	28	49.1	Architect	10	17.5	Civil Engineering Work	9	15.8	10-49	26	46.6
Supplier	5	8.8	Building Material Supplier	5	8.8	Building & Civil Eng Works	5	8.8	50-249	11	19.3
Sub-contractor	5	8.8	Property Developer	7	12.3	Residential	21	36.8	250 & Over	9	15.8
Total	57	100	Civil Engineering Contractor	5	8.8	Total	57	100	Total	57	100
			Quantity Surveying	9	15.8						
			Maintenance Contractor	5	8.8						
			Total	57	100						

Table 5-2 Details of respondents and their role

Category of Position and Job Function					
Position Held	No	%	Job Function – IT Specialist?	No	%
Senior Management Staff	18	31.6	Yes	9	15.8
Middle Management Staff	34	59.6	No	48	84.2
Junior Staff	1	1.8	Total	57	100
Support Staff	4	7.0			
Total	57	100			

5.4 E-business activities in respondent organisations within the Ghanaian construction industry

This section of this research addresses issues regarding e-business implementation with respect to e-business activities, communication networks, level of e-business usage and e-business enabling technologies in construction firms within the Ghanaian construction industry

5.4.1 E-business activities within construction firms in Ghana

This part of the question seeks to explore issues concerning the application of e-business within construction and other firms that participated in the questionnaire survey. Specifically, the question enquired about the degree to which e-business activities such as exchange of documents electronically is conducted within the respective firms. This is to gauge how these activities can improve the procurement process and performance in project management within local firms in the Ghanaian construction industry. This in turn provides the basis to assess the capacities of the firms for e-business technology transfer. This section is presented in two (2) subsections (Activities-documents and Activities-core). Data on these activities was gathered utilising four-point Likert scale varying from "None to High". A weighting was allocated to each point, where "none" = 1, "low" = 2, "medium" = 3, and "high" = 4. As indicated in Section 4.8.3.1 Chapter 4 descriptive statistics was used to analyse the details of the data collected. Specifically, cross tabulation was utilised in this section to provide a clear

understanding of the trend of e-business activities by the various construction firms/organisations surveyed.

5.4.1.1 *Please state the degree to which documents are computerised and exchanged electronically*

Figure 5-1 demonstrated a cross tabulation analysis of e-business activities of construction organisations identified in the Ghanaian construction industry (see Table 5-1 in exchanging computerised documents electronically. The results as shown in Figure 5-1 indicated that the capacity for these activities within contractor organisations is quite low. For example, Figure 5-1 demonstrates cumulatively that the majority, 69% of the organisations who participated in this survey indicated low volume of activities tender documents. Similarly, 61% have moreover indicated low activities in tender processing, while 63% recorded low activities in contract document activities. In contrast, a significant number of 74% of the organisations surveyed demonstrated to have exchanged project programming documents electronically and 53% of them agreed to computerise and sent valuation and final accounts documents electronically (see Figure 5-1).

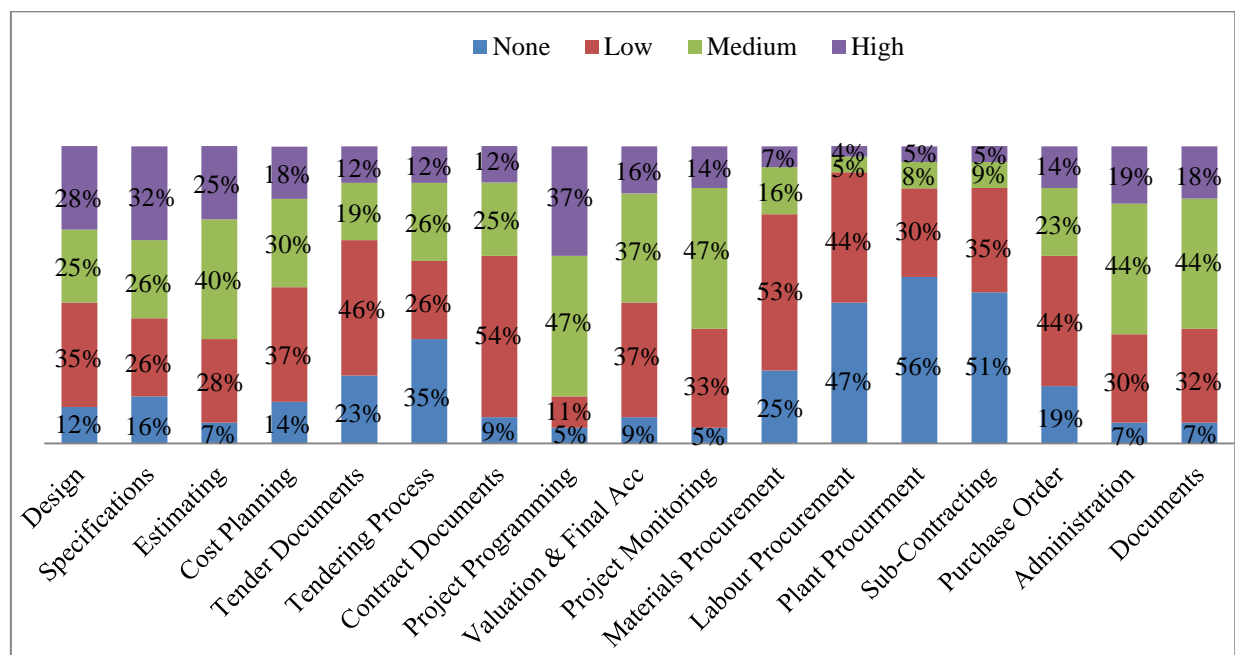


Figure 5-1 Percentages of e-business activities in electronic document exchange

The survey findings again confirmed that project monitoring is another aspect of project management activities; hence 61% organisations surveyed agreed that they have exchanged project monitoring documents. These two activities are perhaps among the most significant

and core activities of both contractors and consultants working the industry. Again, it is of interest to note that the issues regarding materials procurement, labour procurement, plant procurement and subcontracting are quite unpopular within the organisations that have been surveyed. As shown in Figure 5-1, the respondent organisations recorded low activities in materials procurement (78%), labour procurement (91%) and sub-contracting (86%). Although the survey findings demonstrated that the organisations demonstrated low activity in the majority of the activities (see Figure 5-1), they moreover demonstrated quite an appreciable volume of activities in areas that is deemed directly related to their core business function. The survey results further suggested that the majority of the activities within the organisations is conducted manually. For example, Iddris (2012), observed that insufficient knowledge about e-business accounts for low e-business activities among SMEs in Ghana. It is significant to point out that the survey findings provide the basis to support e-business technology transfer within construction utilising FDI in Ghana. First, it could inform foreign firms the level of support their local counterparts required in e-business technology transfer activities. Second, the results as shown in Figure 5-1 can alert the entire industry to take up industry-wide education and awareness of e-business and its benefits to the construction industry.

5.4.1.2 *Please state the core business documents that are computerised and exchanged electronically*

As previously pointed out in Section 5.4.1 this subsection of the research question was designed to gauge respondent organisation's e-business activities towards exchanging core business activities documents electronically. It is significant to note that this analysis was conducted based the data gathered from each of the organisations that participated in this survey. In this regard, the research question inquired about the extent to which core activities, documents are computerised and exchanged electronically. Dealing with this question, the total number of 57 construction related firms/organisations that participated in the questionnaire survey was used for the analysis. Results from cross tabulation analysis of the building works contractor organisation demonstrated an interesting trend in these activities. The trend in this analysis is quite similar to those in the previous analysis (Activities – document) where the majority of the organisations demonstrated activities in their core business function. In this analysis, the results as shown in Figure 5-2 indicated that 58% of the organisations surveyed demonstrated low activities in human resource management, while 42% of the respondent organisations exchanged human resource management documents

electronically. For marketing, 74% of them demonstrated low activities (see Figure 5-2). The low activities moreover occurred in purchasing, where it is shown that 60% of the organisations recorded low activities. These low activities moreover reflected in facilities management, as shown in Figure 5-2 a significant number representing 60% of the organisations survey demonstrated low activities in this area.

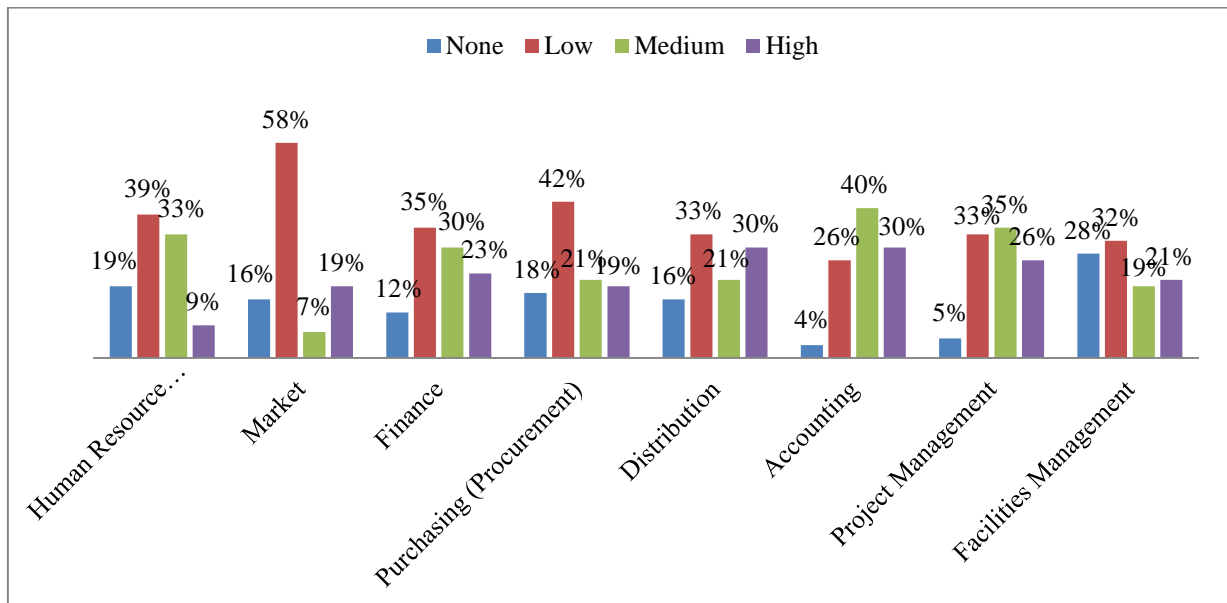


Figure 5-2 Percentages of exchanging core business activities documents electronically

This notwithstanding, there are moreover quite appreciable volume of e-business activities in some areas. For example, 61% high point of project management activities illustrates the fact that it is a significant activity undertaken by the organisations, therefore, respondent's attitude to it is positive. It is worth noting that accounting and finance remains an integral part of the organisations surveyed. The results as shown in Figure 5-2 indicated that, 53% of the organisations computerise and sent electronically finance document while 70% undertook the same activities in accounting. These activities are significant in improving the organisation's financial efficiency – cash flow is significant for construction organisation's performance and survival. The results suggest that the available capacity within the organisation type can be taken further through the support of foreign firms in FDI collaboration with local ones.

5.4.2 Communications network construction firms use in Ghana

This section sought to explore communication within the construction industry and how it can improve performance within the local firms. This part of the question seeks to explore two

main issues. The first question enquired about the type of network the firms/organisations use. Data was generated through the provision of free multiple options to choose from. The second question requested respondents to identify the degree to which they communicate electronically internally and externally. Data was gathered utilising four-point Likert scale varying from "None to High". A weighting was allocated to each point, where "none" = 1, "low" = 2, "medium" = 3, and "high" = 4. As indicated in Section 4.8.3.1 in Chapter 4 descriptive statistics was used to analyse the details of the data collected. Specifically, cross tabulation was utilised in this section, to provide a clear understanding of the trend of e-business activities by the various construction firms/organisations surveyed.

5.4.2.1 *Please identify the type of network use to facilitate communication in construction firms in Ghana*

This subsection enquired about the type of network the respondent organisations use or are likely to use to facilitate electronic communication within their respective organisations. Figure 5-3 highlighted the respondent organisations perception and use of the type of network for communication activities. The results demonstrated that communication networks such as extranet, intranet and sky drive/cloud networks are quite unpopular within organisations in the Ghanaian construction industry as can be seen in Figure 5-3.

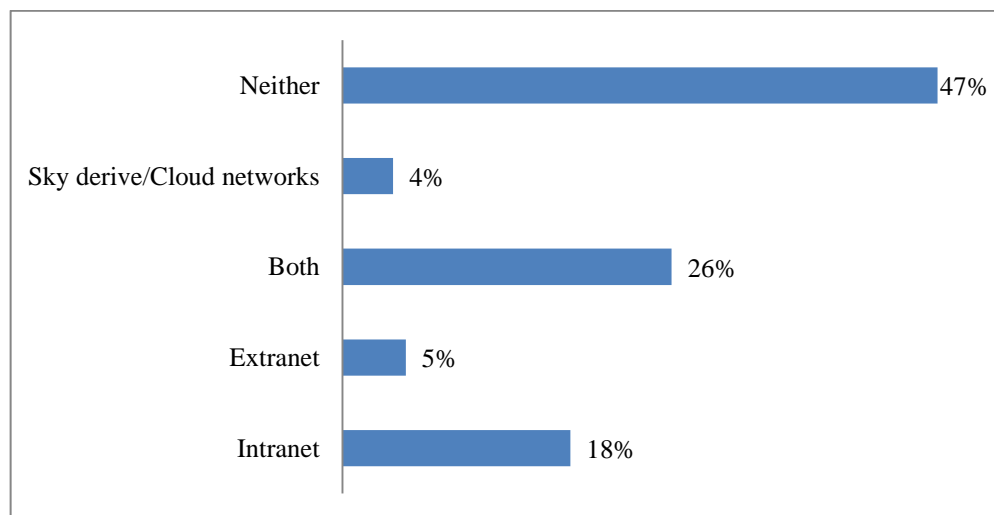


Figure 5-3 percentages of identified networks

The results, to a large extent point to a minimal level of network technology within the Ghanaian construction industry. Improving knowledge and capacities of local firms regarding these network types may translate into an improvement of communication within the industry.

5.4.2.2 *Please identify the degree to which you communicate electronically internally and externally*

This subsection requested respondents to identify the degree to which they communicate electronically internally and externally. For internal communication activities, 25% indicated no activity, 32% low and 21% medium and 23% high respectively (see Figure 5-4). Cumulatively, the results suggest that 57% of the respondent organisations demonstrated low internal communication activities, which perhaps may be due to non-availability of internal communication facility such as an intranet. On the other hand, the organisations surveyed demonstrated quite an appreciable volume of external communication recording cumulative activities of 64% as can be seen Figure 5-4.

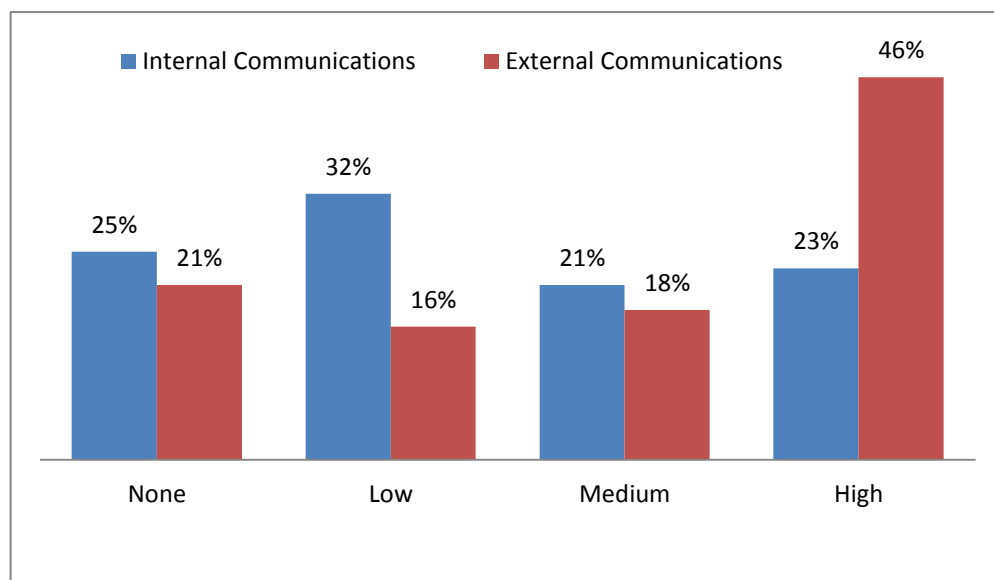


Figure 5-4 Degree of electronic communication

The results of the analysis demonstrated that the respondent organisations have some level of communication capacity, which can be further improved to support construction business in Ghana. It is worth mentioning that the results fit the objective of the research, which seeks to explore and identify capacity of local contractors for e-business technology transfer.

5.4.3 Level of e-business usage among construction firms in Ghana

The first part of the question seeks to explore the perspective of respondents regarding use of e-business enabling technologies. This section is presented in two (2) subsections ('internet usage' and 'enabling technologies'). Data on these activities were gathered utilising four-point

Likert scale varying from "None to High". A weighting was allocated to each point, where "none" = 1, "low" = 2, "medium" = 3, and "high" = 4. As indicated in Section 4.8.3.1 in Chapter 4, Relative Importance Index (RII) was used to analyse the details of the data collected. RII was used in this analysis to evaluate the comparative significance of the activities from respondent organisation's perspective.

5.4.3.1 *If Internet technology is used in your organisation; please state the degree to which it is used*

Respondent organisations were asked if they use the Internet and further asked to show the degree to which the activities in Table 5-3 are undertaken. Based on RII ranking of most preferred activities were identified in the order of significance (see Table 5-3). It can be seen that respondent organisations chose project collaboration and management as the most significant activity to use the Internet for. This to some extent confirmed the understanding that construction activity rely on the supply of information and effective communication among project team members. The rest of the activities received low RII which suggest that the level of these e-business activities within the local construction organisations in Ghana is low, hence the need to support the development of technological capability of the construction industry through foreign and local collaboration, for the purposes of this research Foreign Direct Investment (FDI) in construction can provide an significant medium to enhance the capabilities of local firms.

Table 5-3 Ranking of preferred activities to use the Internet by local contractors

Activities	Respondent Scores				RII	Rank
	1 None	2 Low	3 Medium	4 High		
Project collaboration and management	4	10	27	16	0.741	1
Customer relationship management	2	39	8	8	0.596	2
Supply chain management	5	31	16	5	0.592	3
Lessons learned document	7	29	18	3	0.575	4
Electronic procurement	12	32	4	9	0.544	5
Product/Service promotion	14	27	7	9	0.504	6
Bidding and tendering online	20	26	7	4	0.478	7

5.4.3.2 *Are you using the following enabling technologies for e-business? If so, what is the degree of usage?*

Respondent organisations were asked if they use e-business enabling technologies and further asked to show the degree of usage. Based on RII, ranking of most preferred e-business enabling technologies were identified in the order of significance (see Table 5-4).

Table 5-4 Ranking of preferred e-business enabling technologies

Drivers	Respondent Scores				RII	Rank
	1 None	2 Low	3 Medium	4 High		
Internet	4	12	17	24	0.768	1
CAD	33	4	5	15	0.509	2
Cloud computing	42	7	5	3	0.364	3
BIM	48	3	4	2	0.325	4

The Internet is the most known and used e-business enabling technology among local Ghanaian construction firms/organisations based on the allocation of high significance. With exception of CAD, even though less known and used across the industry, the other technologies appear completely unknown to the local firms and the industry. Perhaps these technologies are still at different stages of development within construction, therefore, require time to begin to show the applicability within developing country's construction industries particularly Ghana.

5.5 ICT investment advice and e-skills development within construction firms in Ghana

This part of the question seeks to explore the perspective of respondents regarding how their organisation operates and maintain e-business system and moreover future activities. This section is presented in three (3) subsections (IT investment advice, IT Expenditure and e-skills development). Descriptive statistics were used to analyse the details of the data collected for the first and second subsections, while Likert scale varying from "None to High" was used in the third part of the question.

5.5.1 ICT investment advice to construction firms

5.5.1.1 Please select all statements that apply to your organisation

Respondent organisations were asked to select all statements that apply to their respective organisations. The question contains four (4) different statements from which respondents were asked to select an option for other(s) that are not included in the list. The following are the statements: obtain advice on IT investment from professional IT providers; obtain advice from an own IT department or IT practitioners; learn through university or other research parties and implement IT investment through government/third party recommendations. For advice on IT investment advice, the majority 52% of respondent organisations say they prefer obtaining advice from professional IT providers. Conversely, 37% agreed that they obtained IT advice from their own IT department (see Figure 5-5).

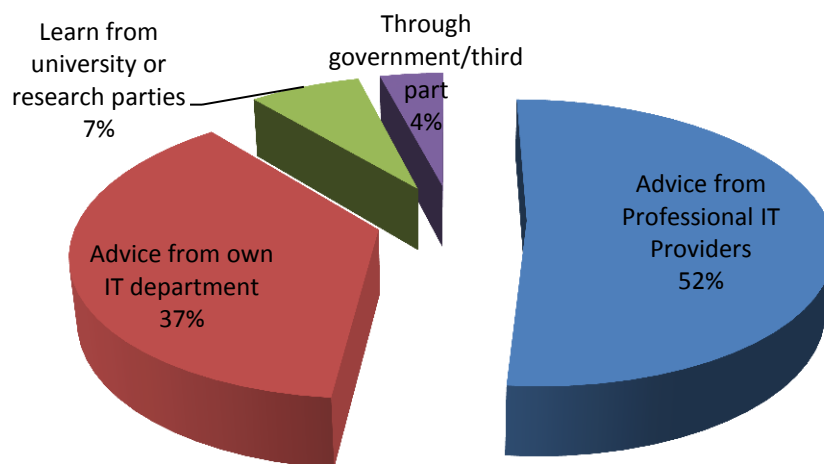


Figure 5-5 Identified IT investment advice

Other sources like, to learn through a university or other research parties and through government or third party recommendations are quite unpopular with respondent organisations. These findings further revealed that, research and development in IT in construction within the construction industry in Ghana seem completely unknown.

5.5.2 ICT expenditure in construction firms in Ghana

5.5.2.1 What is the average annual share of your ICT budget, , including hardware, software, services and personnel, as a percentage of your total company costs in last 5 years?

In this subsection, respondents were asked to indicate their average annual IT budget, including hardware, software, services and personnel. For IT expenditure in local construction firms and professional firms in the construction industry, the majority 44% claimed their annual budget in the last 5 years stands at between 1-4%. This is followed by 32% of the organisations which fall in 5-9% annual budget category while the others recorded 5% and 19% respectively (see Figure 5-6). These findings clearly indicated that the large majority of these local firms spend nothing or just a little on IT related issues. Clearly, this result confirmed the works of Love *et al.* (2001) and Gunasekaran and Ngai (2008), which suggested that financial constraints poses a threat to the development of construction industries in developing countries. The little expenditure may mean occasional acquisition of computers and reprographic equipment for their offices. This activity may require further investigation in order to understand the different levels of annual IT expenditure of these organisations.

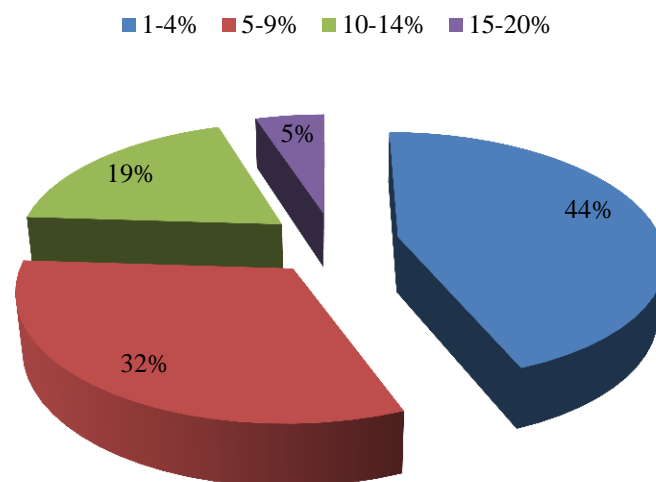


Figure 5-6 Percentages of annual ICT budget

5.5.3 e-Skills development

5.5.3.1 *Rate the degree to which their organisation provides in-house to outsource IT training*

For e-skills development respondents were asked to rate the degree to which their organisation provides in-house to outsource IT training with an option to select statements that reflect their organisation's situation. It can be seen from the ranking based on RII that staff learns new computerised skills through self-learning (see Table 5-5).

Table 5-5 Ranking of e-skills development based on RII

Drivers	Respondent Scores					
	1 None	2 Low	3 Medium	4 High	RII	Rank
The staff learns new computerised skills through self-learning	2	2	30	23	0.816	1
Hire IT practitioners to train staff	5	16	6	30	0.768	2
The staff attends training courses outside organisation	6	15	12	24	0.737	3

Comparatively, hire IT practitioners to train staff and staff attend training courses outside their organisation were allocated a lesser rating. This gives an indication that budgetary allocation for personnel development may not be adequate, particularly in the small local construction firms. The bigger organisations can afford to pay for consultants to train their staff or sponsor staff for courses outside their organisation. These findings are quite significant in the development of the needed IT related skills for e-business implementation within the Ghanaian construction industry. These findings are in agreement with empirical evidence provided by Isikdag *et al.* (2011), which argued that skills development is a key to successful implementation of e-business.

5.6 Drivers, Impact and Barriers of e-Business

This part of the question seeks to explore the perspective of respondents regarding e-business drivers, impact and barriers. It further seeks to understand the significance attached to these activities by respondents. This section is presented in three (3) subsections (drivers, impact and barriers). Data on these activities were gathered utilising four-point Likert scale varying from "None to High". A weighting was allocated to each point, where "none" = 1, "low" = 2, "medium" = 3, and "high" = 4. As indicated in Section 4.8.3.1, Relative Importance Index

(RII) was used to analyse the details of the data collected. RII was used in this analysis to evaluate the comparative significance of the items from the respondent organisations perspectives.

5.6.1 Drivers of e-business in construction based on the perceptions of construction firms in Ghana

5.6.1.1 *Please indicate the reasons your organisation engages in e-business*

Respondent organisations were asked to indicate the most significant reason(s) their organisation will engage in e-business. Ranking of the reason(s) is shown in Table 5-6. From this analysis, it can be seen that the respondent organisations demonstrated that competitive advantage is the most compelling reason to engage in e-business. This is then followed by customer expectation in second position. Competitors engage in e-business and supply chain expectation ranked third and fourth respectively. Assuming this research allocated the responsibility for the top five (5) most significant reasons to engage in e-business, then it can be argued that the four reasons ranked in Table 5-6 are the most significant drivers to engage in e-business. Obviously, this information is significant, particularly to the Ghanaian construction industry as it suggests a moderate awareness of e-business is available within the construction industry in Ghana. Table 5-6 revealed the understanding of respondent organisation regarding what constitute drivers for implementing e-business in construction.

Table 5-6 Ranking of drivers in construction based on RII

Drivers	Respondent Scores				RII	Rank
	1 None	2 Low	3 Medium	4 High		
Competitive Advantage	3	4	14	36	0.864	1
Customer Expectation	3	22	22	10	0.671	2
Competitors Engage in e-Business	5	25	20	7	0.627	3
Supply Chain Expectation	7	26	13	11	0.623	4

5.6.2 Impact of e-business on construction based on the perceptions of construction firms in Ghana

5.6.2.1 *Please in order of significance, identify, how the following impact areas can influence your decision of implementing e-business?*

In order to find out the perspective of the respondent organisations regarding impact of e-business, they were asked to identify the level of influence the following items (see Table 5-7)

would have on their decision to implement e-business. For this discussion, the research allocated responsibility for the top ten (10) most significant impact areas. From this analysis, it can be seen that efficiency of business process was ranked as the most influential impact area followed closely in the second position is organisational innovation. Time and cost saving was ranked third, while market research ranked fourth. Staff training ranked fifth and innovation and expansion of partnership ranked sixth in that order (see Table 5-7). Interestingly, competitive advantage was ranked seventh even though in the ten significant impact areas, it was allocated a lesser significance comparatively. Followed in the eighth position is management control while visibility to supply chain and growth of revenue were ranked ninth and tenth respectively. These findings imply that, there is some level of understanding of e-business within the construction industry in Ghana. For example, findings of the three most significant impact areas was moreover identified by many authors, including Cheng *et al.* (2001), Muffatto and Payaro (2004) and Ruikar and Anumba (2008). However, it is significant to mention that the findings in this research reflect the perspective of practitioners within the Ghanaian construction industry. Table 5-7 illustrates the perception of respondent organisation regarding the impact of e-business in construction.

Table 5-7 Ranking of the impact of e-business on construction based on RII

Impact	Respondent Scores					
	1 None	2 Low	3 Medium	4 High	RII	Rank
Efficiency of Business Process	2	2	16	37	0.868	1
Organisational Innovation	2	3	20	32	0.859	2
Time and Cost Serving	4	6	12	35	0.842	3
Market Research	5	4	20	28	0.811	4
Staff Training	5	5	19	28	0.807	5
Innovation	2	10	20	25	0.798	6
Expansion of Partnership	3	8	21	25	0.798	6
Competitive Advantage	9	7	6	35	0.794	7
Management Control	4	3	30	20	0.789	8
Visible to Supply Chain	4	9	21	23	0.776	9
Growth of Revenue	10	7	8	32	0.772	10
Improving Collaboration	4	15	13	25	0.759	11
Quality of Products	4	16	12	25	0.754	12
Accounting and administration	5	9	25	18	0.746	13
Procurement Cost of Supplied Goods	9	10	12	26	0.741	14
Internal Organisation Relationship	2	12	29	14	0.741	14
Research and Development	5	12	21	19	0.736	15
Quality of Customer Service	1	18	29	9	0.702	16
Productivity	3	24	24	6	0.645	17

5.6.3 Barriers to e-business in construction based on the perceptions of construction firms in Ghana

5.6.3.1 *Please in order of significance, identify, how the following barriers can influence your decision to implement e-business?*

In order to find out the perspective of the respondent organisations regarding barriers to the implementation of e-business, respondents were asked to identify barriers from a list of barriers identified from a synthesis of literature. This research allocated responsibility for the top ten (10) most significant areas. According to the ranking of factors likely to work against the implementation of e-business within the Ghanaian construction industry, the respondents ranked lack of research in IT in construction (R&D) as the top factor that can work against e-business implementation (see Table 5-8). This may be due to inadequate knowledge and investment in e-business in the sector. The second most significant factor was a lack of technical skills in computer software and hardware, after which lack of electricity supply was ranked third. Legal barriers and data transaction and submission were ranked fourth and fifth respectively. As shown in Table 5-8 one significant barrier, resistance to change was ranked sixth while basic competency in IT came in as the seventh most significant factor. Interestingly, cost of investment was ranked eighth. The most significant thing to consider is this factor has been identify by researcher and authors like Ofori (1994a) and Ayarkwa *et al.* (2010), as a factor working against the development of the Ghanaian construction industry. Socio-economic issues and confidence in using new technology ranked ninth and tenth respectively. These findings reflect perceptions within the construction industry in Ghana. However, it is significant to point out that the findings of the two most significant factors confirmed the work of Love *et al.* (2001), Vitkauskaitė and Gatautis (2008) and Isikdag *et al.* (2011). For example, Ofori (2012), recently highlighted socioeconomic problem as a barrier in improving the industry. Table 5-8 depicts the perception of respondent organisation regarding barriers to e-business implementation within the Ghanaian construction industry.

Table 5-8 Ranking of barriers to e-business in construction based on RII

Barriers	Respondent Scores				RII	
	1 None	2 Low	3 Medium	4 High		
Lack of Research in IT in Construction (R&D)	2	2	2	51	0.947	1
Lack of Technical Skills	2	2	7	46	0.925	2
Lack of Electric Power Supply	3	3	3	48	0.921	3
Legal Barriers	2	7	5	43	0.886	4
Security of Data Transaction and	3	5	8	41	0.882	5

Submission						
Resistance to Change	5	3	8	41	0.873	6
Basic Competency in IT	3	3	16	35	0.864	7
Cost of Investment	1	8	15	33	0.851	8
Socio-economic Issues	2	12	10	33	0.825	9
Confidence in Using New Technology	3	5	22	27	0.820	10
Changeable IT Technical Needs of an Organisation	10	4	3	40	0.820	10
Interface with other Systems	6	6	7	38	0.816	11
Availability of Professional Software	7	9	4	37	0.811	12
Modification of Legacy Systems	3	5	25	24	0.807	13
Cultural Influence	2	11	21	23	0.785	14

5.7 Improvement of e-business

This section of the research required respondent organisations to provide some information about potential improvement of e-business in their organisations. This section is presented in four (4) subsections (internal resources, business processes, organisational culture and business goal). As previously noted, descriptive statistics (cross tabulation) were used to analyse the details of the data collected, and subsequently clustered and stacked bar charts were produced and presents.

5.7.1 Internal resources

5.7.1.1 *Please select all the statements below that best describe your organisation's belief in improving e-business implementation pertaining to internal resources:*

In order to find out the perspective of the respondent organisations regarding e-business, implementation utilising internal resources, they were asked to select from a list of statements that best describe their organisation's belief in improving e-business implementation pertaining to internal resources. The following are the list, more IT investment funds; more expenditure in IT infrastructure; increase IT working staff or hire professionals to help; more senior management involvement; better training and option for other(s) that are not included in the list. Findings from this analysis suggest that the great majority 77% of the respondent organisations agreed that all the five statements are relevant (see Figure 5-7).

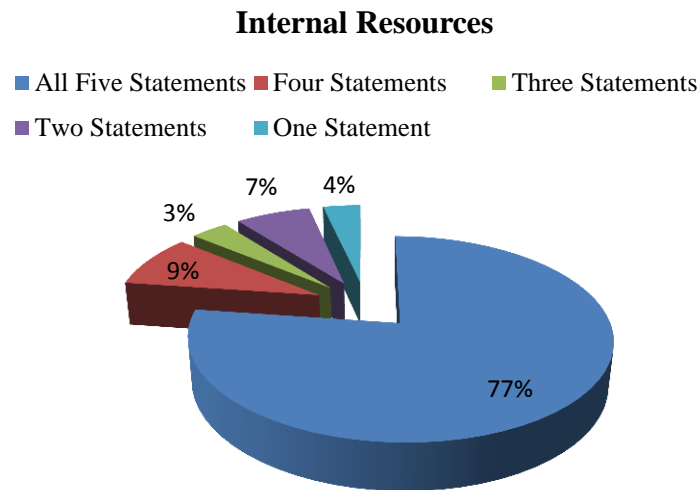


Figure 5-7 Organisation's beliefs in improving e-business utilising internal resources

Meaning all the five statements have been recognised by respondent organisations as the best to describe their organisation's belief in improving e-business implementation utilising internal resources. The challenge for local construction organisation to mobilise the needed internal resources for effective implementation of e-business as all the five identified activities have financial implication. Ofori (1984), GBN (2009), Ayarkwa *et al.* (2010) and Osei (2013), identified financial constraints, delay in payment, low level of trained personnel as some of the nagging issues confronting local firms in the construction industry in Ghana. Figure 5-7 depicts the extent to which internal resources can be mobilised and use regarding e-business implementation within the Ghanaian construction industry.

5.7.2 Business processes

5.7.2.1 *Please select all the statements below that best describe your organisation's belief in improving e-business implementation pertaining to business processes:*

Respondent organisations were asked to **select all** the statements that best describe their organisation's belief in improving e-business pertaining to business process. The statements are as follows: automation of business processes; integration of different business processes; engineering business processes; connect e-business value to business performance and other(s). Figure 5-8 highlighted the views of respondent organisations.

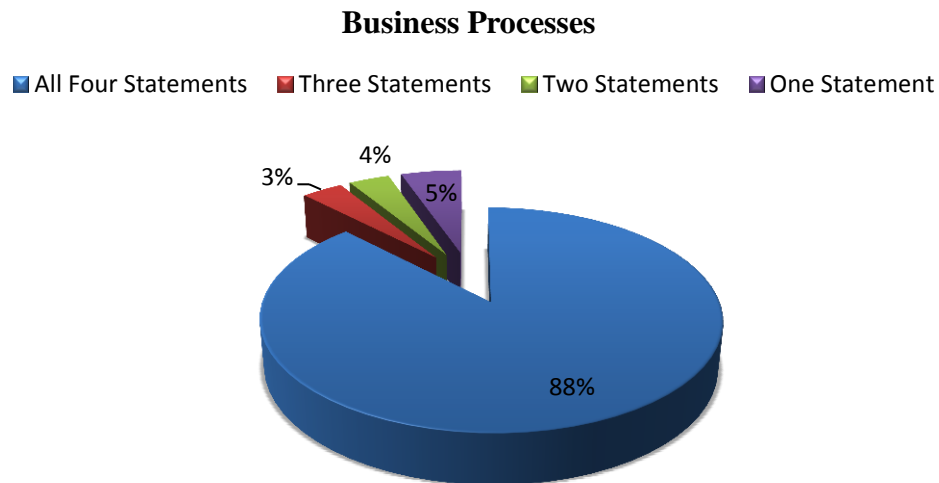


Figure 5-8 Improving e-business pertaining to business process

As can be seen from details in Figure 5-8 almost all (88%) the respondents confirmed that all four statements represent their organisation's belief in improving e-business implementation pertaining to business processes. As noted in the works of Davenport (1993), Adesola and Baines (2005) and Harmon (2007), these set of identified structured activities are designed to transform business process which in turn add value to the entire business value chain. With reference to this, it can be argued that respondent organisations have shown some level of awareness of e-business activities through which they are able to identify activities that can lead to implementation of e-business within the Ghanaian construction industry. It is imperative to undertake process restructuring in order to implement any new technology particularly e-business. Figure 5-8 illustrates the implementation of e-business in respect of business process within construction.

5.7.3 Organisational culture

5.7.3.1 *Please select all the statements below that best describe your organisation's belief in improving e-business implementation pertaining to organisational culture:*

Respondent organisations were asked to **select all** the statements that best describe their organisation's belief in improving e-business pertaining to organisational culture. With respect to this, the statements include the following: recognise the benefits and significance of using e-business; encourage staff to use e-business tools; commit to address issues/inhabitants

when using e-business; change organisational culture to suit for e-business adoption and use and others.

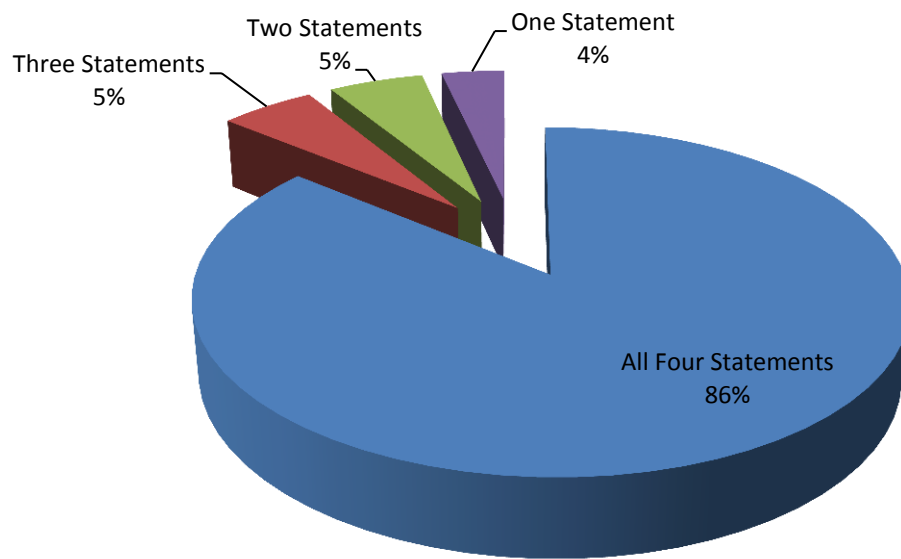


Figure 5-9 Improving e-business pertaining to organisational culture

Again, in this finding, it was revealed that the majority, 86% of respondent organisations confirmed that all four statements represent their organisation's belief in improving e-business implementation pertaining to organisational culture (see Figure 5-9). This acknowledgement from respondents simply can be interpreted to mean that management has a role in initiating activities in order to encourage personnel to play active role. Changing organisational culture is a key to successful implementation of e-business. Cheung *et al.* (2011), explained that organisational culture gives identity to an organisation, therefore, it is significant for organisations to link organisational culture to work environment so that this can reflect the image of the organisation. For example, Ruikar *et al.* (2008b), argued that organisational culture has been linked to the 'people factor'. Therefore, personnel are key elements in the implementation of any new technology particularly e-business. Figure 5-9 demonstrated respondent organisations perspectives of e-business implementation within construction regarding organisational culture.

5.7.4 Business goal

5.7.4.1 *Please select one statement below that best describes your organisation's belief in improving e-business implementation pertaining to a business goal:*

Respondent organisations were asked to **select one** statement that best describe their organisation's belief in improving e-business pertaining to a business goal. With reference to this, three statements covering different policy areas were provided. The following are the statements: sell-side e-business policy, no need to integrate with the overall business goal; e-business policy integrated with the overall business goal; e-business policy incorporated as part of the overall business goal. Figure 5-10 highlighted the opinions of respondent organisations.

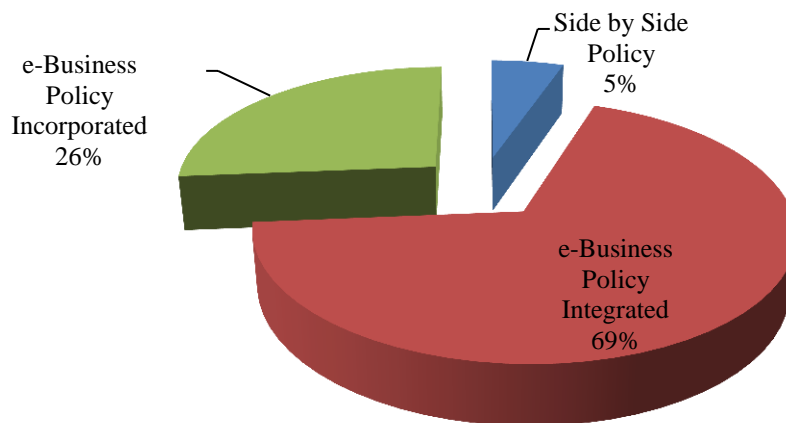


Figure 5-10 Improving e-business implementation pertaining to a business goal

It can be seen from Figure 5-10 that the majority (69%) of the organisations surveyed confirmed that e-business policy integrated with the overall business goal represents their organisation's belief in improving e-business implementation pertaining to a business goal. It is obvious from the findings that a majority of the different organisations surveyed think that e-business policy integrated with the overall business goal is the surest way to improve e-business implementation in the Ghanaian construction industry. Figure 5-10 depicts respondent organisation's views on implementing e-business pertaining to a business goal.

5.8 Future of e-business in your organisation

This section of the research required respondent organisations to provide some information about the future of e-business in their organisations. This section is presented in two (2)

subsections (future investment in e-business and launch of the e-business policy). As previously noted, descriptive statistics (cross tabulation) were used to analyse the details of the data collected, and subsequently clustered bar charts were produced and presents.

5.8.1 Future investment in e-business in the local construction firms in Ghana

5.8.1.1 *Please select one statement below that best describes your organisation's commitment to e-business:*

Respondent organisations were asked to **select one** statement that best describe their organisation's commitment to e-business. The statements include the following: plan to make an investment in 1-5 months; plan to make an investment in 6-12 months; plan to make an investment in 13-18 months; plan to make an investment in 19-24 months and no plan to make an investment. Figure 5-11 highlighted investment plan of respondent organisations.

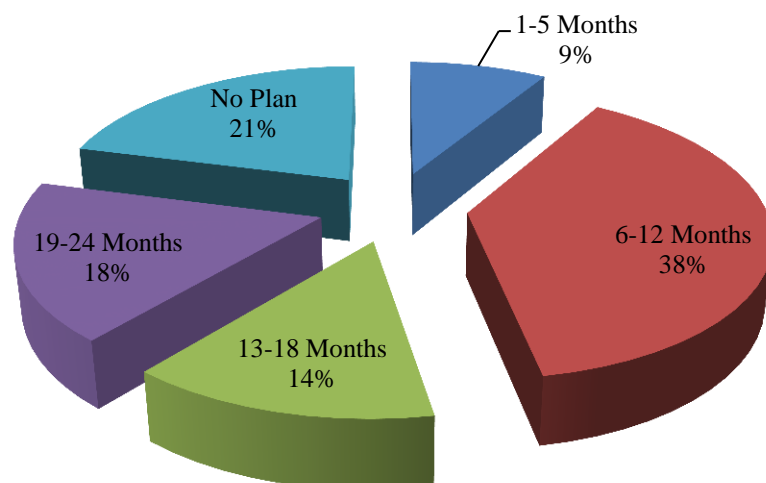


Figure 5-11 Organisation's commitment to future e-business investment

The result in Figure 5-11 demonstrated that 38% of the respondent organisation favour investment plan of 6-12 months, followed by 13-18 representing 14% and 19-24 months representing 18% respectively. It is worth noting that only just 9% of the organisations surveyed agreed to a plan of 1-5 months. It can be seen from Figure 5-11 a significant number of the organisations 21% of them have no plan to invest in e-business. The findings demonstrated varying future investment plans based on organisation type. For a particular interest, it appears the contractor groups take less interest and commitment to investing in e-business in future; perhaps, it is as a result of the general business environment in Ghana where the majority business activities are manually based. It moreover fits into the argument

that most of these local firms lack knowledge and awareness of e-business, making this particular research relevant.

5.8.2 Launch of e-business policy by local construction firms in Ghana

5.8.2.1 *If your organisation has a plan for launching an e-business implementation policy, please indicate its type:*

Respondent organisations were asked if their organisation has a plan for launching an e-business implementation policy, if so they were asked to indicate the policy type. In all four (4) policy types were presented to the respondent organisations to select the one best describe their respective organisations. The following is the list of policy types: short-term (up to 2 years); medium-term (3-5 years) long-term (over 5 years) and do not know yet. Figure 5-12 highlighted the results from the analysis of the data gathered from the respondent organisations.

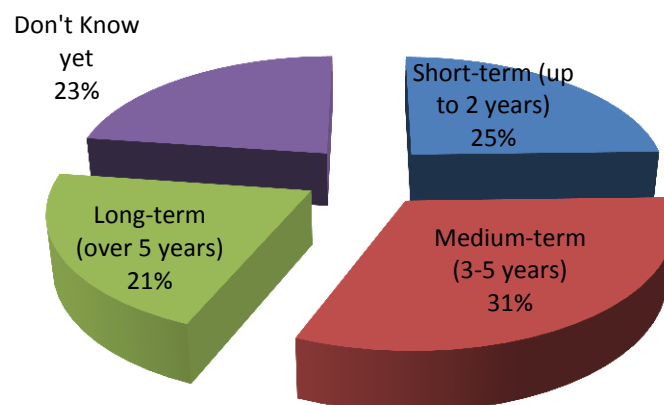


Figure 5-12 Periods to implement e-business policy

The results in Figure 5-12 demonstrates that 31%, representing the largest respondents prefer to have a medium term e-business implementation policy while 21% of them opted for a long term policy arrangement. It is moreover significant to note that a quarter of the respondent organisations agreed to a short term policy arrangement. However, 23% of the respondent organisations have no specific plans and timelines for the implementation of e-business (see Figure 5-12). The large majority of them may have a hazy idea about e-business as shown in earlier sections, critical view of the results suggested that much of e-business implementation has not yet been considered by them. However, this research has altogether highlighted the

understanding of e-business and implementation within the Ghanaian construction industry and further research into e-business activities in the Ghanaian construction industry will add up to the existing body of knowledge in this particular area for the benefit of the entire industry.

5.9 Summary of questionnaire survey and link to case study

The objective of this chapter is to explore the technological capacity of construction related firms/organisations operating in the Ghanaian construction as a precursor to e-business technology transfer. Based on some key findings in chapters 2 of this research, the questionnaire was designed and grouped into six categories as introduced in Section 5.2.2 to explore key issues relating to capacity for e-business technology transfer. The findings of the questionnaire survey demonstrated that the capacity of the local firms operating in the Ghanaian construction industry is quite low coupled with limited knowledge about e-business. Furthermore, these findings have implication for policymakers, Ghana government who is a major employer in the construction industry and the Association of Building and Civil Engineering Contractors of Ghana (ABCCG) who has the responsibility of improving capacities of their members through policy formulation and implementation. For the purposes of this research, the questionnaire survey of the local construction firms in Ghana, partially addressed two key research questions (research question 1 and 4). The research questions for this research are presented in Section 1.6.3 in Chapter 1. Sections 5.4.1 and 5.4.2 addressed research question 1 which is *“how do bottlenecks in the works procurement process affect performance in the construction industry in Ghana”*? While Section 5.4.3 partially addressed research question 4 which is *“what are the primary requirements for e-business technology within the construction industry in Ghana”*? Furthermore to research questions 2 and 3 which were not answered by the survey, an significant issue that seeks further clarification is about *how the primary requirement for e-business technology come together to improve communication and performance within the local firm in the Ghanaian construction industry?* In accordance with the philosophical stance of this research these issues will be further investigated in the next stage of the research through case studies of selected construction firms which comprises foreign and local firms in Foreign Direct Investment (FDI) collaboration in the Ghanaian construction industry. Accordingly, three case studies were conducted with three (3) foreign firms and three (3) local firm collaborators through in-depth semi-structured interviews in order to understand the perspectives of the respondents based on

their experience in FDI environment and to ascertain the main issues of significance for e-business technology transfer.

CHAPTER 6 : CASE STUDIES OF SELECTED CONSTRUCTION FIRMS

6.1 Introduction

The findings of the questionnaire survey were presented and discussed in Chapter 5. The findings and discussions, answered research questions 1 and 4 of the research questions raised in this research (see Section 1.6.3 in Chapter 1). Following that, case study (see Sections 4.5.6.1, 4.5.6.2 and 4.5.6.3 in Chapter 4) was conducted to further investigate issues that were not possible to be answered through the questionnaire survey. Therefore, semi-structured interviews were conducted from selected case study construction organisations comprising foreign and local firms (see Figure 4-6 in Chapter 4) to explain and answer some of the relevant issues that the survey was not able to answer. Furthermore, Table 6-1 presents a breakdown of informants who contributed to the case study through semi-structured interview. Details of the case study are presented in this Chapter demonstrates what the current situation is in the Ghanaian construction industry, but first, the impact of the pilot study (see Section 4.5.6.4) was presented and then followed by the case study analysis and discussions.

6.2 Impact of the pilot study on the case study

Before the main case studies were conducted in Ghana, the interview guidelines were piloted among three different categories of construction industry players in Ghana (see Section 4.5.6.4 in Chapter 4). They include one foreign construction firms, one local contractor and a representative from Ghana government e-governance project office. These organisations were selected based on the fact that they represent the same level of organisations identified in the main case study. The outcome of the pilot study demonstrated that it was an significant aspect of this research in testing the suitability of the interview questions for the purpose of achieving the aim of this research (see Section 1.6.3 in Chapter 1). It provided the basis to check for clarity in the questions and by so doing assessing the relevance of the questions to the aim of this research which is to develop a framework for e-business technology transfer to the Ghanaian construction industry. Based on the outcomes of the pilot study, the main interview guidelines were modified to reflect the comments and suggestions received from the participants. The pilot study moreover, revealed that the interview could be conducted within one hour per participant. These interview guidelines were utilised within CS1, CS2 and CS3.

Figure 4-6 in Chapter 4 provides details of interviewees who were permitted by their respective organisations to participate in this research.

6.3 Case studies findings

6.4 Introduction

As presents in Section 4.5.5 in Chapter 4, three case studies were conducted in this research. This section presents findings from CS1, CS2 and CS3 based on the background presents in Sections 4.5.6.1, 4.5.6.2 and 4.5.6.3 in Chapter 4). To thoroughly explore CS1, CS2 and CS3, four research questions were implemented and utilised (see Section 1.6.3 in Chapter 1). In each of the case, senior managers who form part of decision making were nominated to speak on behalf of their firms (see Table 6-1). In CS1, the interviewees included project manager of a foreign firm (PMF1); project manager for a local firm (PML1) and an assistant manager of a local firm (AML). In the case of CS2, three senior project managers were interviewed comprising a foreign firm represents by a project manager (PMF2), a local firm represents by its general manager (GML) and another local firm represents by a project manager (PML2). In respect of CS3, IT manager (ITMF) was nominated by a foreign firm; a manager (MGL) represents a local while a project manager (PML3) represents the second local firm. To further gain multiple perspectives, expert opinions or views were sought. Procurement and IT specialist (SIMG) from the Public Procurement Authority (PPA) and the other expert (CRF) was from a foreign private consultancy (who has participated and procured FDI/IJV projects in the last 12 (12) years in Ghana and other parts of Africa as shown in Table 6-1. The experts provided general opinions across all the three case studies. This chapter is structured in a way to thoroughly explain the details of the findings. Accordingly, the individual cases are presented in this chapter.

Table 6-1 key case study informants

CS organisation		Informant	Name coding	Remarks
CS1	Foreign firm	Project manager	PMF1	Nominated to speak
	Local firm	Project manager	PML1	
	Local firm	Assistant manager	AML	
CS2	Foreign firm	Project manager	PMF2	Nominated to speak
	Local firm	General Manager	GML	
	Local firm	Project manager	PML2	
CS3	Foreign firm	IT manager	ITMF	Nominated to speak
	Local firm	Manager	MGL	
	Local firm	Project manager	PML3	
Expert interview – General perspective				
Foreign consultant		Country rep	CRF	Nominated to speak
Government of Ghana procurement office		Senior IT manager	SIMG	

6.5 Presentation of findings from CS1

6.6 What are the bottlenecks in the works procurement process in the construction industry in Ghana?

In this section, bottlenecks associated with construction works procurement in the Ghanaian construction industry were investigated within CS1 under research question one (1) in order to determine influential factors that have a negative impact on performance within the construction industry in Ghana. Further, to determine factors influencing technological development within the construction industry in Ghana. The emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 1 in CS1 as shown in Figure 6-1 were grouped under the following themes: construction works procurement and political context. Findings under the themes are presented below.

Question 1-CS1	
Name	Sources
What are the bottlenecks in the works procurement process in the construction	0
Construction Works Procurement	0
Institutional framework	2
Lack of basic technology	4
Lack of skilled personnel	4
Procurement law	3
Political Context	0
Government	3
Strategy to promote e-business	3

Figure 6-1 Factors impacting negatively on works procurement process

6.6.1 Construction works procurement

6.6.1.1 Institutional framework for the approval of procurement plan

Under construction works procurement theme two (2) respondents in CS1 as indicated in Figure 6-1 expressed the view that a significant number of local construction firms operating in the construction industry in Ghana completely do not have the capacity to follow and understand the institutional framework established in the procurement law. For instance, a local construction firm manager, AML expressed opinion based on experience in the construction industry in Ghana as follows:

“...one other thing that delays the procurement process is the institutional arrangement that has been provided by the procurement law in dealing with approval of procurement plans...”

The difficulty in managing the provision of the procurement law is an issue that has to receive attention; something has to be done to support the local contractor to adequately understand the provisions of the procurement process. These findings together with the above statement demonstrates the shortfall in skills to deal with procurement issues, this is confirmed in the works of Ayarkwa *et al.* (2010) and Amoah *et al.* (2011), as indicated in literature, they argued for skills development as the way forward for the development of the Ghanaian construction industry. In support PML1 expressed the following view(s):

“...there are issues concerning threshold approval and grievance resolution during and after award and when exactly to use any of the five procurement approaches provided in the Act 663...”

Further probe into the matter PML1 noted as follows:

“...this process is very slow with different levels of human contacts...there are a lot of manual activities, rendering the process bureaucratic, time consuming, unsatisfactory...”

PML1 further added:

“...procurement officers at the entity levels are inadequate in handling procurement issues...”

6.6.1.2 *Lack of basic technology in the procurement process*

Under construction works procurement majority of respondents in CS1 (4 respondents) as shown in Figure 6-1 agreed that the entire works procurement process within the construction industry in Ghana lacks technology and innovation. AML noted that technology is not prominent in the activities of the construction industry in Ghana this has affected performance across the industry negatively. For instance, AML observed that ineffective communication and poor quality work are a common characteristic of the Ghanaian construction industry. In AML’s opinion, the procurement law is applied without making or injecting anything new to make the procurement process motivating and inspiring. AML further expressed the following view(s):

“...this is why some practitioners are advocating for technology like e-business to facilitate this process...”

The above statement supported the arguments advanced in literature for the introduction of ICT and e-business within Ghanaian construction industry to improve the processes (Ofori, 2012, PPA, 2013). AML pointed out that technological capability in many ways have the tendency to increase productivity thereby making the industry a lot more competitive by adopting innovative ways of doing business. The issues of productivity and competitiveness are consistent with the study of Oladapo (2007) and PPA (2010), in respect of direct benefits of e-business implementation in construction. Additionally, the respondents agreed that utilisation of the Internet facility in the procurement process would go a long way to improve the processes. For example, uploading tender documents for bidders to download would possibly eliminate unnecessary interference in the procurement process. Discussing further, CRF noted that the technological capacity of the local firms in the construction industry is quite low as such they prefer the manual method of work. PML1 noted that the nature of the procurement

process within the construction industry require gradual infusion of ICT. E-business for instance, has the potential to enhance productivity within the industry (Cheng *et al.*, 2001, Muffatto and Payaro, 2004). PML1 mentioned that e-business in particular is an significant means to scale up productivity, competitiveness within the construction industry. CIMG highlighted that lack of basic technology has for many years affected productivity and competitiveness of the local firms hence, their inability to meet deadlines due to their dependency on external sources for works that can be done in-house. CIMG underscored the need for capacity development across the construction industry in Ghana.

6.6.1.3 *Lack of skilled personnel in the construction industry*

Discussions under construction works procurement theme (lack of skilled personnel) demonstrated that the majority of the respondents in CS1 (4 respondents) attested that personnel working in the construction industry, most especially those handling project procurement lacks the experience and skills to undertake procurement activities adequately (see Figure 6-1). For example, a project manager, PMF1 of a foreign construction firm in CS1 pointed out that:

“...Ghanaian construction practitioners are generally ill-trained, they lack basic skills in handling procurement and general day to day project management issues...”

The above statement highlighted the inadequate skills regime within the construction industry in Ghana. The significance of skills development and training is consistent with the argument put forward by Bosworth and Dutton (1990), which explained that training provides the mechanism to improve the capability of workers. PMF1’s position was corroborated by CRF noting that local firms do not have skilled staff to manage their projects. Subsequently, when another respondent, a manager, AML of a local construction firm in the CS1 views were sought about the concern raised about low capacity of procurement personnel AML response varied significantly, with the explanations in relations to the nature of the construction industry in Ghana and the hostile environment in which projects are procured and the difficulty in getting a job as a contractor. However, he acknowledged the earlier concern by PMF1 and further explained as follows:

“...construction project procurement in the Ghanaian construction industry is labour intensive...”

PMF1 further added:

“...for example, designs are generally done manually; tender evaluation and related items are done manually...”

PML1 explained that, there are inadequate trained construction professionals available and those that are available are quite expensive to hire therefore, small construction firms make do with whatever is available to them as expressed by another local construction firm manager AML:

“...the industry has become a freelance environment where many untrained and unlicensed persons are found...”

The arguments by PML1 and AML supported the views expressed by Laryea (2010), regarding non-availability of trained professional within the construction industry in Ghana. Furthermore, these difficulties faced by local construction firm goes beyond the coping capacity of most of these small firms as they have to continually engage in expensive, lengthy and slow procurement processes as a result of the manual processes in every part of the construction management process in Ghana.

6.6.1.4 Procurement law in the context of construction works

Procurement law was investigated under the construction works procurement theme within CS1. As shown in Figure 6-1, three (3) respondents highlighted the difficulty posed by the procurement law in the works procurement process. Virtually, all the three respondents cited the rigid nature of the procurement law which, according to them makes no provision for innovation in the procurement process. Findings from documents analysed demonstrates that the procurement routes are established in the public procurement law (Act 663). In fact, there is a unanimous view pertaining to the poor standard and understanding of the details of the procurement law within the construction industry in Ghana. This is the result of weakness or non-availability of training system (Richardson 2006). For instance, when participants as part of the general question were asked to describe the procurement systems their organisations have been through, their responses were quite unimpressive. Some of the textual responses by AML to the procurement law and its application in the construction industry are highlighted as follows:

“...generally, it has been the traditional procurement system where the function of design is separated from the construction of the facility...”

AML further explained that:

“...design is done entirely by a different set of people after which a contractor is engaged to implement the design; the contractor has no idea about the design solution...”

Further probing of the respondents about what other difficulties the procurement law has imposed on the performance of the construction industry, a manager of a local firm, PML1 in FDI collaboration expressed the following view:

“...NCT is the most used tendering approach where the lowest evaluated tender is considered the best tender for the job, therefore, it is not challenging enough to build the capacity of industry players...”

CIMG on the other lauded the procurement law and argued that it provided the basis for fairness in the works procurement process. However, the process is completely manual, where big volumes of tender documents are processed manually.

6.6.2 Political context

6.6.2.1 Government influence on the procurement process

Under the political context theme, all three (3) respondents (see Figure 6-1) in CS1 were clear in their responses by acknowledging that, government influences have had a negative impact on the construction works procurement process in the construction industry. In many instances, tenders are skewed in favour of contractors who are able to command sufficient political influence; projects are awarded on political affiliation lines making monitoring of such project extremely difficult. Projects are eventually given out to contractors who do not have the resources to undertake such projects. Yet, AML thinks otherwise, political influence or intervention, according to AML may not necessarily be harmful however AML agrees that:

“...there is more to be done to improve the construction works procurement system in order to minimise human to human interface...”

The above statement explained the negative effect of human to human activities in the procurement process. The significance of automating the procurement process was highlighted in literature (PPA, 2010, PPA, 2013). A typical example is the uploading tender documents on the PPA website. Further, AML was of the view that one the significant thing government can do from which the construction industry can benefit is by providing a national Internet infrastructure. This may as well be beneficial to the entire business community in Ghana. CRF agreed with AML and further mentioned that it has an significant role in promoting the use of ICT and e-business in construction. PML1 in CS1 similarly, think that political influence can be of benefit to the industry. For example, it can be exploited to restructure contractor registration framework to enable the system to allow only qualified people to enter the construction industry. PML1 further expressed the following view(s):

“...I think industry led skills development would help the industry to promote the culture of quality work, technology most especially ICT which can improve the industry’s outlook and performance, political influence in my opinion could be of immense benefit...”

In this context PML1 noted that it is significant for government to come to the aid of the construction industry as it appears majority of local firms do not have the financial capability to implement e-business technology.

6.6.2.2 *Strategy to promote e-business in the construction industry*

Under t political context theme three (3) respondents in CS1 and two experts who provided a general opinion on the research topic highlighted the significant role of government in promoting technology use (see Figure 6-1). CRF mentioned that government is the biggest employer in the construction industry in Ghana therefore, it has the responsibility to promote the use of ICT and e-business in the construction works procurement process. CRF further noted that this would minimise face-to-face contacts with government officials and other people involved in the procurement process, thereby reducing unnecessary delays. Osei-Tutu *et al.* (2010), highlighted the negative impact of corruption on construction. PML1 agrees with CRF and explained that this type of promotion may mean that all information relating to the works procurement should be published online in real time basis for contractors to access. This can encourage the various local firms to take up ICT as part of their system. SIMG moreover underscored the significance of government to promoting the use of ICT and e-business, by so doing government office responsible for works procurement would be

adequately placed to monitor the procurement process. Further, SIMG explained that with an e-business system in place, it would be mandatory for all government entities to use the platform for its procurement activities. This requires that all tender notices, participation of tenderers as well as tender evaluation (price, technical specification, financial status, etc.) to be conducted online. This would enable the authority to monitor compliance of entities with their tendering process. This would include tender opening and closing periods, evaluation criteria, notification of contract award, and in some cases contract performance. Contributing to the discussion PMF1 and PML1 highlighted the significance of the government's role in promoting the use of technology such as e-business, mentioning that it would enhance the technological capability of the local firms and the entire construction industry which is suffering from low technology absorption and a shortage of technical and management skills. AML supported the statement made by PML1 and emphasised that technological capability enhances the image of local contractors and moreover enable them to work closely with foreign firms who already exhibited high level usage of technology in their works.

The following section addresses the research question two (2) as outlines in Section 1.6.3 in Chapter 1 which deals with foreign firm support for skills development and e-business technology transfer to the construction industry in Ghana is CS1.

6.7 What motivates foreign contractors to support skills development and e-business technology transfer to the construction industry in Ghana?

Under research question two (2) foreign support for skills development and e-business technology transfer to local firms in the construction industry in Ghana was investigated within CS1 in order to determine influential factors that promote skills development within the construction industry in Ghana. These emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 2 in CS1 as shown in Figure 6-2 were grouped under the following themes: business strategy of foreign firms and improving capability. Findings under the themes are presented below.

Question 2-CS1	
Name	Sources
What motivates foreign contractors to support skills development and e-business t	0
Business Strategy by Foreign Firms	0
Construction business environment	2
Long term business relationship and partnership	2
Improving Capability	0
Existing capacity of local firms	3
Pressure from foreign firms	2

Figure 6-2 Identified factors for skills and e-business development

6.7.1 Business strategy by foreign firms

6.7.1.1 Construction business environment in Ghana

Respondent PMF1 and CRF in CS1 (see Figure 6-2) confirmed that the construction industry environment in Ghana presents a different challenge to them. Understanding the construction business environment has become an opportunity to sustain business in Ghana as a result the firm is working with some selected local firms within the construction industry. However, Indications are that majority of project management activities within the industry are conducted manually. This observation is consistent with the work conducted by Laryea (2010), which acknowledge that the construction industry in Ghana is labour intensive. PMF1 noted that creating the enabling environment among their partners enhances their work in general, therefore, their policy is to support all partners, and this is intended to enhance project management activities and it is consistent with Technology Transfer Agreements – LI 1574. PMF1 further explains that Internet technology has supported their project management activities. For example, PMF1 mentioned the following as part of their activity of improving the construction industry business environment through technology:

“...most of the materials we use on this project cannot be found locally and then as a business entity, we would want competitive prices so we seek invoices from many firms and manufacturers...”

PMF1 added that:

“...this activity is conducted using the Internet where we are able to search for information about firms and manufacturers in this regard; these are some basic activities we are transferring to our collaborators in Ghana...”

“...we encouraged our partners and collaborators to create that kind of business environment where they can possibly undertake basic communication activities between the various partners and project teams...”

“...we see this as a key requirement in sustaining our working relationship so we provided them with activities that can support improvement on their existing working conditions...”

6.7.1.2 Long term business relationship and partnership

Under the business strategy by foreign firms theme two (2) respondents CRF and PMF1 in CS1 as shown in Figure 6-2 admitted the significance of sustaining their construction business operations in Ghana. However, the most significant issue that concern such strategic policy is working together with local firms that have the requisite capacity. For example, PMF1 noted that they have identified the low capacity of the firms they are working with (LF1 and LF2) therefore, there was a need to develop a strategy to deal with the low capacity. Further, PMF1 agreed that the long term business relationship with LFs is an opportunity to continue in business in Ghana without any difficulties in dealing with environmental issues that may confront foreign firms working in the Ghanaian construction industry. In the context of this strategy PMF1 explains as follows:

“...we have moved a little further in expanding our work beyond the services of our main partner, and in this direction we have moreover procured the services of additional specialist local contractors; in the area of curb fixing and pedestrian pavement, cable relocation, local materials supply and many other services that we need for our work...”

‘...our vision is to grow together with our local collaborators here in Ghana as a result we have initiated several processes to support these firms to work together in the industry, we undertake capacity training in contract management, site management, including record keeping and many others...”

“...this is the only way we can directly bring them to understand our method of work and possibly transfer of some key technological skills that may be required during this period of our partnership...”

CRF, a foreign consultant agreed that foreign firms can develop the needed capacity in LFs as a basis to sustain their operation in Ghana. CRF further noted that such capacity development activity ought to be structured so that it can benefit the entire construction industry.

6.7.2 Improving firm's capacity

6.7.2.1 *Existing capacity of local firms*

Under the improving capacity theme (see Figure 6-2) all the respondents in CS1 (3 respondents) agreed that the majority of their firms lacks technological capacity while staff conversely have no adequate experience and skills to handle construction works. For instance AML noted with concern that the number of people with ICT related skills within the construction industry is quite low. This argument agreed with the suggestion by Ruikar (2004), which indicated that people factor is the most significant in the introduction of new technologies. The situation according to AML is worsening by the limited access to the Internet within the construction industry in Ghana, including other sectors of the economy. This in many ways has affected the capacity of many local construction firms. AML further explained that majority of the local firms are unable to access the Internet due to high cost and unreliability of the Internet service. Finance is an significant factor in improving construction performance most especially when it involved the introduction of new technologies (Iddris, 2012). For instance, PMF1 noted that local construction firms in Ghana approach their work activities manually, majority do not have simple computer set up for their works and that they depend on external sources for simple computer related works , including e-mails. PMF1 further explained that the low technological and managerial capacities of the local firms within the construction industry in Ghana posed performance difficulties due to their over reliance on manual activities. This argument again confirmed findings in literature based on the work of Ofori (1994a) and Laryea (2010). Furthermore, the construction industry had to battle with the problem of inappropriate personnel in practice, there is a clear indication that there is absolute skills problem in the construction industry in Ghana. This notwithstanding, PMF1 explained that as partners they are obliged to pull resources together for their mutual benefit. Therefore, as a key requirement for the sustenance of their partnership, training and support for the establishment of basic facilities to enhance work across the partnership and moreover to improve on their existing working conditions has been provided. PML1 moreover noted that the capacity of practitioners in the industry to adopt ICT for e-business activities is quite low. Issues' concerning cost (affordability) is another dimension weighing heavily on the implementation of e-business in the construction industry. PML1 is concerned about the associated high cost of the Internet and mentioned that it is prohibitive. For example, AML stated as follows:

“...non-availability of technology within the construction industry is due to the government’s failure to give ICT the necessary support both in the industry and our training institutions...”

PML1 agreed by commenting that the government has a role to play in providing the enabling environment so that simple technology such ICT and e-business can be utilised to support business processes. However, this research found out that hands full of local firms are using these technologies on a low level and moreover in a sporadic manner. PMF1 suggested that when the proper mechanism is put in place the capacity of the industry practitioners can be raised to adopt and used ICT and e-business within the construction industry in Ghana.

6.7.2.2 *Pressure from foreign firms to improve upon technological and management capacities of local firms*

Under the improving capacity theme (see Figure 6-2) two (2) respondents from LF1 and LF2 in CS1 highlighted the inadequate capacity in the area of technology and management skills, noting that it is a major problem in the development of the construction industry in Ghana. This has affected the majority of the construction firms within the construction industry and turn to impact negatively on project delivery mostly communication and dissemination of information on a timely basis. For example, PML1 of LF1 expressed as follows:

“...in our own way of doing things, we go completely manual, now we are exposed to a foreign firm and we have to cope with the demands on timely basis...”

PML1 further admitted as follows:

“...we have a capacity problem technologically together with basic technical skills in our firms...”

The above statement confirmed the fact that local firms operating within the construction industry have a capacity gap and cannot undertake strategic construction jobs which are often bigger in scope (Eyiah and Cook, 2003). AML of FL2 attributed this to the unstructured nature of the construction industry and general socio-economic difficulties in the area of training and support for the industry. Linking to the same issue further, AML noted the opportunity provided by their collaboration with a foreign firm in developing their technological capacity. According to AML their collaboration afforded them an opportunity to install some basic ICT equipment and the Internet facility to enable the firm to cope with demands from their foreign partner. Furthermore, the firm has to deal with management skills issues within the project environment. This, according to AML was achieved through capacity

development training schemes put together by their foreign partner. On the whole, the respondents agreed that the construction firms in Ghana have not implemented both personnel and firm supported schemes that are linked to the industry. PML1 and AML further acknowledged that industry led skills development would help the industry to promote the culture of quality work, infusion of technology most especially ICT and e-business, by this the industry can achieve improved performance and a better outlook.

The following section addresses the research question three (3) as outlines in Section 1.6.3 in Chapter 1 which deals with using e-business technology to promote construction business improvement in Ghana in CS1.

6.8 How does e-business technology promote construction business improvement in Ghana?

Using e-business technology to promote construction business improvement in Ghana was investigated within CS1 under research question three (3) in order to determine influential factors that have a negative impact on e-business and potential benefits of e-business within the construction industry in Ghana. The emerging factors from the interviews were recorded in NVivo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 3 in CS1 as shown in Figure 6-3 were grouped under the following themes: implementing e-business, management and skills development. Findings under the themes are presented below.

Question 3-CS1		
Name		Sources
How does e-business technology promote construction business imp		0
Implementing e-Business		0
Barriers to e-business		5
Benefit of e-business to firm		4
Management		0
Efficiency of business process		3
Managing construction activities		2
Quality of firms		3
Skills Development		0
Acquisition of new skills		3

Figure 6-3 Identified factors that promote e-business in construction

6.8.1 Implementing e-business

6.8.1.1 Barriers to e-business in construction

Under the implementing e-business theme as shown in Figure 6-3 in CS1 all interviewees (3 respondents), including two (2) experts highlighted the limited skills based upon which to develop e-business services within the construction industry as one the numerous barriers to e-business implementation within the Ghanaian construction industry. According to the respondents, high cost of Internet charges by service providers is another challenge facing practitioners and owners of construction firms in Ghana and it cut across the construction industry. This argument validate earlier findings in literature by Love *et al.* (2001) and Isikdag *et al.* (2011), which suggests that internet infrastructure, finance and ICT skills are major barriers to the implementation of e-business. To further explain the situation in the industry AML stated that the majority of practitioners are not aware of the potential benefits of e-business and for that matter remain unconcerned about e-business use in the industry, this in the view of AML is an obstacle in the development of e-business technology within the construction industry in Ghana. AML stressed that unreliable electric power supply, lack of national ICT infrastructure and high cost of e-business equipment are challenges facing the majority of firms in the industry. CRF In contrast was of the view that local construction managers and owners are inadequate in managing their firms, as a matter of fact; it presents a major obstacle in implementing e-business in the future. PMF1 conversely acknowledged the high cost of Internets services; largely it is a cultural issue that has to be dealt with to pave way for innovation within the industry. PML1 again argued that Furthermore to earlier identified challenges of e-business implementation, low level of economic development may pose a challenge for the majority of local firms as projects are difficult to come by in Ghana. SIMG noted that it is significant for stakeholders in the industry to start working to deal with barriers that have the tendency to derail their efforts to implement e-business. Furthermore, SIMG mentioned that there is the need for the industry and government to initiate research activities into the potentials of e-business with this awareness of e-business would be created.

6.8.1.2 Benefits of e-business to local firms

Under the implementing of e-business theme majority of the respondents in CS1 (4 respondents) as shown in Figure 6-3 agreed that e-business has potential benefits to the Ghanaian construction industry. For instance AML pointed out that the industry may benefit

from e-business components such as e- procurement and e-tendering, which is an significant aspect of promoting growth and efficiency within the industry. This is an indication that the respondents agreed with the works of Aranda-Mena and Stewart (2004) and Hashim and Said (2011), which highlighted the benefits of e-business in construction. AML further noted that, industry practitioners can benefit from developing competencies in using project management software that has the potential to promote quality of work. It is significant for government to facilitate the establishment of payment platform so that procurement activities can be undertaken online as part of e-business delivery process. This is consistent with government of Ghana's e-procurement project. Furthermore, AML noted that the industry and other stakeholder stand to gain in the areas of reduction in postage and travel cost, improved communication and moreover organisation's internal and external communications. E-business can facilitate benefits in terms of access to internal and external market places. Agreeing to AML on some benefits of e-business PMF1, for example, stated as follows:

“...from experience e-business enhances communication, you get quick responses to your request, you are able to request for invoices, procure materials for the project and a lot more time is saved in this respect...”

The above statement by PML1 supported several literature findings most significantly the works done by London and Bavinton (2006), on e-business in construction. PML1 conversely admitted that using e-business as demonstrated by their foreign counterpart obviously would cut down on time spent on tender issues. Contributing to the discussion, SIMG noted that e-business can bring several benefits to local firms in the construction industry. SIMG, for example, mentioned that price database, supplier database, minimised face-to-face contacts with government officials and availability of all the information relating to the procurement process can be published online in real time. These are some benefits that can be derived by local firms and government.

6.8.2 Management

6.8.2.1 *Efficiency of business process in construction*

Under the management theme three (3) respondents (see Figure 6-3) in CS1, PML1, AML and PMF1 agreed that empowering local firms through FDI in construction to promote the culture of learning new things. It is considered a positive engagement to develop the technological capacity of local firms in collaboration with foreign firms on FDI projects and

subsequently the entire construction industry. For instance, AML mentioned that as a result of their partnership with their firm uses computers in a network environment, report are done on time, information is properly stored and retrieved as and when needed. AML further expressed as follows:

“...we are able to communicate with our partners, moreover, our internal and external communications have improved over the period and we are beginning to experience the efficiency in our activities...”

The above expression by AML on efficiency of business process in construction identified the link between e-business and business process improvement and this particular expression was supported by London and Bavinton (2006), who argued that e-Business has the potential to facilitate efficiency in construction activities. AML further explained that, outside the project environment they are able to communicate with other businesses. AML further expressed the following view:

“...technology such as e-business can bring efficiency when put to strategic use...”

AML expressed the need to improve capacity across the industry, pointing out that the current trend of influx of foreign firms in Ghana most of which seeks partners, but are frustrated due to poor capacity of these local firms required the industry's attention. With reference to AML above, PMF1 noted that efficiency of business process within the Ghanaian construction industry can only be achieved through continues capacity development and injection of ICT facilities to enhance processes. Conversely, PML1 explained that most local firms are emerging and recruiting young people who are willing to learn the new technology, mostly ICT based ones such as e-business. PML1 further recounted improvement their firm has achieved since the commencement of their FDI arrangement:

“...now we are able to do planning and scheduling with the support of ICT tools, so we have become a lot more efficient in meeting out targets...”

AML totally agree with this statement and further highlighted that the FDI project provided the platform to acquire ICT skills, understanding project management, planning and scheduling using different ICT tools and some basic Microsoft project software.

6.8.2.2 *Managing construction activities*

Under the management theme two (2) respondents in CS1 as shown in Figure 6-3 agreed that construction work activity is complex with many different parties involved at different stages of the process, hence required a more responsive management approach. Furthermore, all the two respondents noted that the manual processes engaged in managing procurement of construction work is one significant factor that has had a negative impact on the development of the construction industry in Ghana. For instance, CRF who worked with a number of local firms as part of FDI arrangement made the following observation:

“...basically, it appears every aspect of the work procurement process is done manually, and there are many people to deal with which tend to slow the process down...”

In another example, CRF mentioned that individual attitude and work ethics in the local construction firms in Ghana tend to increase this culture of work, the majority of them prefer a manual approach to using computers in their work. This in many instances led to delays in the delivery process. Conversely, respondent CRF mentioned that basic automation of procurement activities at the government level has been proposed, but still far to achieve as government e-government project, which is intended to connect all government agencies is yet to come on board. CRF further noted that once the e-government infrastructure is in place and functioning, construction works procurement documentation would be available online for prospective local firms to access. That is to say there is a future need of local firms to update skills in basic ICT in order to use e-business effectively. AML, however, agreed that manual activities employed in managing works procurement have indeed affected the management of construction works procurement activities both within government and the construction industry.

6.8.2.3 *Quality of local firms*

Under the management theme in Figure 6-3, three (3) interviewees in CS1 agree that e-business has the potential to bring together key players within the construction industry in Ghana through the reduction of manual and paper works, thereby increasing communications and dissemination of information. This assertion by the respondents confirmed earlier literature findings mostly works done by Stewart (2001) and Ribeiro and Lopes (2002), which explained that e-business enhances communication among construction team members

thereby promoting quality of work. This potentially can improve the quality of the local firms in the construction industry. AML argued for capacity development within the industry, this would boost confidence in personnel in handling computers and other ICT equipment. Referring to their current FDI arrangement, AML noted that it has offered an opportunity for them to improve on their work. AML expressed the following view on the benefit of their FDI project arrangement:

“...gradually we are doing away with the culture of manual administrative works...”

Further AML noted that using computers and the Internet for work has indeed supported their work and their capacity has improved through the support of their FDI partner. AML further noted as follows:

“...now the awareness level within our firm quite high as most of our works are done, using computers and the Internet is making communication easier...”

SIMG recounted Ghana government e-government procurement project. SIMG highlighted that mature e-business environment within the Ghanaian construction industry may lead to greater access to market opportunities; much time can be saved on construction related activities thereby improving the quality of the entire industry. PML1 submitted that their FDI project arrangement has enhanced their capacity technologically, it has exposed their firm to many forms of knowledge and skills in construction, it has brought new experiences with development in construction, PML1 further mentioned as follows:

“...for example, our office communicates to our FDI partner’s offices using the Internet and moreover receives communication from them through the same medium...”

PML1 further mentioned that the capacities of local staff have been enhanced in many perspectives, including developing ICT skills which has become a competitive advantage. PML1 further stated as follows:

“...I can say to you confidently that our business has become efficient as well as our staff, we have reduced waste as we have achieved a great reduction in paper usage and postage, our response time to queries and requests has reduced considerably...”

However, SIMG and AML admitted that majority of the local construction firms within the industry, some of which are in the some form of collaboration with foreign firms still have the

low absorptive capacity as a result of poor quality of personnel. SIMG who had in the past arranged several collaborations between local and foreign firms in the Ghanaian construction industry expressed the following concern:

“...some personnel are computer shy and would like to continue their work as they have been doing and would find it convenient to resist any attempt to change their method of work...”

Contributing further, SIMG mentioned that Ghanaian local construction firms do not have any form of proper training for their staff. Those that received some training in the past are engaged in other ventures, some of which are not related to construction, this may be due to non-availability of construction jobs to the majority of the small local firms. This is hindering technology transfer and effective knowledge sharing among key industry players and the most affected are contractors.

6.8.3 Skills development

6.8.3.1 Acquisition of new skills through FDI collaboration

Under skills development theme as shown in Figure 6-3 two (2) respondents from local firms in CS1 together with one (1) expert highlighted the significance of acquiring job related skills. Two respondents (PML1 and AML) confirmed that their foreign FDI partners play an significant role in the acquisition of ICT capacity in terms of skills development for easy adoption of e-business technology. AML mentioned that local contractors for a long time suffered from low technological capacity most especially in the area of ICT which in many ways affected productivity. The identification of low capacity by AML confirms the works of Ofori (1991), many years ago and it is still relevant within the Ghanaian construction industry, a common phenomenon within construction industries in developing countries. SIMG and AML further made reference to the opportunity offered by the presence of foreign construction firms in Ghana. Subsequently, the opportunity of FDI project arrangement through which many have acquired ICT related skills. For example, PML1 mentioned that they have acquired planning and scheduling skills which are done using computers. PML1 add that this FDI in construction has enhanced their capacity technological wise, and moreover exposed personnel to many forms of knowledge and skills in construction. For example, the office communicates to the FDI partner office using the Internet and moreover receives communication from them through the same medium. The capacities of the local

staff have been enhanced in many perspectives, including developing ICT skills. PML1 highlighted some benefits they have derived from the FDI project as follows:

“...we have reduced waste as we have achieved a great reduction in paper usage and postage...”

AML further explained that their personnel have acquired ICT skills and have improved upon those skills through constant interaction between them and their foreign counterpart. They have access to the use of construction management software and are knowledgeable in areas such as project programme planning and moreover scheduling. For e-business technology transfer, ICT skills acquisition remains an significant aspect. In the context of this research the respondents have confirmed the assertion that FDIIs/IJVs provide the means for skills development. For instance, Ofori (1994b) and Carrillo (1996), argued that IJVs provides an excellent mechanism for skills development and improvement.

The following section addresses research question four (4) as outlines in Section 1.6.3 in Chapter 1 which deals with primary requirements for e-business technology transfer within the construction industry in Ghana CS1.

6.9 What are the primary requirements for e-business technology within the construction industry in Ghana?

Primary requirements for the establishment of e-business technology within the Ghanaian construction industry was investigated within CS1 under research question four (4), in order to solicit industry practitioners and expert's perspective on minimum capacity for the introduction of e-business within the construction industry in Ghana. The emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 4 in CS1 as shown in Figure 6-4 were grouped under the following themes: organisation readiness, and technology and environment. Findings under the themes are presented below.

Question 4-CS1	
Name	Sources
What are the primary requirements for e-business technology within the	0
Organisation Readiness	0
Organisation structure	3
Organisational culture	4
Staff orientation and training	3
Technology and Environment	0
Legal and regulation system	3
National ICT Infrastructure	3
Organisation's ICT infrastructure	4

Figure 6-4 Fundamental requirements for e-business technology transfer

6.9.1 Organisational readiness

6.9.1.1 *Organisational structure in the local firms*

Under organisational readiness theme respondent PMF1 in CS1 agreed together with respondents AML and CRF as shown in Figure 6-4 that organisational structure plays a significant role in the management of an organisation. For example, PMF1 noted that local construction firms in Ghana suffer from inefficiency due to the absence of a well define organisational structure, therefore, the introduction of new technology such e-business can affect the organisation negatively if it is not aligned to a well-defined structure. This expression is in conformity with previous literature most especially the work of Iddris (2012), which explained the significance of organisational structure as a key ingredient in the development of any organisation. Therefore, local firms need to redefine their organisational structure in line with their new philosophy to enable them benefit from the investment the foreign firms are making in them. For example, CRF explained that foreign firm Furthermore to supporting local firms to take on board some basic technological issues in the area of computers and the Internet, they moreover transfer management capability to the local firms and for the effective realisation of this knowledge, it is significant for the local firms to undertake some level of restructuring and roles defined properly in order to do away with issues of ‘one man’ business syndrome. AML agreed with both PMF1 and CRF on the issue of structural reforms within local construction firms, most especially those firms that are collaborating with foreign firms. AML concludes by stating the following:

“...these reforms are intended to influence all the employees to support, first, the transfer of e-business technology initiative within the firm and subsequently apply the technology to their respective works...”

6.9.1.2 *Organisational culture in the context of e-business technology transfer*

Under the organisation readiness theme, four (4) respondents in SC1 (see Figure 6-4) confirmed that culture plays a significant role in the introduction and acceptance of new technology. AML and PML1 mentioned that most of the local firms in the construction industry in Ghana know that ICT can improve some basic processes with the construction supply chain. Yet, the local firms operating in the construction industry in Ghana hold onto the traditional way of doing business. For example, they prefer working with hard copy documents as against any form. PMF1 mentioned that drawings are issued in hard copy as well as reviews with all the accompanying signatures together with an acknowledgement from the recipient at all levels of the supply chain. PMF1 further stated that the outlook of the construction industry in Ghana is deeply traditional up to governmental levels, this form of communication remains problematic in the management of projects mostly by local contractors. PMF1 observed as follows:

“...the understanding can be deduced that the system for electronic activities within the construction industry in Ghana is not available...”

CRF is of the view that the traditional way of working within the construction industry in Ghana has become an embodiment of the industry and attitudinal for people who work in the industry. Therefore, the transfer of e-business technology through FDI arrangement, local partners ought to accept a paradigm shift and in this regard, personnel are paramount, because it is impossible to introduce new technologies into an organisation when the current working environment is not ready to permit such new technologies (Claver *et al.*, 2001). Holding onto this is ‘how we do it’ attitude can be problematic, continuous staff development and orientation is a significant aspect of changing the culture to conform to adopting new technology such as e-business within the construction industry in Ghana.

6.9.1.3 *Staff orientation and training for local firms*

Under the organisation readiness theme three (3) respondents (see Figure 6-4) in CS1 identified that staff constitute a major requirement for technology transfer and in this context e-business technology. PMF1 agree that staff factor must be considered whenever any organisation is planning to introduce and use new technology. PMLF1 mentioned that it is significant to train staff and moreover give them proper orientation in the area of the new

technology by so doing staff would be encouraged to understand the philosophy of e-business and to use the technology. Several authors alluded to the significance of training in improving capacity of personnel; see, for example, the works done by Bosworth and Dutton (1990) and Ruikar *et al.* (2006). PMF1 further, noted that foreign firms are providing training needs for their local partners to enable them cope with development in the construction industry and moreover to understand deliverable of utilising network computer system for their work. Once staff understand and accept the training and orientation, the inefficiency and low level of technology would gradually change in line with new management philosophy. This would have a ripple effect on the low technological capacity of the local firms in the Ghanaian construction industry. PMF1 further noted that the benefits local firms gain from their foreign counterparts are quite significant. However, it is significant to have these trainings provided by the foreign firms in a more structured form for the benefit of the entire construction industry in Ghana. PMF1 added that the benefits of the new technology should be made known to staff and the anticipated benefits to them during training sessions. Contributing to the discussion, PML1 concurred with PMF1 on the structured training programme and further stated as follows:

“...when the proper mechanism is put in place the capacity of the industry practitioners can be raised to adopt and use ICT and e-business within the construction industry in Ghana...”

AML agreed and further acknowledge the significance of FDI in construction and the role their foreign partners are playing in improving their capacity technology wise.

6.9.2 Technology and environment

6.9.2.1 Legal and regulation system to support e-business

Respondent PMF1 and AML in CS1 together with one (1) expert who provided a general opinion on the research topic confirmed that legal and regulatory system is an significant factor in the development of e-business as indicated under technology and environment theme in Figure 6-4. PMF1 mentioned that if legal and regulatory issues are not properly addressed, it may serve as an impediment in adopting e-business. The above statement by PMF1 confirms similar argument by Ruikar and Anumba (2008), in which they highlighted the significance of legal, regulatory and security system for the effective implementation of e-business. SIMG confirmed that security issues are a very significant factor that has the

tendency to inhibit the adoption and application of e-business. In this respect PMF1 and SIMG agreed that government has a lot of responsibility in providing this facility, in their opinion the Internet comes with a lot of challenges, mostly fraudulent activities so the system must be secured for reliability and against fraudulent activities. Businesses must take place in a system where there is trust, so security of business transactions and data transfer must be incorporated in the system. Government must ensure that the system is regulated legally to enable confidence while using it. People must accept the legal system covering this kind of transactions. For example, SIMG confirmed the passage into law of the Electronic Transactions Act, 2008 Act 772 as part of a Ghana government initiative of providing a well-defined legal regime for e-business transactions within different sectors of the Ghanaian economy.

6.9.2.2 *National ICT infrastructure for the implementation of e-business*

Under technology and environment theme three (3) respondents in CS1 as indicated in Figure 6-4, including one (1) expert who was interviewed to provide a general perspective on the research topic agreed together with CS1 participants that, national ICT infrastructure is an significant aspect of technology such as e-business. Although PMF1 admitted that e-business in construction in implemented countries is still low, there is moreover enough evidence to suggest that they have moved beyond basic e-business activities. Contributing further, PMF1 noted that to experience incremental development of e-business in the context of the Ghanaian construction industry, it is significant to approach e-business implementation in a gradual manner. First, the most significant things are, government ought to create the enabling environment by establishing a national ICT infrastructure and then move on to develop policies in support of e-business usage. As previously noted in the literature, Iddris (2012), argued that ICT infrastructure together with the right policies can speed up wider adoption of e-business. PMF1 further noted that non-availability of this facility remains a factor in the low technological capacity of local firms in Ghana. For instance, PMF1 explains that once the national ICT infrastructure is put in place, organisations, including construction would be encouraged to take advantage of such facility as the government may move all business activities to that platform. Agreeing to PMF1, SIMG highlighted that one surest way to entice the construction industry to adopt and use ICT and e-business is by directing that all construction works wholly or partly funded by government must be procured through e-government platform. By this every firm within the construction industry would subscribe to using the Internet and ICT facilities and related applications to enable them to access projects advertised by the government. AML agreed that there is more to be done to improve the

technological capacity of the local firms in Ghana. PMF1 further expresses the following view on government's role:

“...pressure from the government can provide the needed motivation for construction organisations in Ghana to implement basic e-business activities or systems which may not go beyond intra and inter organisational communication activities...”

SIMG submitted that one cardinal thing in this is that any national ICT infrastructure utilising the Internet automatically become a global issue, therefore, it is significant to upgrade communication infrastructure within the country in order to cope with the application of e-business in construction and other sectors within the Ghanaian economy.

6.9.2.3 Organisation's ICT infrastructure to support e-business

All three (3) respondents in CS1 together with one (1) expert as shown in Figure 6-4 confirmed that one of the biggest challenges apart from personnel and technical expertise for the local firms in Ghana is the financial capability to establish ICT infrastructure for their respective firms. For example, PMF1 noted that local firms suffered from low technological capacity and inexperienced personnel this has affected the development of construction firms and the construction industry as whole negatively. CRF moreover noted that to address this technological imbalance in the Ghanaian construction industry, local firms are taking advantage of the influx of foreign firms in Ghana through different forms of collaborations. This initiative is consistent with Technology Transfer Agreements - LI 1574 and supported within the FDI in construction in order for them to improve on their technological capacities and capabilities. For example, discussing the relevance of FDI in construction, the view of PML1 on organisation's ICT infrastructure is expressed as follows:

“...I can say that coming face to face with this FDI project arrangement, our technological capacity and capability have improved as we are able to take up some basic technological advancement by installing network computers that has been advancing our communication with our partners...”

When AML views were sought concerning the relevance of their collaboration with a foreign firm in the area of establishing ICT infrastructure in their construction firm, AML's views corroborates that of PML1 and further highlighted as follows:

“...generally, I must admit that this collaboration has been helpful to us, as per the arrangement we need to have some basic ICT equipment and the Internet facility to enable us to network our system to support our work together with our partners ...”

The above statement by PML1 agrees with the argument advanced recently by Naseebullah *et al.* (2011), stating that ICT infrastructure remains a prime factor for organisations to implement e-business.

The following section addresses all the four research questions as outlined in Section 1.6.3 in Chapter 1 in relation to case study 2 (CS2) as presents in Section 4.5.6.2 in Chapter 4.

6.10 Case study 2 (CS2)

6.10.1 Introduction

This section presents finding from CS2 based on the background of CS2 (see Section 4.5.6.2 in Chapter 4).

6.11 Presentation of Findings from CS2

6.12 What are the bottlenecks in the works procurement process in the construction industry in Ghana?

Bottlenecks associated with construction works procurement in the Ghanaian construction industry were investigated within CS2 under research question one (1) in order to determine influential factors that have a negative impact on performance within the construction industry in Ghana. Further, to determine factors influencing technological development within the construction industry in Ghana. These emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 1 in CS2 as shown in Figure 6-5 were grouped under the following themes: construction works procurement and political context. Findings under the themes are presented below.

Question 1-CS2	
Name	Sources
What are the bottlenecks in the works procurement process in the construction	0
Construction Works Procurement	0
Lack of basic technology	4
Lack of skilled personnel	3
Procurement law	3
Political Context	0
Government intervention in ICT skills development	2
Strategy to promote e-business	3

Figure 6-5 Factors impacting negatively on works procurement process

6.12.1 Construction works procurement

6.12.1.1 *Lack of basic technology in the procurement process*

Under the construction works procurement theme lack of basic technology for work was identified by four (4) interviewees, including one expert as a factor that is impacting negatively on the procurement process within the Ghanaian construction industry (see Figure 6-5). CRF mentioned that the low level of basic technology, such as computers and the Internet appears to be among the most significant issue that has negatively influenced performance and development of the construction industry in Ghana. This support the argument by Essel (2014), stating that technology development is essential for emerging economies like Ghana, in order to enhance organisation's performance. For instance, PMF2 observed that the most basic technology, which is the Internet, is not commonly seen within the construction industry being exploited to advance construction related activities. In contrast, majority of the local firms may have access to the Internet but used it for unrelated activities which may not necessarily have positive impact on performance of the firms. PML2 further noted that moving forward; there is an urgent need to overcome the technological gap that existed in the construction industry in Ghana. Essel (2014), further noted that the technological gap is as a result of low research and development in emerging economies like Ghana coupled with low capacity in attracting technology transfer. In the views of PML2, technology like e-business has a major role in the improvement of the entire construction process. GML concurred with PML2 and pointed out, to some extent there is some positive outcome as some practitioners have demonstrated awareness by stressing that technology can be of help to support the industry. For example, GML again highlighted that ICT and the Internet can enhance communication within the industry in turn minimise unnecessary interference during the procurement process thereby reducing corrupt activities.

6.12.1.2 Lack of skilled personnel in the construction industry

All the three (3) interviewees in CS2 as shown in Figure 6-5 during the interview under the construction works procurement theme agreed that lack of skilled personnel in the construction industry has been a negative factor in the development of the Ghanaian construction industry over the years. This observation by the respondents in CS2 agreed with the work of GBN (2009), which identified low level of trained personnel in the Ghanaian construction. CRF a foreign consultant pointed out that until establishing FDI collaboration in the construction industry recently, there was no training and capacity development for staff of local firms operating in the construction industry in Ghana. CRF further explained that, training activities are intended to address the shortfall in skills in the construction industry. PML2 who represents a local firm attested that majority of personnel and owners of local firms lacks the necessary skills they required to manage their respected firms. Unfortunately, these local firms find it difficult to provide training to develop their human resource to meet the challenges of managing projects. GML pointed out during the interview that there is an urgent need to get serious with staff development issues within the industry. From experience foreign firms are more likely to offer training and other facilities to personnel of local firms who have had some previous knowledge and skills upon which they can build. GML further explained that trainings offered to local firms by their foreign counterparts are mostly internally organised. However, the local firms were encouraged to source for trainings elsewhere, especially those that can provide the needed skills to support technology transfer in the area of e-business.

6.12.1.3 Procurement law in the context of construction works

Under the construction works procurement theme, the procurement law was investigated in CS2 in order to gain thorough understanding of the law and its application within the construction industry in Ghana. Literature review of the procurement law provided that, the procurement system is the type that the design is separated from construction so the majority of firms only bid for the constructional aspect of most projects. The procurement law provides different procurement systems; the one for consultants is different from contractors. For example, SIMG explained that, design and other engineering aspect of projects are procured separately. Under this arrangement majority of government projects follow National Competitive Tender (NCT) route (see

Table 2-8 in Chapter 3), normally the work is advertised in the national dailies stating the requirements for the work, including the type of firms to tender (see firm classification in Section in Chapter 3) for the work. In this regard, contracting firms normally bid for the works based on advertisement without any idea of the design solution. For instance, to further explain the difficulty posed by the procurement law and practice, interviewee, PML2 expressed as follows:

“...basically the procurement process provided by law is an expensive one especially for us the small contractors, we have to produce documents in huge volumes and this is completely a manual activity throughout to tender evaluation...”

Under this theme, three (3) respondents as shown in Figure 6-5 identified the inflexible nature of the procurement law. For example, PML2 agreed that the law provides an equal opportunity for local firms and moreover to curb corrupt acts within construction works procurement process. Osei-Tutu *et al.* (2010), identified several corrupt practices within the Ghanaian construction industry and the promulgation of the law was intended to cure these acts in the industry. However, the law provides no opportunity for innovation in the works procurement process. Conversely, PML3 noted that procurement of works under the public procurement law generally can be described as being time consuming as the entire process is manual based and quite bureaucratic. The process lacks technology and monitoring is completely non-available as a result the construction industry has not been able to come out with quality of firms and works in the industry. One other thing that is frustrating in the procurement process has to do with delays in payment, especially when it comes to government projects. These are some of the major bottlenecks affecting the industry. To further buttress the points raised by GML, PML2 mentioned that the procurement process is not as transparent as it has been made known publicly; the process is completely manual from the purchase of the tender document to submission of completed document; there are too many people involved in the procurement system here in Ghana, this in most cases resulted in corrupt practices in the process, bid details are leaked to other competitors; political influence is sometimes evident in the process. Aduamoah and Campion (2012), argued that one of the setbacks of the procurement system in Ghana is excessive documentation. Therefore, there is need to automate some basic aspects such work notices, tender documents and submission of tender as part of the procurement process to reduce human to human contact (Osei-Afoakwa, 2013). PML2 further noted that, until working together with a foreign firm they did not know that technology such as e-business has the capability to enhance the construction works procurement process.

6.12.2 Political context

6.12.2.1 Government intervention in ICT skills development

Under the political context theme, two (2) respondents as shown in Figure 6-5 in CS2 identified government intervention in ICT skills development as a positive outcome. For instance, PML2 pointed out that in an attempt by government to adequately harness the power of ICT and moreover empower the youth in ICT, an intuition was created to train the youth in ICT. This initiative supported the discussion of e-Business W@tch (2006), which suggested continuous ICT skills development training across the construction sector. In a more recent time PPA (2014), recognised the need to update staff skills in different areas , including ICT to support procurement activities. This, according to PML2 would have effect on the ICT skills needs of the construction industry in Ghana in the future. Furthermore to this, there are several government intervention programme aimed at equipping the youth in ICT skills. GML noted that through government intervention programme a lot more people have acquired ICT skills in recent time. However, the construction industry is not benefiting from it as yet. According to the submission of GML, to be successful in this particular endeavour, government has to look at a detailed strategy for making ICT trainings available throughout the country so that industries can benefit from the available ICT skilled personnel.

6.12.2.2 A strategy to promote e-business in the construction industry

Finding from the research under the political context in CS2 three (3) respondents, including one expert (see Figure 6-5) agreed that Furthermore to the training scheme instituted by the government, the strategy to promote e-business is another positive intervention by government to encourage business to harness the potentials of ICT and the Internet. To further deepen this strategy for real gain, PMF2 suggested continuous education, explaining that sometimes there is the need to provide a strategic platform in order to explain the benefits of e-business with this awareness of real issues can be created making it possible for the business community to accept and use the technology. GML Conversely was of the view that it is significant to let businesses understand the underlining philosophy of e-business. One other significant issues that was revealed was an incentive, PMF2 pointed out that as part of the strategy to promote the use of e-business, government may consider providing incentives for investors in this sector in order for them to provide affordable services and moreover professional software for the construction industry. SIMG explained that the government's

efforts in promoting the use of e-business include the following: the public procurement authority (PPA) has provided an online procurement planning tool for assessing performance of entities, and moreover as a form of contract management and implementation of e-Government Procurement (eGP) system. It is expected to hold all project wholly or partly funded by government.

The following section addresses the research question two (2) as outlines in Section 1.6.3 in Chapter 1 which deals with foreign contractor support for skills development and e-business technology transfer to the construction industry in Ghana in CS2.

6.13 What motivates foreign contractors to support skills development and e-business technology transfer to the construction industry in Ghana?

Under research question two (2) foreign support for skills development and e-business technology transfer to local contractors in the construction industry in Ghana was investigated within CS2 in order to determine drivers that promote skills development within the construction industry in Ghana. These emerging factors from the interviews were recorded in NVivo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 2 in CS2 as shown in Figure 6-6 were grouped under the following themes: business strategy of foreign firms and improving capability. Findings under the themes are presented below.

Question 2-CS2		
Name		Sources
What motivates foreign contractors to support skills development and e-business t		0
Business Strategy by Foreign Firms		0
Construction business environment		2
Long term business relationship		2
Improving Capacity		0
Existing capacity of firms		4
Foreign firms collaboration		4
Pressure from foreign firms		4

Figure 6-6 identified factors for skills and e-business development

6.13.1 Business strategy by foreign firms

6.13.1.1 Construction business environment in Ghana

Under the business strategy by foreign firms theme, two (2) respondents in CS2 as indicated in Figure 6-6 agreed that it is significant for foreign firms to know their new environment and it can only be achieved through a partnership with local firms. For instance, CRF noted that working in an environment that is new to you, it is obvious that you get to know the business environment through the creation of business associates who are experienced in the existing business environment. Working in an environment which is entirely new to you may have many challenges, including culture and legal issues, therefore, it is significant to establish with existing businesses in order to facilitate activities. PMF2 stressed the following:

“...we could not have gained grounds without working with stakeholders already working in the construction industry here in Ghana, so the obvious thing is to quickly come together with some local firms to facilitate smooth integration into the construction sector...”

6.13.1.2 Long term business relationship

Finding from this research pointed to the fact that foreign firms which have established collaborations with local Ghanaian firms are of the view that long term business relationships are key to their success in the construction industry in Ghana. This was confirmed by two interviewees in CS2 as shown in Figure 6-6. CRF noted that, through a long term business relationship, the foreign firms can conveniently transfer knowledge, technology and expertise to their counterparts, this would go a long way to sustain their business and make local firms a lot more competitive and quality minded organisations within the industry. Moreover, it is good for the operations of foreign firms, in particular, regarding their existence in the construction industry in Ghana. PML2 conversely acknowledged the need to establish long term relationships with their collaborators in the industry. PML2 emphasised the following point:

“...sincerely we have been working with our local partners and collaborators for many years, our relationships have been mutually beneficial...”

PML2 further explained that their local firm collaboration is quite big in the areas such as suppliers of materials, components and fittings. PML2 admitted that the partnerships they

have established over the years promoted their work in Ghana and this same model has been replicated elsewhere within the African continent.

6.13.2 Improving capacity

6.13.2.1 *Existing capability of firms*

The research findings in CS2 under the improving capacity theme demonstrated that four respondents, including one expert agreed that existing capacity of local firms operating within the construction industry in Ghana is low (see Figure 6-6). In many cases their low level of project management has resulted in low standard output. CRF noted that, low capacity of firms in the construction industry has affected the growth of the industry negatively. For example, CFR cited the following as some of the weak points of the local firms as: lack of the Internet, unqualified work force, non-availability of skilled personnel. Contributing to the discussion on low capacity of local firms PMF2 acknowledge that the existing capacity of the local firms is quite low both in management and technology. Low capacity among local firms has been pointed out in literature by researchers and authors like Ofori (1994a) and Laryea and Mensah (2010), this findings and views expressed by respondents confirmed their works within the industry. Assessing the situation further, respondent PML2 who is a local contractor explained that it is a common knowledge across the industry that local contractors need support to improve on their capacity. PML2 noted that one area which is problematic in their project management has been communication between project members. PML2 argued that communication is a key component to improving performance in project delivery. PML3 conversely, acknowledge the benefits their collaboration in the areas of management and technology.

6.13.2.2 *Foreign firm collaboration in the Ghanaian construction industry*

Under the improving capacity theme, the majority of respondents (4 respondents) in CS2 as shown in Figure 6-6 confirmed that a well-established collaboration can bring about positive development within the construction industry in Ghana. For instance, CRF explained that in any of their collaborations they endeavour to bring qualified and experienced expatriate staff together working hand in hand with their local counterparts to ensure technology transfer. CRF further pointed out that the current collaborations are beginning to support capacity in management and technological skills among local firms who are participating in the FDI

project. This assertion was corroborated by PMF2 who is a foreign contractor. PMF2 mentioned that for local firms in the lower level, it was an opportunity for them to develop management and other significant skills. PML2 further, noted that it is worth mentioning that most of these local firms have indeed implemented capacities as a result of the collaboration. Eliciting further to understand the perspectives of the local firms in the partnership, PML2 noted that from experience this collaboration has provided a wealth of in-depth knowledge and learning benefits to their firm. This has translated into the procurement and installation of computers and printers. PML2 further expressed the following view about e-business:

“...for me all about this e-business technology, it is about having computers and printers in a network environment, utilising the Internet technology to facilitate sharing of information, in the form of document and two-way communicate...”

Furthermore, PML2 mentioned that, there is every indication in their firm that this collaboration in the past two years has positively impacted on the ICT skills development of both clerical and technical staff. PML3 pointed out that FDI projects can be an excellent strategy for technology transfer; hence it is an significant medium to utilise in developing the capacities of local firms.

6.13.2.3 Pressure from the foreign firms to improve upon technological and management capacities of local firms

Under the improving capacity theme, 4 respondents, including one (1) expert (see Figure 6-6) agreed that pressure from foreign firms remains a positive engagement in promoting the culture of using e-business. For instance, CRF observed that the FDI arrangement is making local firms to work extra hard to meet certain basic requirements such installation of the Internet and computers to support their work. PMF2 who is a foreign contractor acknowledged that there is the need for their local partners to communicate with them in real time. PMF2 further stated as follows:

“...the thing is we would send an email to you so if you do not have the facility, then obviously you cannot cope with the demands...”

PMF2 explained further that, the challenge is, local firms would have to make available for use certain basic communication infrastructure. GML a local contractor admitted that work demands from their foreign counterparts put some acceptable pressure on them. PML2 moreover a local firm sees the pressure from their foreign counterparts as a positive

engagement in developing their capacities speedily. PML2 again noted that the local firms have received valuable encouragement from which they able to upgrade their technological capacities, thus using the Internet for work.

The following section addresses the research question three (3) as outlines in Section 1.6.3 in Chapter 1 which deals with using e-business technology to promote construction business improvement in Ghana in CS2.

6.14 How does e-business technology promote construction business improvement in Ghana?

Using e-business technology to promote construction business improvement in Ghana was investigated within CS2 under research question three (3) in order to determine influential factors that have a negative impact on e-business introduction and potential benefits of e-business within the construction industry in Ghana. These emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 3 in CS2 as shown in Figure 6-7 were grouped under the following themes: implementing e-business, management and skills development. Findings under the themes are presented below.

Question 3-CS2	
Name	Sources
How does e-business technology promote construction business improvemen	0
Implementing e-Business	0
Barriers to e-business	4
Benefits of e-business to firms	5
Benefits of e-business to government	1
Management	0
Efficiency of business process	4
Quality of firms and performance	4
Skills Development	0
Acquisition of new skills	4

Figure 6-7 identified factors that promote e-business in construction

6.14.1 Implementing e-business

6.14.1.1 *Barriers to e-business in construction*

The findings in CS2 in this research suggest that interviewees recognised the significant role of foreign construction firms in improving the technological capacities of local firms through FDI within the Ghanaian construction industry. However, barriers to e-business have been highlighted under the implementing e-business theme by four (4) respondents as indicated in Figure 6-7. For example, CRF cited electricity supply as one of the challenges industries in Ghana face. The comment by CRF is quite relevant as it cut across the discussions in literature, it emerged that among several barriers the works of Love *et al.* (2001), Rankin *et al.* (2006), Vitkauskaite and Gatautis (2008), highlighted infrastructure as a major barrier in the implementation of e-business. Conversely, PMF2 a foreign firm which has demonstrated using e-business during the interview noted that, cost of investment, lack of technical capacity and lack of awareness are some pertinent issues that has to be addressed. Supporting PMF2, PML2 commented that industry practitioner's incapability may be linked to several challenges but prominent among them include: lack of ICT skills and technical support within the industry and lack of online payment system. PML3 a local firm, moreover supported the issue concerning affordability and then explained further that, for small firms it may be expensive to acquire these machines, procure the services of skilled personnel and pay for the expensive Internet facility.

6.14.1.2 *Benefits of e-business to local firms*

As indicated in Figure 6-7 benefits of e-business to firms emerged as one of the most significant factors that has the potential to improve performance within the Ghanaian construction industry. This factor was pointed out by five (5) respondents, including two (2) experts. For instance, CRF started by stating that e-business is a process facilitator. It provides the ability to keep in time with team members on a project. PMF2 a foreign contractor recounted their experience with e-business, by stating that they used it to prepare reports and distribute to their offices abroad and project partners in good time. Further PMF2 expressed the following views:

“...we as contractors, we have applied e-business to design solutions where issues concerning rework have been minimised...”

“...for us it saves time and enhances communication between project partners and professionals...”

The statement above confirmed the work of London and Bavinton (2006), Kong *et al.* (2008) and Baladhandayutham and Venkatesh (2010), they argued that e-business provides information and communication facilities. PMF2 noted that, one major benefit of e-business technology is that it supports planning and scheduling. In this context, the firm is able to do the stocktaking in advance to enable them to prepare and order materials in good time. PML2 supported the comments on the benefits of e-business and noted that it is an opportunity for those local firms that are in collaboration with foreign firms to go further by exploring extra benefits in other areas like online project management issues. GML expressing views based on their collaborative experience noted that e-business provides the opportunity to improve on business activities within the construction industry, by cutting down on time in terms of delivery and reduction in postage costs. For GML the biggest benefit has to do with the facilitation of communication between different sectors and people who are connected with a particular project. In general term, e-business had the potential to transform and improve performance within the construction industry in Ghana. This was supported by CIMG and further added that within the Ghanaian construction industry and government's perspective, the industry stands to benefit from greater knowledge of competition, by virtue of being able to view opening of tenders over the Internet, online access to tender advertisement and reduction of manual work and contract related papers, by this, the routine administrative processes become simpler.

6.14.1.3 Benefits of e-business to government

Research findings in CS2 indicated that one of the interviewee a procurement specialist and e-government procurement project consultant who provided a general view(s) on the research topic as shown in Figure 6-7 noted that government stands to gain from e-business. CIMG pointed that government procurement office has been unable to effectively monitor projects, but with e-business in place the following activities can be undertaken by the procurement office:

Monitoring and Compliance - with an e-business system in place, it will be mandatory for all government entities to use the platform for its procurement activities. This will require that all tender notices, participation of tenderers as well as tender evaluation (price, technical specification, financial status, etc.) to be conducted online. This will enable the authority to

monitor compliance of entities with their tendering process. This will include tender opening and closing periods, evaluation criteria, notification of contract award, and in some cases contract performance.

Reduction in Complaints - the authority receives a number of complaints covering such issues as the loss of tenders, late opening of tenders, destroying of tenders, congestion at tender openings, suspicion with award of contract and many more. An e-business system will eliminate such complaints. Tenders submitted online cannot be tampered with, tender closing will be done automatically by the system, there will be no need for tender opening and tender evaluation and award will be done online based on set criteria, thereby eliminating issues relating to suspicion of contract awards. Simply put, no tender fracas.

Data Exchange - there will be an increased data exchange between public entities and tenders, i.e. contractors, suppliers and consultants. These data would provide the Authority with a wide range of information to enable it generate statistics on public procurement activities in the country. Such information would help in policy formulation, government budgetary allocations, etc. Wide range of reports can be generated for decision making such as;

- Total procurement summary
- Summary of works completed
- Feedback report
- Tender search details
- Tender data statistics
- Tenders geographical wise
- Department Wise Tenders
- Validated database of contractors experience and much more.

6.14.2 Management

6.14.2.1 Efficiency of business process in construction

Four (4) respondents, including one expert in CS2 identified the significant role foreign firms in collaboration with local firms in supporting them in improving on their business process (see Figure 6-7). For instance, CRF observed that when issues concerning ICT and e-business are addressed in the construction industry, efficiency would begin to be part of business

processes undertaken by local firms. PMF2 agreed with the observation made by CRF and mentioned that as a foreign firm, it is their contribution to the construction industry in Ghana. PML2 agreed by stating that their business is a lot more efficient in handling their communications, procurement of materials and request to their partners. PML2 further mentioned as follows:

“...we are efficient in the delivery of our tasks in terms of reports and queries...”

It has been suggested that e-business facilitate efficiency of business processes through improvement and moreover cut administrative costs (Robeiro and Love, 2003, Ruikar and Anumba, 2008, Baladhandayutham and Venkatesh, 2010). GML conversely, called for a structured approach so the benefits as seen by local firms in collaboration with foreign firms can be extended to other local firms.

6.14.2.2 *Quality of local firms and performance*

Findings from this research in CS2 as shown in Figure 6-7, the majority of interviewees (4 respondents), including two (2) experts who provided general views on the research agreed that the quality of the local firms in the construction industry in Ghana is poor. This has affected performance and development of the local firms. For example, Ofori (1984), Ahadzie (2011) and Amoah *et al.* (2011), as pointed out in literature gave credence to worrying trend of poor quality of staff of local construction. However, CIMG noted that the FDI collaboration has enhanced the images of the local firms who are working with foreign firms on some specific projects in Ghana. For instance CRF, a foreign consultant noted that during a recent assessment of their support to their local collaborators, evident show that all the local contractors are using computers for work and have moreover participated in capacity development trainings in management and technological issues which were intended to improve the quality of the local firms. CRF further explained that most of these trainings are done internally due to the high cost of such trainings outside. PMF2 mentioned that improving quality of the firms means transforming the firm into delivering quality work in the construction industry. PMF2 was of the view that one way of achieving quality is building the technological capacity of the local firms, most significantly, through collaborations/JVs and that is the only way to enhance the quality of a local firm. The point made by PMF2 was corroborated by GML a local firm in collaboration with PMF2. PML3 acknowledge that

through collaboration their firm is now ICT compliant in task execution and delivery. GML explained further as follows:

“...this collaboration has given us the opportunity to plan our technological needs, brings us to the point where we can determine the type of equipment we may need for our work and the time frame to undertake such investment...”

6.14.3 Skills development

6.14.3.1 Acquisition of new skills through FDI collaboration

Four (4) interviewees, including two (2) experts in CS2 as shown in Figure 6-7 stated that foreign firms in collaboration with local firms have a major role in supporting their local counterparts in acquiring skills in ICT and management. Two (2) local firms interviewed confirmed receiving numerous capacity training and have moreover attended workshops organised by their foreign counterparts purposely designed to train them for project management and use of the Internet for work. For example, PML3 stated that their site work has improved, through the trainings provided by their foreign counterpart; their personnel have acquired skills in site management, resources management and record keeping. Training can support and build confidence and moreover improve the dignity of staff (Cheng *et al.*, 2001). Furthermore, they have moreover acquired ICT skills and it is supporting the work of the firm. CIMG noted that generally, there is evidence of improved ICT skills among staff of the local firms in collaboration with foreign firms.

The following section addresses the research question four (4) as outlined in Section 1.6.3 in Chapter 1 which deals with primary requirements for e-business technology within the construction industry in Ghana in CS2.

6.15 What are the primary requirements for e-business technology within the construction industry in Ghana?

Primary requirements for the establishment of e-business technology within the Ghanaian construction industry was investigated within CS2 under research question for (4) in order to solicit industry practitioners and experts, perspectives on minimum capacity for the introduction of e-business within the construction industry in Ghana. These emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter

4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 4 in CS2 as shown in Figure 6-8 grouped under the following themes: organisation readiness and technology and environment. Findings under the themes are presented below.

Name	Sources
What are the primary requirements for e-business technology within the	0
Organisation Readiness	0
Organisation culture	3
Staff training scheme	4
Technology and Environment	0
Legal and security system	3
National ICT infrastructure	3
Organisation's ICT infrastructure	5

Figure 6-8 Fundamental requirement for e-business technology transfer

6.15.1 Organisational readiness

6.15.1.1 *Organisational culture in the context of e-business technology transfer*

Three (3) respondents in CS2, including one expert as indicated in Figure 6-8 agreed that culture plays an significant role in technology transfer activities within the construction industry. Organisational culture was highlighted under the organisational readiness theme in CS2 by the respondents as a key factor in undertaking technology transfer mostly from foreign firms to local firms. People and culture issues need to be addressed particularly to overcome resistance to change as resistance has been documented a setback in the implementation of new technology (Elliman and Orange, 2003, Hashim and Said, 2011). For example, CRF mentioned that culture is very significant in helping both foreign and local firms to understand one another in order to build a good working relationship that can promote a learning environment. For example, PML2 commented that working together with their foreign counterpart, they work in an open and frank environment, technology, form part of their work culture, time and professionalism are adhered to. GML explained that the positive things with their firm was working with the foreign firm has influenced their organisational culture in many perspectives. PML3 expressed the following view(s):

“...we now turned to see our transactions in a more business direction than in the past...”

PML3 highlighted that the major obstacle in technology transfer for improvement of performance can be linked to organisational culture. The majority of the local firms within the industry undertake their tasks through manual means and most of them are not willing to change to any other form.

6.15.1.2 *Staff training schemes for local firms*

As indicated in Figure 6-8 in CS2 training and capacity development emerged as one of the most significant activities undertaken by foreign partners in improving capacity of the local firm they are in partnership with. This was highlighted by four (4) respondents, including one expert. For instance, CRF observed that FDI projects provides an opportunity for Ghanaian local firms to develop their capacity both human resource and technological capacity. Mohamed *et al.* (2008), argued that skills development has a direct link to enhancing productivity. CRF further noted that it is appropriate to have a policy to guide implementation of FDI collaboration within the Ghanaian construction industry. This was supported by PMF2 who mentioned that staff development is a key factor in technology transfer schemes and in this regard their firm has a scheme to improve the capacities of personnel of their local partners. PML2 acknowledged the significant role played by their foreign counterpart in providing capacity development training as part of the FDI collaboration. However, PML2 noted that inadequate professional training still exists in the Ghanaian construction industry, a situation that has to be confronted in order to promote good practices and improvement across the industry. One significant thing PML2 alluded to during the interview was an awareness creation as part of the training scheme. It was found out from the research that the majority of practitioners within the construction industry in Ghana are not aware of the potential benefits of e-business. Creating awareness within the industry is an significant aspect of ensuring that practitioners within the industry become abreast with new developments within the industry. Supporting PML2, GML submitted that the biggest problem with the industry is the influx of unprofessional people undertaking many activities within the industry. GML further explained that in promoting e-business, education is significant. For e-business technology transfer to succeed it requires the understanding of the philosophy underpinning the whole e-business concept.

6.15.2 Technology and environment

6.15.2.1 Legal and security system to support e-business

Three (3) interviewees in CS2 as shown in Figure 6-8 stated that for a strong and robust system, it is significant for the government to have in place good legal and security system. PMF2 explained that regulatory issues are crucial in the implementation of e-business. Further, PMF2 mentioned that it is significant for government to develop the system in a way that practitioners both within and without can have confidence in the system. Contributing to the discussion, PML2 noted that security is the most significant factor in the establishment of e-business system. This was agreed to by SIMG who confirmed that within an e-business environment, security is vital and must take care of issues concerning data exchange and reliability issues where confidentiality of data must be maintained.

6.15.2.2 National ICT infrastructure for the implementation of e-business

Findings from this research demonstrated that the government has an significant role in promoting, adopting and use of e-business within the construction industry in Ghana. This was highlighted by three (3) respondents in CS2 as shown in Figure 6-8. PMF2 noted that a government led effort in providing or making available ICT infrastructure needed to aid e-business may have a positive impact on the development of the construction industry. Supporting PMF2, PML2 mentioned the need for incentives for Internet Service Providers (ISPs) so that issues of accessibility and affordability can be properly dealt with in order to encourage businesses to invest in this technology. Conversely, CIMG observed that national ICT infrastructure plays an significant aspect in e-business deployment. Therefore, the government's efforts in encouraging investment in the sector in relation to government policy to promote the use of ICT to improve business remain significant. In contrast, PML2 pointed out that national ICT infrastructure and Internet services for businesses lies not only in the physical aspect, issues of affordability must be addressed alongside.

6.15.2.3 Organisation's ICT infrastructure to support e-business

Five (5) respondents, including two (2) experts in CS2 as shown in Figure 6-8 identified organisation's ICT infrastructure as a significant aspect of e-business technology transfer. CRF recognised the significant role of foreign firms in improving the technological capacity

of the local firms they are working with. CRF explained that, to harness the benefits of the knowledge and skills acquired by the local firms during their collaboration activities, it is significant for the local firms to establish their own ICT infrastructure at the firm level in order to put their skills into use. PML2 and GML who are local contractors agreed and stated that ICT infrastructure at the firm level has the potential to bring to fruition their experiences and skills acquired from their foreign counterparts. For example, they cited ICT equipment, firms' network infrastructure as some of the development they put in place as a result of their partnership with foreign firms. In contrast, CIMG was of the view that it is significant for the local firms to approach implementation issues in a more strategic way. For example, CIMG note that, first and foremost, there must be an assessment of the firm's capacity and readiness and then follow by a clear policy spelling out steps to follow, including a coherent staff development scheme.

The following section addresses all four research questions as outlined in Section 1.6.3 in Chapter 1 in relation to CS3.

6.16 Case study 3 (CS3)

6.16.1 Introduction

This section presents finding from CS3 based on the background of CS3 (see Section 4.5.6.3 in Chapter 4).

6.17 Presentation of Findings from CS3

6.18 What are the bottlenecks in the works procurement process in the construction industry in Ghana?

Under research question one (1) bottlenecks associated with construction works procurement in the Ghanaian construction industry were investigated within CS3 in order to determine influential factors that have a negative impact on performance within the construction industry in Ghana. Furthermore, to determine factors influencing technological development within the construction industry in Ghana, the emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes as shown in Figure 4-10 in Chapter 4. The emerged themes, in particular, for research question 1 in CS3 as shown in Figure 6-9 were grouped under the

following themes: construction works procurement and political context. Findings under the themes are presented below.

Name	Sources
What are the bottlenecks in the works procurement process in the const	0
Construction Works Procurement	0
Lack of basic technology	4
Lack of skilled personnel	3
Procurement law	3
Political Context	0
Government	4
Strategy to promote e-business	3

Figure 6-9 Factors affecting works procurement process negatively

6.18.1 Construction works procurement

6.18.1.1 *Lack of basic technology in the procurement process*

The Research findings from CS3 interviews demonstrated that one of the biggest setbacks which has affected procurement activities and performance within the construction industry is a lack of basic technology. This factor was highlighted by four (4) respondents, including two (2) experts as indicated in Figure 6-9. For instance, CRF a foreign consultant who provided an expert view on the researched topic highlighted that, the low technological capacity of the local contractors within the Ghanaian construction industry has affected performance across the industry, including government office responsible for works procurement activities. For example, CRF noted that, the Internet may be found in some local organisations, but are not used to improve their work, meaning there is no knowledge and awareness within local firms as how to use the internet to transform the construction business activity. The findings highlighted by CRF were supported by CIMG. Contributing to the discussion, MGL a local contractor (FDI collaborator) highlighted non-availability of basic equipment such computers and printers. MGL moreover noted that, the problem partly may be laid on the ‘doors steps’ of government who for a long time failed to develop the needed infrastructure. PML3 moreover FDI collaborator agreed to earlier statements and added that, the majority of the industry practitioners do not have the required skills to effectively manage ICT related technologies, hence the low level of technology in the industry. PML3 argued that, lack of ICT skills, both technical and managerial skills have been the major obstacle in the development and performance of the construction industry in Ghana.

6.18.1.2 *Lack of skilled personnel in the construction industry*

Another factor under construction works procurement theme that has a negative effect on the procurement system within the Ghanaian construction industry was identified by three (3) interviewees in CS3 as indicated in Figure 6-9. Lack of skilled personnel to undertake procurement related activities. For instance, CRF a foreign consultant who provided expert opinion on the research topic revealed that the majority of the local construction firms do not employ qualified personnel to manage their organisations and projects. MGL explained how the construction industry has to deal with non-availability of skilled and professional staff as a result of the low financial capacity of local contractors to engage people who have the skills required by local contractors to manage and perform adequately on their projects. The above statement corroborated earlier finding by Laryea and Mensah (2010). PML3 another local contractor supported PML4 and further stated that the industry needs skilled personnel therefore, the industry has to change their approach by encouraging local contractors to recruit people with the requisite competences and qualifications.

6.18.1.3 *Procurement law in the context of construction works*

Under the construction works procurement theme in CS3 three (3) respondents as shown in Figure 6-9 identified the significance of the public procurement law in providing a level field for works procurement within the Ghanaian construction industry. In this respect the law provides the legal framework for all procurement in respect of goods, works and services procured with public funds partly or wholly (PPA, 2003). CIMG noted that the procurement law provides a control mechanism against abuse, however, the provisions and application of the details of the law to a particular project or job require a lot of paperwork, and a lot of energy is required during tender procedures and processes of dealing with volumes of documents manually. MGL a local contractor who has used the procurement law in their project procurement activities for both pre and post contract engagements agreed with its legal framework in the sense that the intention of the law was to provide fairness in the procurement and performance of a particular contract. However, the system requires a lot of man hours and it is quite frustrating. Generally, the majority of tenders are based on the traditional type where the contractors only submit tenders without knowing anything about the design solution making the procurement process quite cumbersome and difficult to monitor. PML3 conversely, support the argument advanced by CIMG and MGL. PML3 highlighted the tedious and expensive nature of the procurement process and the most

frustrating aspect is the human to human system created by the law. In this regard, PML3 argued that the purpose and intent of the law as earlier stated is defeated. Therefore, for a full realisation and benefit of the procurement system for the construction industry in Ghana, there is a need for the introduction of ICT to facilitate the deployment of e-business to support the performance within the construction industry.

6.18.2 Political context

6.18.2.1 Government influence on the procurement process

Four (4) interviewees, , including one (1) expert in CS3 as shown in Figure 6-9 stated that the government has a major role to play in improving the technological capacity of construction firms within the construction industry in Ghana through the provision of the needed infrastructure to support such capability development within the industry. However, most of the respondents submitted that there is no clear policy direction to support the construction industry in order to develop its technological capability and capacity to enhance performance within the construction industry. One positive development that was referred to by CRF was government recent initiative in expanding Internet access across the country. CRF and PML3 agreed that government has the responsibility to provide the enabling environment for ICT to thrive in the economy. Furthermore to earlier statements, PML4 suggested that government can play a role in supporting the industry with trainings and facilities that can enhance their capacity and efficiency. By so doing PML3 was of the view that good business culture and injection of basic technology for work within the industry can be achieved.

6.18.2.2 A strategy to promote e-business in the construction industry

A strategy to promote e-business technology by the government within the construction industry was identified by three (3) interviewees, including one (1) expert (see Figure 6-9 in CS3) as one of the major factors to improve technological capacity of the local contractors within the construction industry. For instance, ITMF a foreign contractor mentioned that one effective way to promote the use of e-business in the industry is by government encouraging local contractors to build their capacities in order to take advantage of the numerous government interventions in ICT trainings. For example, ITMF stated that, government may start by listing project on a PPA website where all can visit, download and print out tender document(s) other relevant project documents, this can come in the for form of government to

business (G2B) arrangement (see Section 2.6.6 in Chapter 2). Conversely, PML3 mentioned that one another effective way of getting industry to use e-business can be achieved through government, industry collaboration to develop strategies to promote skills development to support e-business technology application within the industry. PML3 moreover noticed a positive intervention by government instituting ICT training schemes across the country, this can support the industry ICT skills needs in future. CIMG procurement specialist and e-government procurement project consultant explained that e-business has the potential to improve performance in the construction industry. In this direction the government has initiated an e-government procurement project as a means of transforming the economy, curbing corrupt acts and improving project procurement in the ICT environment.

The following section addresses the research question two (2) as outlines in Section 1.6.3 in Chapter 1 which deals with the foreign contractor's role in supporting skills development and e-business technology transfer to the construction industry in Ghana in CS3.

6.19 What motivates foreign contractors to support skills development and e-business technology transfer to the construction industry in Ghana?

Under research question two (2) foreign firm's support for skills development and e-business technology transfer to local contractors in the construction industry in Ghana was investigated within CS2 in order to determine influential factors that promote skills development within the construction industry in Ghana. These emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 2 in CS2 as shown in Figure 6-10 were grouped under the following themes: business strategy of foreign firms and improving capability. Findings under the themes are presented below.

Question 2-CS3		
Name	Sources	
What motivates foreign contractors to support skills development and e-business t	0	
Business Strategy by Foreign Firms	0	
Construction business environment	3	
Long term business relationship	3	
Improving Capacity	0	
Foreign firms Collaboration	3	
Low capacity of local firms	4	
Pressure from foreign firms	2	

Figure 6-10 identified factors for skills and e-business development

6.19.1 Business strategy

6.19.1.1 Construction business environment in Ghana

As indicated in Figure 6-10 under the business strategy theme in CS3, it was emerged that foreign firm, consider knowing their business environment as an significant aspect of supporting local construction firms to develop. This was highlighted by three (3) respondents in CS3. For instance, CRF noted that it is significant to know your new working environment and the local team you have at hand, adapting to the business environment and cultural issues would enable a foreign firm to establish firmly. On the side of ITMF a foreign firm working together with some local construction firms mentioned that partnering with home grown Ghanaian firms on their residential projects has proved highly successful. PML3 a local firm in partnership with PMF3 highlighted the significant role ITMF is playing in developing their capacity, technologically (using computers and the Internet to perform work) and moreover for their part in supporting them to settle in the construction industry in Ghana.

6.19.1.2 Long term business relationship

Under the business strategy theme, three (3) respondents in CS3 as shown in Figure 6-10 agreed that establishing long term business relationship plays an significant role in improving technology transfer activities from foreign firms to their local counterparts. For example, CRF commented that establishing long term relationship with local partners is very significant in supporting local firm to build relationship with their foreign counterparts leading to an understanding of different cultures. This was supported by ITMF a foreign contractor who added that long term relationship and capacity development, especially in technology transfer activities are inseparable; it provides different levels of interaction necessary for learning.

Adding further to the discussion MGL mentioned that the good relationship between them and their foreign counterparts provided, enabling environment to undertake several capacity development activities in support of e-business technology transfer.

6.19.2 Improving firm's capacity

6.19.2.1 Foreign firm collaboration in the Ghanaian construction industry

Three (3) respondents in SC3 as shown in Figure 6-10 stated that foreign firm collaboration within the Ghanaian construction industry can be considered as an significant aspect of the capacity improvement leading to e-business technology transfer. For instance, ITMF a foreign contractor mentioned that local firms that are working with them have the opportunity to learn from them directly using ICT together with the Internet. ITMF further explained that the local firms moreover have the opportunity of experiencing using the Internet to transfer project documents to partners within Ghana. Conversely, MGL a local contractor observed that since they came together with their foreign counterpart, there is evidence of technology development especially ICT and the internet. For example, MGL noted that before the FDI arrangement, all of their office work was done manually, but now all the permanent staff are computer literate, every office has networked computers and other equipment to support their work. PML3 moreover a local contractor explained that the benefits of their collaboration are application of some relevant project management tools. Most significantly, PML3 explained that their constant interaction with the foreign contractor in the project environment led to direct and in some cases the indirect acquisition of knowledge and skills which will remain in the construction industry in Ghana.

6.19.2.2 Low capacity of local firms

Existing capacity of local construction firms under the improving firm's capacity theme has been identified by four (4) respondents as low (see Figure 6-10). The respondents in CS3 were of the view that there is a need to develop and upgrade the capacity of local firms in Ghana and this can be achieved through foreign and local firm collaborations. CRF agreed that foreign firms play a major role in improving on the existing capacity of local firms who are in partnership with them. Especially, it is considered as a means to continue with their business relationship with local firms when their capacity is brought to a minimum level. According to ITMF for a meaningful transfer of e-business technology capability by a foreign

firm, there is the need for local firms to attain some minimum level of capacity improvement. To achieve this minimum capability, MGL suggested that the industry players have to collaborate with relevant institutions to support capacity improvement and development across the industry. PML5 agreed and further submitted that, there is an urgent need to work towards improving the existing capacity of practitioners as a means of championing the development agenda of the industry. PML3 moreover identified the positive development within their organisation as a result of their FDI arrangement. PML3 cited some of the benefits they have gained in the areas of ICT skills, computers and technical support. This has enhanced their firm's image and capacity during the period of this FDI collaboration.

6.19.2.3 *Pressure from foreign firms to improve upon technological and management capacities of local firms*

As shown in Figure 6-10 in SC3 pressure from foreign contractors emerged as one of the most significant drivers in improving the technological capacity of local contractors in collaboration with foreign firms. As identified in Figure 6-10 already, this was pointed out by two (2) respondents who are local contractors. MGL agreed that foreign firms put demands that require the use of computers and the Internet. For example, it was generally agreed with them that, communication will come to all partners in the form of emails so there was a need to install the facility that can support our firm in that respect. This was supported by PML3 who noted that pressure from the foreign firms played a significant role in the development of their firm's technological capacity. One significant benefit that has resulted in this was the zeal to meet deadlines as administrative and communication issues have been taken care of by the Internet facility.

The following section addresses the research question three (3) as outlines in Section 1.6.3 in Chapter 1 which deals with using e-business technology to promote construction business improvement in Ghana in CS3.

6.20 How does e-business technology promote construction business improvement in Ghana?

Using e-business technology to promote construction business improvement in Ghana was investigated within CS2 under research question three (3) in order to determine influential factors that have a negative impact on e-business introduction and potential benefits of e-business within the construction industry in Ghana. These emerging factors from the

interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 3 in CS2 as shown in Figure 6-11 were grouped under the following themes: implementing e-business, management and skills development. Findings under the themes are presented below.

Name	Sources
How does e-business technology promote construction business imp	0
Implementing e-Business	0
Benefits of e-business to firms	5
E-business barriers	4
Management	0
Efficiency of business process	2
Quality of firms	5
Skills Development	0
Acquisition of new skills	4

Figure 6-11 identified factors that promote e-business in construction

6.20.1 Implementing e-business

6.20.1.1 *Benefits of e-business to local firms*

As illustrated in Figure 6-11 in CS3 benefits of e-business to local construction firms emerged as one significant area that can play a major role in the improvement of performance within the construction industry in Ghana. To this end, foreign firms are considered by their local counterparts to have an influence in building the capacity of local firms to take advantage of the benefits of e-business in construction in Ghana. This was identified by five (5) respondents, including two (2) experts who provided a general perspective on the research topic. CRF a foreign consultant explained that foreign firms have demonstrated to their local counterparts in some practical activities of e-business within a project environment. CRF further cited examples of e-business as a process facilitator, where things are delivered on time. ITMF a foreign contractor supported CFR and then explained further that it supports their communication policy in terms of sharing project information and in many cases as demonstrated to local partners, it enhances project delivery in different ways. For example, project management activities, project collaboration initiatives are some of the benefits that have accrued to them, including their local partners in Ghana. However, MGL noted that there are difficulties within the construction industry to accept and use computers for their work, this is due to the fact that the majority of professional and decision makers are quite old and

who would not like to change their ways of working. MGL, based on their experience since they started working together with a foreign firm highlighted the following benefits: it provides data storage facility, cut down on human to human interaction which may have the potential to reduce procurement related corruption, facilitation of quick result as it speeds up work and faster means of accessing information and communication. To this end and in the context of the Ghanaian construction industry, e-business provides a basic integrated environment for professionals to engage. PML3 agreed and observed that e-business has the potential to improve performance in the construction industry in Ghana when implemented in the industry. Supporting earlier findings, CIMG observed that e-business can achieve reduction in processing time and management of contracts, the possibility of submitting tenders online, there would be no need to travel to present bids, additionally reduction in courier costs.

6.20.1.2 *Barriers to e-business in construction*

Under the implementing theme in CS3, four (4) interviewees identified that foreign firms play an significant role in capacity improvement and transfer of e-business technology. However, the interviewees as shown in Figure 6-11 are of the view that there are barriers to deal with in order to achieve a smooth implementation of e-business technology within the construction industry in Ghana. For instance, CRF noted that one challenge that can affect e-business implementation within the Ghanaian construction industry has been identified as lack of office space and proper governance structure for effective implementation of technology such as e-business. For example, ITMF a foreign contractor mentioned that the Internet facility which is the main facilitator of e-business and useful for business improvement is rather expensive as a result the majority of local firms are unable to exploit this technology. ITMF further identified personnel and awareness of the potentials of e-business in the development and improvement of performance in the construction industry in Ghana as a major challenge facing the construction industry in Ghana. In assessing the situation in the industry, MGL observed that the majority of professionals within the industry are quite old and would not want to change their way of working as lack of knowledge and awareness of the potential benefits of e-business rendered them to think that ICT based systems may not bring anything new to their work. As noted earlier by PML3, the high costs associated with investment were again captured by MGL. For example, financial issues have been largely identified by all the interviewees as a barrier to implementation of e-business. All the local firms who participated

in CS3 cited non-availability of projects; this according to PLM3 put local firms in a difficult financial situation which prevent them from recruiting technical and ICT skilled personnel.

6.20.2 Management

6.20.2.1 *Efficiency of business process in construction*

Two respondents in CS3 as shown in Figure 6-11 agreed that implementing e-business can significantly influence business processes within local firms in Ghana. Improving performance through e-business technology transfer is an significant strategy that can inject efficiency into the business process within the construction industry in Ghana. For example, MGL a local contractor, coupled with a foreign construction firm argued that procurement system and general performance within the construction industry can become more efficient. Making reference to their engagement with a foreign firm, MGL noted that there is the need to improve the capacity of local construction firms in order to support them with some basic ICT tools and equipment that are required to facilitate the implementation of e-business. In support of MGL, MPL3 who is moreover a local contractor noted that business process within the Ghanaian construction industry is not efficient, therefore, there is need to re-engineer the process of doing business through e-business to enhance performance within the industry (see Section 2.12.1.1 in Chapter 2).

6.20.2.2 *Quality of local firms*

In Figure 6-11 in CS3 five interviewees identified the significant role of e-business to promote quality of local firms within the construction industry in Ghana. They further agreed that improving technological know-how of local construction firms by their foreign counterparts can act as a catalyst in enhancing quality and improve the image of local firms in Ghana. In this direction ITMF a foreign firm agreed to policy of improving the capability of their local counterparts in line with Technology Transfer Agreements (TTA) LI 1574. However, CRF observed that the major problem with local construction firms in Ghana is that they lack technological capability and skilled staff to prosecute projects satisfactorily. CRF was of the view that those local construction firms that are coupled with foreign firms have an opportunity to develop their capabilities rapidly in order to enhance the quality of their firms. Supporting CRF, MGL a local contractor noted that there is evidence of benefits accruing from their involvement with a foreign firm, their staff are confident in using computers, the

majority of them confirmed having their personal email addresses. It is worth mentioning that through education and in-house capacity trainings the personnel have received over the period, the firm is better placed in decision making which is deemed to have impacted positively on the quality of the firm. MGL further expressed the following view(s):

“...the Internet has supported our internal work and communication activities...”

PML3 underscored the significant role foreign firms are playing in improving their capabilities technologically and managerially. However, PML3 still believes that the construction industry in Ghana is not developing as expected due to factors such as inadequate personnel, lack of investment in the industry as observed earlier. PML3 further argued that this phenomenon is having a negative impact on the quality of local firms. CIMG noted that as much as FDI in the construction industry is beneficial, there is need to provide a proper and acceptable mechanism that can promote FDI within the construction industry.

6.20.3 Skills development

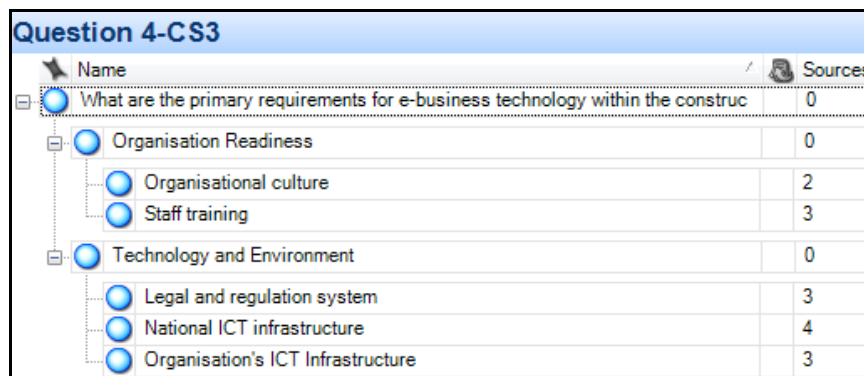
6.20.3.1 Acquisition of new skills through FDI collaboration

Four (4) interviewees, including two (2) experts in CS3 under the skills development theme as shown in Figure 6-11 identified that foreign firms play a major role in supporting skills development targeted at using ICT equipment and managerial functions within a project environment. CRF for instance, observed the poor level of skills within the construction industry in Ghana and highlighted the significance of the influential roles foreign firms are playing in improving skills in the industry. In supporting the statement by CRF, CIMG mentioned that from a general perspective, a collaboration of this nature is expected to improve ICT skills where personnel are able to deal effectively with ICT related issues in the firm. MGL a local contractor who is working with a foreign firm underscored the significance of their collaboration and its positive impact on skills development. For example, MGL explained that project management, planning and scheduling and communication skills are some significant project related skills they have acquired over the period. PML3 conversely, highlighted computer based forecasting, recording and analysis of site activities and site management skills as some significant skills their personnel have acquired as a result of working with a foreign firm.

The following section addresses the research question four (4) as outlined in Section 1.6.3 in Chapter 1 which deals with primary requirements for e-business technology within the construction industry in Ghana in CS3.

6.21 What are the primary requirements for e-business technology within the construction industry in Ghana?

Primary requirements for the establishment of e-business technology within the Ghanaian construction industry was investigated within CS3 under research question for (4) in order to solicit industry practitioners and experts, perspectives on minimum capacity for the introduction of e-business within the construction industry in Ghana. These emerging factors from the interviews were recorded in NVvo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes (see Figure 4-10 in Chapter 4). The emerged themes, in particular, for research question 4 in CS3 as shown in Figure 6-12 were grouped under the following themes: organisation readiness and technology and environment. Findings under the themes are presented below.



Name	Sources
What are the primary requirements for e-business technology within the construc	0
Organisation Readiness	0
Organisational culture	2
Staff training	3
Technology and Environment	0
Legal and regulation system	3
National ICT infrastructure	4
Organisation's ICT Infrastructure	3

Figure 6-12 Fundamental requirements for e-business technology transfer

6.21.1 Organisational readiness

6.21.1.1 *Organisational culture in the context of e-business technology transfer*

Under the organisational readiness theme in CS3 two (2) respondents who are local contractors (MGL and PML3) coupled with foreign firms agreed that organisational culture plays an significant role in introducing e-business as part of technology transfer activity within an organisation (see Figure 6-12). For example, MGL explained that before joining with a foreign firm, project activities, mostly those that concerns administrative engagements

are manually conducted. Basically, the organisational culture reflects the way business is conducted over the years (Martins and Terblanche, 2003). MGL further noted that, one significant lesson from working with a foreign firm for the purposes of technology transfer; there is the need to transform the culture of the organisation first and foremost through capacity development training and orientation. For example, MGL explained the benefit of organisational culture transformation as follows:

‘...our work culture changed as a result of several encounters we had with our partners. Additionally, we have seen them used ICT and the Internet for their work... we have picked the skills which helped us to speed up our work and brought us progress and improvement to our business...’

Conversely, PML3 mentioned that the FDI project has enhanced their technological culture and attitude to work.

6.21.1.2 Staff training for local firms

In Figure 6-12 three (3) interviewees, , including one (1) expert in CS3 as shown in Figure 6-12 agreed that the most significant activity to undertake when preparing to introduce e-business is building the capacity of staff in order to bring them to understand the concept and philosophy of e-business. CRF pointed out that the most basic thing to do that can support a fast e-business technology transfer to local firms is developing the capacity of staff that would be ready to accept e-business and use it. When this basic requirement is met, taking it further through FDI project environment may be an easier thing for the foreign firms. In support, MGL underscored the significance of training as key requirement that can support the successful transfer of e-business technology. For example, MGL explained that through training organised by their foreign counterpart, the concept and benefits that can accrue from using e-business was adequately explained to them. The processes are well understood and the level to start thinking about the implementation of e-business, however, the key thing is the training we have had and the explanation of the philosophy of e-business. MGL further expressed the following view(s):

“...after all we hear about these every now and then, but for me the most significant thing is about education and the understanding of things that can be achieved through the application of e-business...”

PML3 supported the views expressed by MGL in the above statement and further submitted that capacity development in areas of management and technical upgrading remains an significant requirement for e-business technology transfer. Hence, local firms ought to develop personnel capacity development strategy in order to be ready to start the technology transfer process.

6.21.2 Technology and environment

6.21.2.1 *Legal and regulation system to support e-business*

Under the technology and environment theme in CS3 as shown in Figure 6-12 three respondents highlighted the significance of adequate legal and regulatory regime for successful implementation of e-business. For instance, CRF noted that for Ghana as whole to take advantage of e-business, one key requirement for successful implementation of e-business a good legal and regulatory environment. This is the only way business can be transacted confidently via an e-business platform. MGL a local contractor was of the view that government ought to concentrate on the formulation of laws that can protect e-business activities. In supporting SIMG mentioned that security is an significant element of effective utilisation of e-business, therefore, there should be laws to ensure that data is exchanged reliably.

6.21.2.2 *National ICT infrastructure for the implementation of e-business*

Another basic requirement for implanting e-business as identified by respondents in CS3 is the provision of national ICT infrastructure. Under the technology and environment theme as shown in Figure 6-12 three respondents agreed that national ICT infrastructure is a key element in implementing e-business. Documents available suggest that the government is expanding ICT/internet infrastructure across the country which is intended to support and facilitate e-government procurement project. CRF noted that the availability of a national infrastructure serves as a motivator for companies to connect at an affordable rate. Buttressing the point by CRF, ITMF a foreign firm noted that it is significant for government to provide the enabling environment Furthermore to encourage investment in the area. PML3 a local contractor suggested that the construction industry players and groups must concentrate efforts in bringing their members together to take advantage of the availability any such infrastructure. SIMG explained that government intervention in the provision and expansion

of the Internet infrastructure is a positive development in the promotion of e-business within the Ghanaian economy. It is expected that e-business activities within construction will pick up when Ghana government e-government procurement project is fully implemented.

6.21.2.3 Organisation's ICT infrastructure to support e-business

Three (3) respondents in CS3 under technology and environment theme identified organisation's ICT infrastructure as an significant requirement for the implementation of e-business (see Figure 6-12). ITMF a foreign firm noted that, organisation's own ICT infrastructure is one of the basic needs that can support e-business implementation at the organisational level. Network infrastructure at the organisational level naturally encourages personnel who have been trained are motivated to accept and use the system and further develop their skills as they continue to use it. MGL a local contractor agreed and stated that since the establishment of their collaboration there is evidence of benefits in this direction. For example, personnel have the ability to use computers in a network environment, improvement of their computer skills and the ability to use search engines. This is as a result of the availability of computers and the Internet at the premises of the firms. PML3 moreover a local contractor mentioned that foreign firms have influenced them significantly in improving their technological capability at the firm level. However, the bigger problem lies within the construction industry where the majority of the construction firms who do not have the opportunity to improve their capacity to operate computer facilities.

6.22 Summary and link

This chapter of this thesis presents key research findings from within cases based on qualitative research approaches. A total of three (3) case studies (CS) was conducted to investigate four (4) research questions as outlined in Section 1.6.3 in Chapter 1 which aimed to achieve the aim and objectives of this research (see Sections 1.6.1 and 1.6.2 in Chapter 1). CS1, CS2 and CS3 were FDI projects selected based on the criteria establish in Section 4.5.5 in Chapter 4 of this thesis. Findings from the three (3) case studies revealed the current situation within the Ghanaian construction industry, they include: lack of competency in management; the need for ICT skills development was highlighted in order to facilitate the implementation e-business, and improving the limited knowledge about e-business. By identifying and addressing these issues it is expected that e-business technology transfer to the Ghanaian construction industry can be successful. The next chapter focuses on cross case

analysis and synthesis of individual cases presented in this chapter, with references to relevant literature and the questionnaire survey.

CHAPTER 7 : CROSS CASE ANALYSIS

7.1 Introduction

This chapter is designed to provide a cross case analysis and discussion of the questionnaire survey and three case study presents in Chapters 5 and 6 respectively, and to make comparisons with key literature findings presents in chapters 2 of this thesis. The discussions in this chapter are based on comparisons of findings across the three case studies (CS1, CS2 and CS3) and questionnaire survey. The approach for discussion is broadly designed based on the research questions presented in Section 1.6.3 in Chapter 1 and it is set as follows: First, research question 1 which relates to bottlenecks associated with construction management activities, including procurement in the Ghanaian construction industry was discussed. Second, research question 2 which investigated foreign contractor support in skills development and e-business technology transfer to the Ghanaian construction industry was discussed. Third, research question 3 investigated the use of e-business technology to promote construction business improvement in Ghana was discussed. Fourth, research question 4 which deals with primary requirements for e-business technology within the Ghanaian construction industry are discussed and finally, key findings from the cross case were used to refine the conceptual framework implemented in this research during the early stages of the research.

7.2 Case studies results

Based on research questions (see Section 1.6.3 Chapter 1), the following sections analysed and discusses findings from CS1, CS2 and CS3 and comparisons of emerged themes from NVivo ten software across the three case studies (see Section 4.8.3.2 and Figure 4-9 and Figure 4-10 in Chapter 4). For the purposes of analysis and clarity of discussion, the themes were assigned numbers based on the frequency of occurrence across the CS. When a particular theme or factor occurred across all the CS it implies that it is a common concern to the interviewees. Moreover, single occurrences are considered as unique occurrences hence treated with equal significance as a single occurrence of a particular factor across the three CS could present a unique case for consideration. Consistent with the aim of this research, key factors derived from the analysis in this chapter are used to refine the conceptual framework implemented in the earlier stages of this research.

7.2.1 What are the bottlenecks in the works procurement process in the construction industry in Ghana?

Research question 1 was investigated within the three case studies. Findings are presented in Sections 6.6.1, 6.13.1 and 6.20.1 in Chapter 6. This section of this research analysed and compared emerged themes or factors from the sections and chapter noted above. For the purposes of analysis and discussion, the emerged themes from the three CS showing numbers of occurrences across the CS are presented in Table 7-1.

7.2.1.1 Discussion of findings and synthesis

The discussion in this Chapter was primarily based on the analysis and discussions on the previous chapter (Chapter 6). To maintain quality of scale, Table 7-1 was derived from NVivo outputs as illustrated in Figure 6-1 - Figure 6-4 in CS1 in Chapter 6, and this process of achieving quality of scale was applied to subsequent Tables (Table 7-1 - Table 7-4) in this chapter.

Table 7-1 Key issues emerged from case study research question 1

Constructions works procurement Factors	CS1			Construction works procurement Factors	CS2			Construction works procurement Factors	CS3			Total No. of occurrences	Summary of intervention
	Summary of influence factors	No. of occurrences	Source		Summary of influence factors	No. of occurrences	Source		Summary of influence factors	No. of occurrences	Source		
Institutional framework	Lack of understanding. Inadequate management skills.	2	Fig. 6	No details provided	No details provided	N/A	N/A	No details provided	No details provided	N/A	N/A	2	Improve capacities of local firms
Lack of technology	No computers. Manual process	4	√	Lack of basic technology	No Internet. No computers.	4	Fig. 6	Lack of basic technology	No internet access. No computers & printers. Inadequate infrastructure. Lack of ICT skills.	4	Fig. 6	12	Need for equipment support and awareness of ICT and e-business
Lack of skilled personnel	Low procurement skills. Low project management skills.	4	√	Lack of skilled personnel	No training schemes. Low management skills.	3	√	Lack of skilled personnel	Unskilled managers. Financial constraints.	3	√	10	Education/training and continuous professional development
Procurement law	Poor understanding of details. Manual process.	3	√	Procurement law	Costly process. Manual process. Less transparent.	3	√	Procurement law	Manual process. Excessive paperwork.	3	√	9	Need for seminars/workshop on provisions of the law
Political context													
Factors													
Government	Interference	3	Fig. 6	Government intervention in ICT skills development	Skills training facility. Strategy for ICT skills training.	2	√	Government	Infrastructure (Internet/electricity). Policy to support training	4	Fig. 6	9	The provision of national infrastructure, i.e. Internet and electricity
A strategy to promote e-business	Awareness of e-business. Commitment from government.	3	√	A strategy to promote e-business	Access to internet facility. Understanding the philosophy	3	√	A strategy to promote e-business	Government, industry collaboration.	3	√	9	Encourage both government offices responsible for procurement and industry players to

					of e-business.								use e-business
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The findings from the case studies (CS) regarding research question 1 demonstrated that under construction works procurement theme four (4) issues are of significance to the improvement of the construction work procurement process as shown in Table 7-1. The findings suggested that these issues are common to all the three CS. Under works procurement, institutional framework occurred once under CS1 (see Table 7-1) which, equally can be of significance to the entire process. The impact of institutional framework on the capacities of the local construction firms can have a consequential effect on works procurement process, although it occurred only in just one of the cases. Institutional framework here refers to the specific process that has to be rolled out in line with the requirements of the procuring entity's financial approval threshold and in most instances the red tape that surrounds it makes it very difficult for some firms to understand hence a critical issue that needs to be addressed. In this particular instance finding, reported in CS1 (see Section 6.6.1.1 in Chapter 6) suggested that most local construction firms operating within the industry lack the capacity to follow and understand the institutional framework provided in the procurement law of 2003. Although represented by just two occurrences (see Table 7-1) in CS1, by no means it is an insignificant factor. Furthermore, it was highlighted by AML that *“one of the causes of delays in the procurement process is the institutional arrangement that has been provided by the procurement law of 2003.”* capacity challenges facing local firms has been identified by AML and PML1 as reported in CS1. The reason this factor appeared once may as well be ascribed to the fact that local firms, perhaps find it difficult to understand the effect it has on the procurement process, even though it can be compared to other factors identified. Although it occurred only in CS1, it presents a unique case that requires the attention of stakeholders within the industry and policy initiatives by the government procurement office to improve the capacities of the local firms through training activities. Further, it is significant to submit that, the interpretation of the law into a programme of action within the procurement process is a good thing to get right the first time as identified by the CS1 respondents. Such knowledge and understanding can be improved through continuous training and professional development.

Another factor that has a negative impact on the procurement process is lack of technology (see Table 7-1). The findings suggested that this factor or theme is a common concern to all the three CS as shown by the interviewees. As indicated in Table 7-1, CS1, CS2 and CS3 highlighted lack of technology that include both the hard and software elements, thus lack of computing facilities as a negative influence on the improvement of the construction procurement process (see Sections 6.6.1.2, 6.12.1.1 and 6.18.1.1 in Chapter 6) implying that,

it is found as a common concern across the three CS compared with institutional framework which occurred once in CS1. As reported in CS1 AML observed that ineffective communication and poor quality of work are a common characteristic of the Ghanaian construction industry. It is therefore, suggested that e-business can resolve communication difficulties and brings about timely information flow within the procurement process. This statement is consistent with London and Bavinton (2006), who argued that e-business technology provide commercial efficiencies in construction information, procurement and contract management. The results from the questionnaire survey moreover suggested that the technological capacities of local construction firms are quite low in terms of using ICT and the Internet to improve the procurement process. For example, exchanging of project related documents electronically are not done to support e-business as they appeared not to have any deliberate policies to implement e-business, however, this capabilities can be enhanced to deliver e-business within these organisations (see Sections 5.4.1.1 and 5.4.1.2 in Chapter 5). As observed by Iddris (2012) insufficient knowledge about e-business accounts for low e-business activities among local firms. On a similar note, the discussion on capacity development received much attention. For example, Section 2.17.4 in Chapter 2 was based on the current status of the Ghanaian construction industry in which capacity and capability in terms of developing the construction industry were explored. Consistent with the discussion in Section 2.12.2 capacities are about the question of local firm's ability to employ staff who can receive training and continuous professional development in order to improve performance within their firms (Vincent, 2008, ECITB, 2013). Conversely, capabilities within the Ghanaian construction industry has to do with the ability to get things done efficiently utilising available competencies (Vincent, 2008). To move forward in dealing with technology gap identified earlier (see Section 1.4 in Chapter 1), the discussion and analysis similarly identified specific capacity development action that is required from local firms, these include: awareness and contribution of e-business; self-initiative capacity development; capacity development through education, training/workshop and exchange of ideas through local collaborations. It is believed this can have a long term impact on the capacity development of local firms within the construction industry if conducted through a structured industry led programme.

As shown in Table 7-1 lack of personnel and procurement law are a common concern to all the three CS. The interviewees explained that these themes or factors have negatively impacted the procurement processes within the Ghanaian construction industry. As pointed out in the previous discussion, improving personnel capacities and capabilities of local

contractors through training and continuous professional development would have direct impact on procurement law factor in the procurement processes. Lack of skilled personnel was highlighted by interviewees in all the three CS as shown in Figure 6-1, Figure 6-5 and Figure 6-9 in Chapter 6. CS1, CS2 and CS3 noted at different stages with different expressions based on their experiences in the industry (see Sections 6.6.1.3, 6.12.1.2 and 6.18.1.2 in Chapter 6). For example, it is reported in CS1 by PMF1 that “...*Ghanaian construction practitioners are generally ill-trained; they lack basic skills in handling procurement and general day to day project management issues...*” The reason for this phenomenon was linked to poor financial capacities of local firms to recruit qualified staff and continue to train them (Laryea and Mensah, 2010). MGL in CS3, advocated for a paradigm shift through skills development within the industry. Analysis of CS1, CS2 and CS3 underlined the need to have industry led training schemes as previously discusses in Section 2.17.2 in Chapter 2 with specific emphasis on training centres moreover continuous professional development within the industry. This is the only way the industry can develop the capacities and capabilities of personnel and this can form the basis for providing adequate skilled personnel within the industry which ultimately can enhance any future collaboration with foreign firms. Conversely, a significant number of interviewees (9) noted that poor understanding of the procurement law demonstrated by local firms is linked to the poor nature of personnel working within the local organisations. In this context the details of the procurement law as it applies to the procurement process can be referred to; administrative and institutional arrangements and procedures stipulated for procurement activities. They seem not to be conversant with the details of the procurement law. CIMG as reported in CS1 and CS3 noted that this is exacerbated by the manual process advocated by the procurement law (see Section 6.6.1.4 and 6.18.1.3 in Chapter 6). Furthermore, interviewees explained that the time consuming nature of the procurement process is as a result of poor procurement skills of personnel within the industry. For instance, AML in CS1 observed that skills shortage and lack of technology in the procurement process render the entire process inefficient and time consuming (see Section 6.6.1.3 in Chapter 6). The way forward in a situation like this within the industry can be achieved through investment, in seminars and workshops on the provisions of the procurement law ostensibly to improve their understanding and professional image of personnel working in the industry.

Under political context (see Table 7-1) three factors emerged, namely: government; a government strategy in ICT skills development and strategy to promote e-business. Findings from CS1 and CS3 suggested that government (occurred in two CS see Table 7-1) has a role

in improving the procurement process. CS organisations identified inadequate national infrastructure for electricity and Internet (see, for example, Section 6.6.2.1 in Chapter 6). For example, an interviewee in CS3 identified that the provision of technology infrastructure can support capacity and capability development (see Section 6.18.2.1 in Chapter 6). This finding is consistent with the discussions in Sections 2.19.1.1, 2.19.1.2 and 2.19.1.3 in Chapter 2. In contrast, government strategy in ICT skills development occurred once under CS2 (see Table 7-1). Perhaps the initiative was not designed specifically to address the skills problem within the construction industry, hence considered insignificant by the interviewees. However, two interviewees in CS2 (see Figure 6-5) identified government intervention in ICT skills development through the creation of an institution purposely to train the youth as a positive intervention. For instance, PML2 in CS2 in Chapter 6 noted that it will go a long way to support the construction industry in the future. With reference to ICT training, PML3 in CS2 noted a need for a government led strategy. It is of significance to the construction industry to partner government to fashion out specific ICT skills training for the industry. Making such skills available throughout the country can improve the skills base of the industry as these personnel would be available within the industry. The third factor under the political context theme is a strategy to promote e-business. The finding suggested that this factor is a common concern to all the interviewees (see Table 7-1). This factor came up in CS1, CS2 and CS3 as shown in Table 7-1. The concern shown by the interviewees in this factor supports the argument that government has the responsibility to encourage local businesses to harness the potentials of e-business through incentives and support for the local firms to develop their technological capabilities. Arguably, e-business is one surest way to manage and deal with the numerous bottlenecks associated with the procurement process within the Ghanaian construction industry. PMF2 in CS2 in Chapter 6 explained that for a real gain, there is a need for continuous education and training directed at local construction firms. This observation was corroborated by a foreign contractor ITMF (see Section 6.18.2.2 in Chapter 6) noting that one effective way to take advantage of e-business is through encouragement of local construction firms to undertake specific capability development through ICT trainings. Conversely, PML3 moreover supported the strategic skills development plan to support the use of e-business technology within the Ghanaian construction industry.

7.3 Summary and key issues

This section discusses and synthesised findings based on research question 1 as presents in Section 1.6.3 in Chapter 1. Key findings considered as bottlenecks associated (see Table 7-1) to the procurement process within the Ghanaian construction through further analysis and synthesis of findings presents in Sections 6.6, 6.12 and 6.18 in Chapter 6. The factors working against improvement within the construction were identified. It was argued that to deal with capacity and capability gap identified earlier in the discussion, the discussion identified specific capacity development action that is required from local firms, these include: awareness and contribution of e-business; self-initiative capacity development; capacity development through education, training/workshop and exchange of ideas through local collaborations, while government has the responsibility of providing the enabling environment through the provision of infrastructure for the deployment of e-business technology.

The following section discusses and summarised results from research question 2 which explored the interest behind foreign firm's efforts to support skills development and e-business technology transfer to local construction firms within the Ghanaian construction industry.

7.3.1 What motivates foreign contractors to support skills development and e-business technology transfer to the construction industry in Ghana?

Foreign firms support for skills development and e-business technology transfer to local contractors in the construction industry in Ghana was investigated within CS1, CS2 and CS3 (see Figure 6-2, Figure 6-6 and Figure 6-10 in Chapter 6) in order to determine drivers that promote skills development and e-business technology transfer within the construction industry in Ghana. Earlier discussion of drivers to construction e-business (see Section 2.10.2 in Chapter 2) demonstrated some relevant drivers to construction based on the work of Eadie *et al.* (2007) which can be seen in Table 2-2 in Chapter 2. The emerged themes from the interviews were recorded in NVivo 10 first as free nodes (see Figure 4-9) and then further grouped into themes as tree nodes as shown in Figure 4-10. The emerged themes, particularly for research question 2 were grouped under the following themes: business strategy of foreign firms and improving capability as shown in Table 7-2.

7.3.1.1 *Discussion of findings and synthesis*

Table 7-2 Key issues emerged from case study research question 2

Business strategy Factors	CS1			Business strategy Factors	CS2			Business strategy Factors	CS3			Total No. of occurrences	Summary of intervention
	Summary of influence factors	No. of occurrences	Source		Summary of influence factors	No. of occurrences	Source		Summary of influence factors	No. of occurrences	Source		
Construction business environment	Business continuity. Manual activities.	2	Fig. 6-2	Construction business environment	Knowledge of business environment. Creation of business associates.	2	Fig. 6-6	Construction business environment	Building local teams. Local partnership	3	Fig. 6-10	7	Improving capacities in project management activities.
Business relationship & partnership	Working together with local firms. Long term business relationship.	2	√	Business relationship & partnership	Business successes.	2	√	Business relationship & partnership	Building relationships. Understanding cultures.	3	√	7	Encouraging interactions for learning. The opportunity to improve capacity
Improving capability													
Factors													
Existing capability of local firms	Lacks technological capacity. Lacks experience and skills in project management	3	Fig. 6-2	Existing capability of local firms	Low standard output. Unqualified staff. Poor communication structure.	4	Fig. 6-6	Low capacity of local firms	Business relationship influences	4	Fig. 6-10	11	Provision of training in project management. Computer facilities. Expansion of Internet access.
Pressure from foreign firms	Inadequate capacities in technology and management skills.	2	√	Pressure from foreign firms	Low culture of e-business.	4	√	Pressure from foreign firms	A driver in improving technological capabilities.	2	√	8	Installation of computer facilities. Improve access to computers and the Internet.
No details provided	No details provided	N/A	N/A	Foreign firm collaboration	Low capacity in management and technological skills.	4	√	Foreign firm collaboration	Experience the use of the Internets for business purposes.	3	√	7	Access to the Internet. Encourage collaborations.

This discussion is based on the measures presents in Section 7.2. Under the business strategy by foreign firms theme two factors came up as a common concern to all the three CS (see Table 7-2). It is evident from the results that foreign firms consider their business environment significant for their businesses and one way to achieve this is through support for local firms through programmes and activities aimed at bridging the capacities and capabilities gap that exist between them. The role they play in achieving this is highlighted in Sections 6.7.1.1, 6.13.1.1 and 6.19.1.1 in Chapter 6. The interaction between local and foreign firms has the potentials to improve the understanding among the local firm's ability to know what constitute drivers which may lead to skills development and e-business technology transfer. For example, Section 5.6.1 in Chapter 5 explored through questionnaire survey respondent perspectives regarding drivers for e-business technology transfer. Results indicated that respondents demonstrated understanding of what constituted drivers for e-business through the ranking of pre-set drivers presented to them (see Table 5-6 in Chapter 5). In the order of significance or reason to deploy e-business in the future, respondents ranked competitive advantage the most compelling reason to deploy e-business (see Table 5-6 in Chapter 5). Furthermore, results from CS1, CS2 and CS3 demonstrated agreement between the three CS, the significant impact foreign construction firms are making in terms of capacity and capability development through various interventions in the form of trainings and workshops. These indeed exposed local firms in identifying key issues that can serve as drivers in promoting e-business in construction. In contrast, these initiatives may not be sustained as it is not based on any form of regulation or structured approach. That notwithstanding, results demonstrated that the most significant thing or driver is the '*desire*' my local firms to develop their capacities and capabilities through collaborative efforts where they can harness the capabilities of e-business. By this, local firms can move a little beyond manual activities to using a basic computerised system where communication via emails and sharing of information between project team can be achieved. It is, therefore, anticipated that the technology gap between foreign firms and their local counterparts can be minimised through some basic e-business activities. One other key driver that permeates through the results of the CS for both foreign and local firms is '*business sustainability*' which can be referred to as competitiveness. It further demonstrated that '*partnership*' drives the desire to improve capacities and capabilities Furthermore to enhancing their project management capabilities. For example, PMF1 in CS1 noted the significance of the Internet in their project delivery process. PMF1 further noted that the Internet supported their search of material globally through competitive sourcing of materials and services through the collection of invoices, "*these are some of the basic activities we are transferring to our local partners in*

Ghana”. The second factor under the business strategy by foreign firms is long term business relationship. It could be recalled that this factor was moreover emerging as a common concern to CS respondents, alongside construction business environment (see Table 7-2). Results further indicated that establishing ‘*long term relationship*’ provides the basis for mutual benefits, therefore,; the driving force is a ‘*good business relationship*’. CRF as reported in CS2 explained that through long term business relationship, foreign firms can conveniently transfer knowledge, expertise and specific technology to their local counterparts in order for them to gradually attain their desire level through bridging the technology capabilities gap that exists between them.

Discussing research question 2 further, under improving capacity theme four (4) factors emerged with varying responses as presents in Table 7-2. It can be seen from Table 7-2 that the factor ‘existing capacity of local firms’ was a common concern occurring in CS1 and CS2 as indicated in Table 7-2. Both CS1 and CS2 agreed that the existing capacity of local firms in general is low and less competitive. This research identified that the existing capacity of local firms can be explained to mean, the one that lacks the technological capability as mentioned previously, lacks computing facilities, while staff are inexperienced and lack skills to manage construction works. For example, AML in CS1 noted with concern that people with ICT related skills are of low calibre. This has affected the capacities and capabilities of local construction firms to work competitively. Discussing the poor state of the local firms, PMF1 a foreign contractor in CS1 mentioned that local firms in Ghana approach their work activities manually, the majority do not have simple computer work stations for work, and they turn to depend on external sources for computer related works, including emails. For example, CFR as reported in CS2 cited the Internet, unqualified workforce and non-availability of skilled personnel as some of the weak points of the local firms. In contrast, PMF2 in CS2 observed that it is not entirely the fault of the local firms. The poor state of affairs came about as a result of a long period of neglect of the local firms. The effect of this neglect breeds, deep management and technological deficiencies which in effect created the low capacities and capabilities of the local firms. PML2 in CS2 noted that it is a common knowledge across the industry that “...*local contractors need support to improve on their capacities and capabilities...*” Moving the discussion further, one factor that emerged as a common concern to all the CS as shown in Table 7-2 is pressure from foreign firms. This factor occurred in all the three CS. It has created the opportunity for local firms to take that first step in taking up the challenges to improving their business environment. According to AML in CS1 and MGL in CS3 (see Sections 6.7.2.2 and 6.13.2.3 in Chapter 6) the pressure from their foreign

counterparts was an opportunity to develop their technological capacities through the installation of basic ICT equipment and the Internet to facilitate their work and to “...cope with demands from their foreign counterparts...” PML3 in CS3 moreover confirmed that pressure from their foreign counterparts played a significant role in their firm’s technological capability. Conversely, foreign firm collaboration (see Sections 6.13.2.2 and 6.19.2.1 in Chapter 6) emerged as another factor occurring across CS2 and CS3 as shown in Table 7-2. *Foreign firm collaboration* is a key driver in developing the capacities and capabilities of local firms working together with foreign firms. Capacities and capabilities are consistent with the previous discussions (see Section 2.12.2 in Chapter 2). For instance, PMF2 in CS2 mentioned that the collaboration is an opportunity for local firms to develop management and other significant skills needed within the industry. This has impacted positively on the ICT skills for both technical and clerical staff. The capabilities of this nature can do many things to support project management activities, as mentioned by PMF3 in CS3 the collaboration provides the opportunity for local firms to learn directly the use of e-business activities, for example, experiencing using the Internet to share project information to members of a project team.

7.4 Summary and key issues

Section 7.3.1.1 further discusses and analysed research question 2 which explored issues connected to foreign contractors support for skills development and e-business technology transfer to local firms in Ghana as presents in Sections 6.7, 6.13 and 6.19. It was noted from the discussions that the factors in the sections teased out drivers for e-business in relation to the strategies adopted by foreign firms which aimed at improving the capacity and capability of local firms. Furthermore, to the ranking of drivers for e-business, presents in Section 5.6.1 in Chapter 5 (see ranking in Table 5-6 in Chapter 5), results from the CS further revealed the following drivers: desire to develop skills; business sustainability; partnership and foreign firm collaboration and long term relationship. Findings moreover suggested that foreign firms through strategies cited in Sections 6.7.1, 6.13.1 and 6.19.1 in Chapter 6 (see Table 7-2) supported capacities and capability development through training workshops and interactions. These processes have led to local firms installing basic ICT equipment that supported e-mail communications in a two way-directions, i.e. between them and their foreign counterparts as depicted in Figure 7-1.

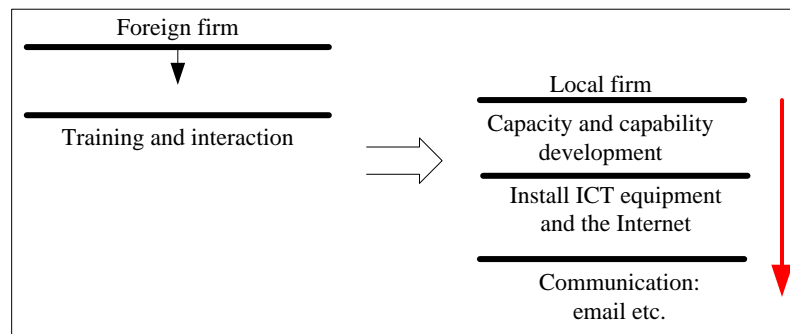


Figure 7-1 Supporting local firms to improve communication using e-business

It is further revealed that local firms implemented capacities in ICT skills and are able to use search engines for various reasons, including search materials. This suggests that, for effective e-business technology transfer process to be successful, the first and most significant activity is capacities and capability development as can be inferred from the findings.

The following section discusses and summarised results from research question 3 which explored the benefits and barriers of e-business technology in relation to the Ghanaian construction industry.

7.4.1 How does e-business technology promote construction business improvement in Ghana?

Using e-business to improve construction business in Ghana was explored within CS1, CS2 and CS3 (see Figure 6-3, Figure 6-7, and Figure 6-11 in Chapter 6) in order to determine barriers and benefits to the construction industry in Ghana. The emerged themes from the interviews were recorded in NVivo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes as shown in Figure 4-10 in Chapter. The emerged themes, in particular, for research question 3 were grouped under the following themes: implementing e-business; management and skills development as shown in Table 7-3. The understanding here is, for e-business technology transfer to be effective in order to harness the benefits of e-business within the Ghanaian construction industry, there is the need to address these identified barriers to e-business in construction.

7.4.1.1 Discussion of findings and synthesis

Table 7-3 Key issues emerged from case study research question 3

Implementing e-business Factors	CS1			Implementing e-business Factors	CS2			Implementing e-business Factors	CS3			Total No. of occurrences	Summary of intervention
	Summary of influence factors	No. of occurrences	Source		Summary of influence factors	No. of occurrences	Source		Summary of influence factors	No. of occurrences	Source		
Barriers to e-business	Limited skills base. High cost of Internet. Lack of infrastructure	5	Fig. 6-3	Barriers to e-business	Inadequate electricity infrastructure Lacks awareness of e-business.	4	Fig. 6-7	Barriers to e-business	Lack of office spaces. Lack of Internet facility. Aged staff.	4	Fig. 6-11	13	Provision of Infrastructure. Expand internet access. Provide skills training.
Benefits of e-business to firms	Deployment of e-business activities, e.g. e-procurement and e-tendering	4	√	Benefits of e-business to firms	Improve reporting system. Enhances communication.	5	√	Benefits of e-business to firms	Process facilitation. Support for communications. Project management.	5	√	14	Expand infrastructure. Computer facilities e.g. hard and software. Provide training.
No details provided	No details provided	N/A	N/A	Benefits of e-business to government	Monitoring and compliance. Reduction in complaints. Data exchange	1	√	No details provided	No details provided	N/A	N/A	1	Provide infrastructure. Expand Internet access.
Management													
Factors													
Efficiency of business process	Culture of improving the work procedure.	3	Fig. 6-3	Efficiency of business process	Manual process. Less transparent.	4	Fig. 6-7	Efficiency of business process	Manual process. Excessive paperwork. Improve process.	2	Fig. 6-11	9	Positive engagement. Access to computer facilities. Internet access
Managing construction activities	Different parties involved in the process.	2	√	No details provided	No details provided	N/A	N/A	No details provided	No details provided	N/A	N/A	2	Improve communication structure.
Quality of firms	Excessive manual activities. Low calibre of staff	3	√	Quality of firms and performance	Poor performance. Low image of local firms.	4	Fig. 6-7	Quality of firms	Technological know-how. Improving project management skills.	5	Fig. 6-11	12	Deploy e-business to improve communication. Provide training.
Skills development													

Factors													
Acquisition of new skills	Need for job related skills	3	Fig. 6-3	Acquisition of new skills	Skills training facility. Continuous professional development.	4	Fig. 6-7	Acquisition of new skills	Develop training schemes. Undertake collaboration with both foreign and local firms.	4	Fig. 6-11	11	Use foreign firm collaboration to acquire skills

In this section the findings from a literature review, CS and questionnaire survey are synthesised in order to provide detailed understanding of the key issues in relation to e-business implementation within the Ghanaian construction industry. The results of the questionnaire survey (see Section 5.6.3 in Chapter 5) demonstrated the perception of respondents in respect of barriers to e-business in construction. This is demonstrated through ranking of a set of barriers (see Table 5-8 in Chapter 5) presents to them. For example, both small and big firms ranked among others, the lack of research in IT in construction, lack of technical skills and lack of electricity supply as some of the barriers to e-business in construction in Ghana. On a similar note, the CS results turned to corroborate some of the identified barriers to e-business in construction and new ones identified in the CS. AML in CS1 (see Section 6.8.1.1 in Chapter 6) mentioned that practitioners in the industry are not *aware* of the potential benefits of e-business, for that matter remained unconcerned about e-business. AML further stressed that *unreliable electricity supply*; *inadequate national ICT infrastructure* and *high cost of e-business equipment* are some key challenges facing local firms in the industry. These findings are consistent with the works of Eadie *et al.* (2010a), Eadie *et al.* (2010b) and Isikdag *et al.* (2011), which demonstrated that infrastructure is a barrier to construction e-business (see Section 2.10.1 in Chapter 2). It could be recalled that lack of electricity supply was ranked as the third most significant barrier to e-business in construction (see Table 5-8 in Chapter 5). Electricity supply should be considered as an significant factor to kick start the use IT as it is the only source for running IT equipment such as computers, printers, servers, etc. Furthermore, PMF1 in CS1 observed that *low economic development* pose a challenge to local firms as projects are difficult to come by in Ghana. It moreover emerged from the questionnaire survey that socioeconomic factors (see Table 5-8 in Chapter 5) turned to influence e-business development negatively. Although statistics show that the construction industry has contributed significantly to economic development, economic benefits are not evenly distributed as a result, most local firms which are operating at the grassroots/district levels struggle to find regular work. What it means is skills development would suffer as many are unable to pay for education and professional training at the grassroots and district levels due to non-availability of work and employment. PMF2 in CS2 conversely, note that from experience *high cost of investment* and *lack of technical capacity* prevented most local firms to consider a simple computer work station. Again, the questionnaire survey results corroborated the CS results in the areas of cost of investment and technical skills (see Table 5-8 in Chapter 5). Although there are several constraints to e-business implementation within the industry, prominent among them include: *lack of ICT skills*; *technical support* and *lack of online payment system* (PML2 in CS2). Reference can be

made to the questionnaire survey results in Table 5-8 in Chapter 5 in respect of competency in IT and technical skills. Furthermore, to these findings Vitkauskaite and Gatautis (2008) and Najimu (2011), identified resources, lack of skills, cost and training as some of the major barriers to the implementation of e-business in construction (see Section 2.10.1 in Chapter 2). CRF's contribution reported in CS3 (see Section 6.20.1.2 in Chapter 6) noted that one of the barriers to e-business construction is *lack of offices paces and proper governance structure* of local firm as these elements bother with the decision making process within an organisation. Contributing further to the discussion MGL in CS3 mentioned that majority of professional who makes the decisions are *quite old* and would not want to change their way of working. Furthermore, PML4 and PML5 in CS3 cited *financial constraints* as a reason for which local firms are unable to recruit technical and ICT skilled personnel. It is envisaged that when the identified barriers are addressed it will pave the way for successful implementation of e-business within the Ghanaian construction industry. In line with this, this research moves further to explore the impact of benefits to construction e-business.

It is perceived within the Ghanaian construction industry that e-business can play a major role in the improvement of performance within the industry. To this end, foreign firms are considered by their local counterparts to have the influence in developing the capacities and capabilities of local firms to take advantage of the benefits of e-business. Prior to the CS questionnaire survey was conducted to explore the perception of respondents regarding benefits or the impact e-business may have on their respective firms. The result from the survey (see Section 5.6.2.1 in Chapter 5) suggested that efficiency of business process, organisational innovation; time and cost saving are some identified impacts of e-business in construction (see Table 5-7 in Chapter 5). On a similar note, the CS identified impacts of e-business (see Sections 6.8.1.2 and 6.14.1.3 in Chapter 6) reflecting the perceptions of players within the construction industry in Ghana. AML in CS1 agreed that e-business has several benefits and mentioned that the industry stands to benefit from e-business components such as e-procurement and e-tendering which is an significant aspect of *growth and efficiency of business process* within construction. This corroborated the ranking of the impact of e-business reported in Section 5.6.2.1 in Chapter 5. As shown in Table 5-7 in Chapter 5 efficiency of business process and growth were ranked among the first ten most significant impact factors. AML further noted that industry practitioners can benefit from *developing competencies in project management software* that has the potential to promote *quality of work* within the industry. PML1 in CS1 and AML associated e-business with the benefits of *reduction in postage and travel costs, improved communication* for organisations in terms of

internal and external communications. PMF1 in CS1 conversely, expresses as follow “... *from experience e-business enhances communication, you get quick responses to your requests, you are able to request for invoices, procure materials for the project and a lot more time is saved in this respect...*” SIMG as reported in CS1 and CS2 explained that e-business has the benefit of providing *price database, supplier database* and further explained that it can minimise face-to-face contact. CIMG further added in CS2 that the construction sector stand to benefit from greater knowledge competition, by virtue of being able to *view opening of tenders* over the Internet, *online access to tender advertisements* and *reduction in manual work* and contract related paper work, by this the routine administrative processes become simpler. These findings moreover, are consistent with the works done by Issa *et al.* (2003) and Ruikar and Anumba (2008), which explained that e-business can make it possible to have online tendering service (see Section 2.9.3.6 in Chapter 2). Furthermore, PMF2 in CS2 indicated that e-business supported their work in the preparation and distribution of reports in good time and further expressed as follows “...*we as contractors, we have applied e-business to design solutions where issues concerning rework have been minimised... for us it saves time and enhances communication between project partners and professionals...*” PML2 moreover commented on the benefits of e-business and noted that it is an opportunity for those local firms that are in collaboration with foreign firms to go further by exploring extra benefits in other areas like online project management issues. PML3 expressing views based on their collaborative experience noted that e-business provides the opportunity to improve on business activities within the construction industry through effective communication and *sharing of project information*. This was confirmed by ITMF in CS3 stating that e-business supported their communication strategy and this was demonstrated to the local firms we collaborate within the industry. MGL in CS3 based on their experience with a foreign firm highlighted the following e-business benefits: it provides *data storage facility*; *cut down on human to human* interaction which may have the potential to reduce procurement related corruption; *facilitation of quick results* as it speeds up work and faster means of accessing information and communication. To this end and in the context of the Ghanaian construction industry, e-business can provide a basic integrated environment for professionals to engage. CIMG as reported in CS2 noted that the government stands to gain from e-business too. With e-business in place government procurement office can undertake the following procurement related activities: monitoring and compliance; reduction in complaints and data exchange (see Section 6.14.1.3 in Chapter 6). Although the benefit of e-business to government occurred in one case study, it presents a unique case for government to take up e-business initiatives and

implementation very significantly. Ultimately, it can address challenges associated with communication at government level and excessive human to human interactions.

The discussion of the impact of e-business in construction as noted earlier was reported in Section 5.6.2.1 in Chapter 5. The questionnaire survey results demonstrated that construction professionals ranked efficiency of business process the first most significant impact (see Table 5-7 in Chapter 5) of e-business in construction. It is moreover evident in CS under management theme (see Figure 6-3 in Chapter 6). Efficiency of business process was a common concern to all the three CS (see Sections 6.8.2.1, 6.14.2.1 and 6.20.2.1). For instance, AML in CS1 mentioned that working together with a foreign firm has improved their capacity and capability through training and continuous professional development, AML stated that: *“...we are able to communicate with our partners, moreover our internal and external communications have improved over the period and we are beginning to experience efficiency in our activities...”* PMF1 moreover in CS1 noted that efficient business process within the Ghanaian construction industry can only be achieved through continues capacity development and the injection of ICT facilities to enhance the processes. Recounting their experience with their foreign counterpart PML1 in CS1 noted that: *“...now we are able to do planning and scheduling with the support of ICT tools which previously was done manually, so we have become a lot more efficient in meeting our targets...”* This is further explained by CRF as reported in CS2 that when ICT and e-business issues are addressed in the local firms, the efficiency would begin to be part of their business process. In supporting the discussion of CRF, PMF2 mentioned that as a foreign firm, developing capacities and capabilities of local firms they work with is their contribution to the development of the entire industry. As noted by AML in CS1, PML2 in CS2 moreover confirmed that some selected activities such as *“...communication, procurement of some materials and request to their partners...”* have become a lot more efficient. The above discussions demonstrates the skill type being transferred from foreign firms to their local counterparts, therefore, the point can be made that when local firms sustained and improved upon these skills they can gradually develop and sustain e-business capability which can support the management of their construction activities better. Although ‘managing construction activities’ (see Section 6.8.2.2 in Chapter 6) occurring only in just CS1 (see Table 7-3) it is by no means insignificant factor. Arguably construction activity is complex with many different parties involved at different stages of the process, hence required a more responsive management approach. CRF as reported in CS1 stated that e-business can potentially *integrate the processes* in order to reduce manual activities. AML in CS1 noted that manual activities employed in managing works

procurement have indeed affected the management of construction works procurement activities negatively both within government and the construction industry.

On a similar note, e-business is believed to have an impacting role in improving the quality of local firms within the industry. Respondents in the questionnaire survey ranked quality of product as the 12 most significant factors (see Table 5-7 in Chapter 5). This is further reflected in the CS (see 6.8.2.3, 6.14.2.2 and 6.20.2.2 in Chapter 6) results. The findings suggested that this factor is a common concern to all the three CS (see Table 7-3). Respondents in the CS expressed the view that improving *technological know-how* of local construction firms by their foreign counterparts can act as a catalyst in enhancing quality and the image of local firms in Ghana. On this basis AML in CS1 suggested capacity and capacity enhancement; this according to AML would enhance the confidence in personnel working with local firms, especially those of them who are using computer facilities for their work. Intimating further that their collaboration with a foreign firm is an opportunity for them to improve on their work with improved awareness of e-business stating that “...now the awareness level within our firm is quite high as most of our works are done using computers and the Internet making communication easy...” Furthermore, PML1 mention that “...our office communicates to our foreign counterpart using the Internet and moreover receives communication from them through the same medium...” with reference to this, CRF as reported in CS2 mentioned that their recent assessment demonstrated that local firms are using computers and the Internet for their works and have moreover participated in capacity development trainings in management. PMF2 in CS2 conversely, maintained that improving capacities and capabilities was intended to transform the local firm in delivering quality work. CRF as reported in CS3 noted that local firms coupled with foreign firms have an opportunity to develop their capacities rapidly in order to support the delivery of quality work within the industry at the same time improving the quality of their firms. PML3 in CS3 underscored the significance of foreign firms in improving their capabilities technologically. However, PML3 still believes that the construction industry in Ghana is not developing as expected due to factors such as *inadequate personnel* and *lack of investment* in the industry. These two factors, moreover, were ranked among the first ten significant barriers to e-business in construction (see Table 5-8 in Chapter 5).

As noted earlier respondents identified that foreign firms play a major role in supporting skills development targeted at using ICT equipment and managerial functions within project environments. General views from the questionnaire survey suggested that IT skills

development is not taken seriously by local firms (see Section 5.5.3 in Chapter 5) perhaps due to budgetary constraints. The results demonstrated that staff learns new computerised skills through self-learning (see Table 5-5 in Chapter 5) compared to any other forms. Conversely, the CS confirmed that foreign firms supported skills development of local firms they are working with (see Sections 6.8.3.1, 6.14.3.1 and 6.20.3.1 in Chapter 6). PML1 and AML in CS1 confirmed that their foreign partners play an significant role in the acquisition of ICT skills. These skills have been improved upon through constant interaction between them and their foreign counterparts. Furthermore PML2 in CS2 acknowledged the improvement in the management of their site activities due to trainings provided by their foreign counterpart with emphasis on resources management and recording keeping. MGL in CS3 added project management, planning and scheduling moreover formed part of the skills acquired during their collaboration with a foreign firm. It is, therefore, an indication that for technology transfer to be successful, it must be built on a sound skilled workforce. Again, as suggested by respondents in Section 6.9.1.3 in Chapter 6 for a structured training approach to e-business technology transfer; it is, therefore, imperative to develop the capacities and capabilities of personnel in the local firms through training, education and collaborations within the industry as the first step. Once capacities and capabilities gap is bridged, technological capabilities can be implemented in the second stage of the technology transfer process.

7.5 Summary and key issues

Section 7.4.1.1 further discusses and analysed research question 3 (see Section 1.6.3 in Chapter 1) which explored e-business as a tool to improve construction business in Ghana as presents in Sections 6.8, 6.14 and 6.20. The discussions in this section cover barriers to construction and impact of e-business technology. Essentially, the discussion identified key barriers to e-business within the Ghanaian construction industry. It further established impacts of e-business based on the perspective of construction industry practitioners. The presumption is when the barriers are addressed as part of the e-business implementation process the industry will begin to realise the impact of e-business. The barriers came under four action areas, namely: education and training; government; finance and management (see Figure 7-2). The understanding is these action areas provide the necessary input to addressing the identified barriers as part of the implementation process. On a similar note, the impacts are moreover grouped as follows: firm; basic; advanced and the government (see Figure 7-2). These findings dovetailed into the finding in research question 1 while providing input to support e-business technology transfer model in Figure 2-3 in Chapter 2. It is significant to

note, moreover that Figure 7-2 provides a direct input for updating the conceptual framework implemented earlier in the research (see Figure 3-2 in Chapter 3) by taking on board or incorporating issues regarding skills and technological infrastructure as shown in barriers column in Figure 7-2. Among the implications of this research within the Ghanaian construction industry, the findings presents in Figure 7-2 provide useful insight to firms in the Ghanaian construction industry and key components of the conceptual framework modification. Further, the findings can support government institutions responsible for e-GP project, policy makers and supply chain advocates who have argued for e-business within the construction industry in Ghana. It is of significance to note that the findings would be able to assist local firms within the construction industry who desire to implement e-business.

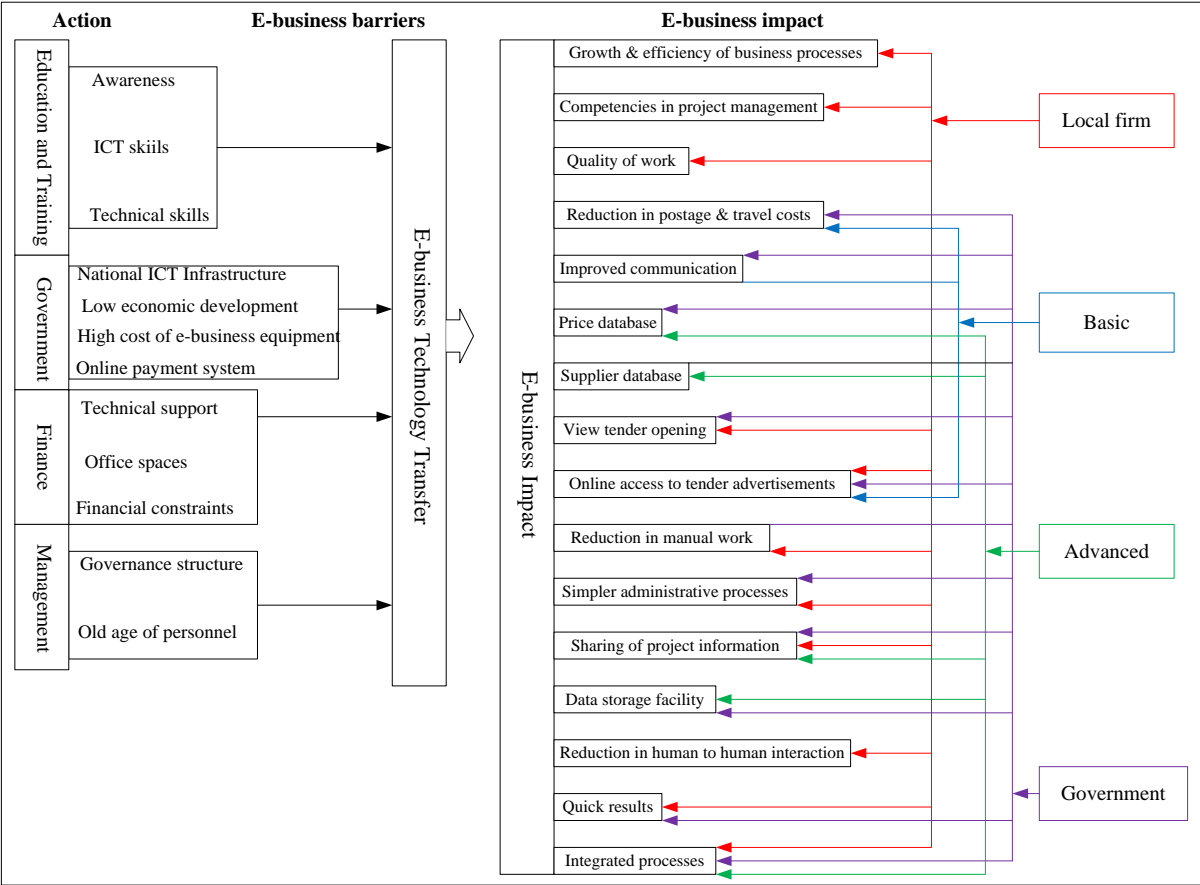


Figure 7-2 Perceived e-business barriers and impact

7.5.1 What are the primary requirements for e-business technology within the construction industry in Ghana?

The primary requirement for the establishment of e-business within the Ghanaian construction industry was explored within CS1, CS2 and CS3 (see Figure 6-4, Figure 6-8 and Figure 6-12 in Chapter 6) in order to solicit industry practitioners and expert views on minimum requirement for the introduction of e-business within the construction industry in Ghana. It could be recalled that the fundamental requirement for e-business transfer was explored in a previous Chapter (see Section 2.12 in Chapter 2) in order to provide a baseline upon which to progress with research question 4. The emerged themes from the interviews were recorded in NVivo 10 first as free nodes (see Figure 4-9 in Chapter 4) and then further grouped into themes as tree nodes as shown in Figure 4-10 in Chapter 4. The emerged themes, in particular, for research question 4 were grouped under the following themes: organisation readiness; technology and environment as shown in Table 2-1.

7.5.1.1 *Discussion of findings and synthesis*

Table 7-4 Key issues emerged from case study research question 4

Organisational readiness Factors	CS1			Organisational readiness Factors	CS2			Organisational readiness Factors	CS3			Total No. of occurrences	Summary of intervention
	Summary of influence factors	No. of occurrences	Source		Summary of influence factors	No. of occurrences	Source		Summary of influence factors	No. of occurrences	Source		
Organisational structure	Suffer inefficiency due to poor governance system.	3	Fig. 6-4	No details provided	No details provided	N/A	N/A	No details provided	No details provided	N/A	N/A	3	Improve capacities of local firms. Provide governance structure
Organisational culture	Deeply traditional approach to project management.	4	√	Organisational culture	Traditional approach to work. Manual activities The basis for both foreign and local firms to collaborate.	3	Fig. 6-8	Organisational culture	Traditional approach to work. Manual activities The basis for both foreign and local firms to collaborate.	2	Fig. 6-12	9	Need for equipment support and awareness of ICT and e-business. Improve communication structure.
Staff orientation and training	Low management skills. Low project management skills.	3	√	Staff training	No training schemes. Low management skills.	4	√	Staff training	Unskilled managers. No staff development schemes.	3	√	10	Education/training and continuous professional development. Understand philosophy of e-business.
Technology and environment													
Factors													
Legal and regulatory system	Tendency to prevent the use of e-business system.	3	Fig. 6-4	Legal and security system	Tendency to prevent the use of e-business system.	3	Fig. 6-8	Legal and regulatory system	Tendency to prevent the use of e-business system.	3	Fig. 6-12	9	Provision of adequate regulation and security systems backed by law.
National ICT infrastructure	Inadequate infrastructure for the deployment of e-business.	3	√	National ICT infrastructure	Inadequate infrastructure for the deployment of e-business.	3	√	National ICT infrastructure	Infrastructure for the deployment of e-business.	4	√	10	Provide national ICT infrastructure. Expand electricity infrastructure
Organisation's ICT infrastructure	No computer facilities. No Internet access.	4	√	Organisation's ICT infrastructure	No computer facilities. No Internet access.	5	√	Organisation's ICT infrastructure	No computer facilities. No Internet access.	3	√	12	Provision of computer facilities. Provision WLAN.

The first part of this discussion is based on organisational readiness for e-business technology transfer. Under organisational readiness theme, three factors (see Table 7-4) are discussed. It can be seen from Table 7-4 that three factors, namely: organisational structure; organisational culture and staff orientation and training emerged as what constitute organisational readiness for e-business technology transfer within the Ghanaian construction industry. In exception of organisational structure which occurred only just in CS1, findings suggested that the rest two occurred in all the three cases, meaning these factors are a common concern to all the three CS (see Table 7-4). The above indication can be explained to mean that to achieve organisational readiness for e-business technology transfer these three factors must be addressed. Three respondents (see Figure 6-4 in Chapter 6) noted under organisational structure factor (see Section 6.9.1.1 in Chapter 6) that organisation governance structure plays a significant role in the management of an organisation. This is in support of the argument that organisations like those found within construction need to put in place adequate governance structure in order to follow any intended improvement initiative with specific responsibility in respect to the organisational structure. Organisational structure here refers to the operational arrangement which defines specific job functions and clearly showing channels of authority in line with what the organisation is set up to undertake. For example, PMF1 in CS1 noted that local construction firms suffer from inefficiency due to the absence of a well-defined organisational structure. PMF1 further mentioned that the introduction of a new technology like e-business can be rejected if it is not properly aligned to a well-defined structure within the organisation. According to CRF as reported in CS1, CRF noted that it is significant for local firms to undertake some level of restructuring and roles defined properly so that they can do away with “...*one man business syndrome*...” AML in CS1 mentioned that it is significant for those of them in collaboration with foreign firms to take up the challenge to improve their capacities and capabilities because “...*these reforms are intended to influence and improve the image our firms*...” It can therefore, be argued that providing an organisational structure could be explained to mean a sign of readiness for improving the image of the firm and potentially, provide the basis for recruiting the right calibre of people. Although this factor occurred only in CS1 and represents by just three occurrences in CS1 (see Table 7-4), it is by no means insignificant factor. Furthermore, to organisational structure, another significant factor that has to be addressed in readiness for e-business technology transfer is organisational culture (see Table 7-4). In this regard, organisational culture was explored within CS1, CS2 and CS3 (see Sections 6.9.1.2, 6.15.1.1 and 6.21.1.1 in Chapter 6). Organisational culture was highlighted by respondents as an significant factor as it is an expression of the image of the organisation. According to Ruikar *et al.* (2008b), culture

at the workplace takes into account the attitude, outlook, and feelings of staff within an organisation (see Section 2.12.2 in Chapter 2). AML and PML1 in CS1 noted that there is a moderate awareness that ICT can improve some basic process but local firms hold onto the traditional way of doing business. PMF1 in CS1 described the cultural outlook of the industry as “...*deeply traditional right to governmental level*...” It can be recalled from the results of a questionnaire survey (see 5.6.3 in Chapter 5) that culture can have a negative influence on the implementation of e-business if the recipient organisations are unable to manage the process properly. It is in this vein that CRF as reported in CS2 explained with specific reference to the Ghanaian construction that understanding the two cultures can lead to the good working relationship that can promote a learning environment. Conversely, PML2 commented that changing their manual work culture to using computers was influenced by their foreign counterpart, although it was a difficult challenge it has transformed them professionally as they now adhere to time, it moreover provides an in-depth understanding into the gains and benefits that can accrue to the firm. MGL in CS3 noted that with the support from their foreign counterpart, they transformed their manual work culture into using computers through capacity development and orientation programmes. Therefore, it is significant to put people at the centre of introducing any new technology making people factor an significant philosophy (Ruikar *et al.*, 2008b). The results of culture analysis moreover demonstrated that capacity development can help reorient the culture within the Ghanaian construction industry through awareness.

It can be seen from Table 7-4 that respondents noted that staff training or capacity development is an significant requirement for e-business technology transfer. This is evident in CS1, CS2 and CS3 (see Sections 6.9.1.3, 6.15.1.2 and 6.21.1.2 in Chapter 6). PMF1 in CS1 noted that personnel are the most significant factor to consider when planning introducing a new technology. Therefore, it is significant to have a training scheme which is aimed at developing the necessary skills that is required to sustain the new technology. With reference to e-business, PMF1 in CS1 noted that it is significant to train personnel continuously in ICT skills, for example, using search engines for a variety of job tasks. Contributing to the debate PML1 in CS1 noted that the most significant aspect of technology transfer is training. For the purpose of this research training refers the specific staff development schemes which sought to give confidence and encourage staff to understand the philosophy behind e-business, with emphasis on the benefits to their firms and personal development. PMF1 in CS1 again submitted that they provide training needs for their local counterparts to enable them to cope with the demands of the industry and moreover to understand the benefits of e-business

systems. Previous discussions on government e-Government Procurement (e-GP) project (see Section 2.19.1.3 in Chapter 2) identified capacity development as one aspect that is required for transferring e-business knowhow and skills to stakeholders (suppliers, contractors and consultants). The above discussions further underscored the significance of capacity and capability development for e-business technology transfer. Consistent with the aim of this research, foreign and local firm's collaboration is one form that can support government capacity development initiative in the transfer of ICT related skills to the players within the Ghanaian construction industry. Capacity improvement as pointed out in this research is consisted with the government's effort in developing e-GP which is similar to e-business (see Section 2.19.1.3 in Chapter 2). As shown in the conceptual framework implemented (see Figure 2-4 in Chapter 2) earlier in the research, the findings in this discussion are relevant to the update of the conceptual framework.

Legal/security and regulation system is another factor that occurred in all the three CS. It is, therefore, suggested that this factor is a common concern to the respondents as indicated in Table 7-4. According to the submission by PMF1 and PMF2 in CS1 and CS2 respectively, they mentioned that legal and regulatory issues are an significant aspect of e-business and if not properly addressed it can serve as an impediment in the adoption of e-business. This is confirmed by three interviewees in CS2 (see Figure 6-8), stating that a robust legal and security system is significant. It could be recalled that legal barrier was confirmed through the questionnaire survey results as the 4th most significant barrier to e-business implementation (see Section 5.6.3 and Table 5-8 in Chapter 5). The above augments seems to confirm the work of Iddris (2012) who noted that Ghanaian SMEs are reluctant to implement e-business because of lack of legal regulatory and security systems. Furthermore, SIMG as reported in CS2 and PML2 in CS2 explained that within e-business operational environment security is vital to take care of issues concerning data exchange, reliability and confidentiality of data. MGL in CS3 mentioned that government ought to formulate laws to protect e-business activities, further to MGL's submission, SIMG confirmed that the passage into law of the Electronic Transactions Act, 2008 Act 772 as part of Ghana government initiative of providing a well-defined legal regime for e-business transactions within different sectors of the Ghanaian economy. Earlier discussion in Section 2.19.1.2 in Chapter 3 confirmed Act 772 and further indicated that the Public Procurement Act, 2003 Act 663 will be amended to include electronic tendering which was previously not part of Act 663. It is imperative to put in place a comprehensive legal and security system to support the implementation of e-business, this view is consistent with Ruikar and Anumba (2008), who identified legal,

regulatory and security system as significant factors in the implementation of e-business. The significance of the legal framework and security are highlighted in the literature (see Section 2.12.4 in Chapter 2), ranking (see Table 5-8 in Chapter 5) based on respondent perceptions and CS analysis. These findings show that the legal framework and security are essential components of e-business technology transfer and implementation. In line with the aim of this research which sought to develop an e-business technology transfer framework for the Ghanaian construction industry, the security of the system must be a priority in order to have a robust system. In this regard, legal/security system can be used to update the conceptual framework implemented earlier in the research (see Figure 3-2 in Chapter 3).

Another key component of e-business is ICT/Internet infrastructure, especially at the national level, as can be seen from Table 7-4 respondents noted national ICT infrastructure as a significant factor, meaning it came up in all the three CS (see Sections 6.9.2.2, 6.15.2.2 and 6.21.2.2). Responses from respondents confirmed the significance of ICT/Internet infrastructure as has already been pointed out in literature as one of the main barriers to the deployment of e-business, see, for example, the works of Eadie *et al.* (2007), Eadie *et al.* (2010b) and Isikdag *et al.* (2011), at different stages within construction. For instance, PMF1 attributed low penetration of basic form of e-business to the non-availability of a national ICT/Internet infrastructure. National Internet infrastructure here refers to a dedicated data route hosted by government with Internet exchange points and network access points where services can be made available through service providers. Organisations, including construction can then have access to the Internet through Internet Services Providers (ISPs). The respondents in all the three CS noted that government has a role in providing this infrastructure. PMF2 in CS2 admitted that government led effort in making available Internet infrastructure would have a positive impact on the development of the construction industry. Buttressing the view of PMF2, CRF as reported in CS3 noted that the availability of a national infrastructure can serve as a motivation for companies as they can subscribe at an affordable rate. This agreed with government initiative in promoting e-business through e-GP project as noted in Section 2.19.1.1 in Chapter 2. According to government document on e-GP project national ICT/Internet infrastructure include but not limited to the following activities: National backbone infrastructure to all districts in Ghana; National data centre and a secondary data facility for disaster recovery capability; Extended e-Government infrastructure Network to 1050 sites around the country base on fibre optic, VSAT and terrestrial networks for wireless; Deployment of 8000 LAN ports furthermore to existing 6500 LAN ports in government offices and Public Key Infrastructure (PKI) for computerised form

of message encryption particularly for tender submission and opening security. This means organisations, including construction would have access to using this infrastructure to support their work. It is moreover evident from Table 7-4 that organisation's ICT infrastructure occurred in all the three CS again, meaning it is moreover a common factor to all the cases. This analysis pointed to the fact that it is an significant requirement for the implementation of e-business at the organisational level. Organisation's ICT infrastructure acknowledged by the respondents in all the three CS (see Sections 6.9.2.3, 6.15.2.3 and 6.21.2.3 in Chapter 6) as a challenge for the development of local firms within the construction industry in Ghana. For instance, PMF3 noted that organisation's own ICT infrastructure constitute one of the basic needs that can support e-business implementation at the organisational level. According to Ruikar *et al.* (2006), "technology factor covers all aspects related to Information Technology (IT) and communications technologies (e.g. Internet technology) which include both the hardware and software usage and its availability within a company, department or workgroup". In conjunction with the national ICT/Internet infrastructure (see Section 2.19.1.1 in Chapter 3). Based on the report of PPA (2013), organisational ICT infrastructure is explained to mean such related activities covering the availability of the Internet and connectivity, Local and Wide Area Network (LWAN) infrastructure, furthermore to significant ICT devices such desk top computers, Uninterrupted Power Supply (UPS), other multi-functional devices such reprographic machines and availability of electricity. The significance of ICT/Internet infrastructure in the literature, government document and CS demonstrated that ICT/Internet infrastructure remains a key component to the implementation of e-business. Furthermore, research question 4 (see Section 1.6.3 in Chapter 1) provided key components for the update of the conceptual framework implemented earlier in the research (see Figure 3-2 in Chapter 3).

7.6 Summary and key issues

Research question 4 (see Section 1.6.3 in Chapter 1) provided enough grounds and justification for fundamental requirements for the implementation of e-business in the Ghanaian construction industry. It emerged that issue that forms key components of implementing the simplest form of e-business taking into account, moreover research questions establish in Section 1.6.3 in Chapter 1, demonstrated that it is significant for organisations to get ready through changing organisational culture in the form of capacity development. Findings moreover suggested that legal/security and regulation system, national ICT/Internet infrastructure together with that of organisation's ICT/Internet infrastructure

demonstrated through ranking as a very significant requirement for the implementation of e-business within the Ghanaian construction industry. These key findings through the synthesis of literature, questionnaire survey results and CS results points to summarised elements that can be used to modify the conceptual framework implemented earlier in the research (see Figure 3-2 in Chapter 3). As indicated in the objectives of this research (see Section 1.6.2 in Chapter 1), the modified conceptual framework will be subjected to validation through expert opinion on the suitability and applicability of the framework within the Ghanaian construction industry.

7.7 Synthesis and modified conceptual framework

Research question 1 (see Section 1.6.3 in Chapter 1) explored and identified bottlenecks in the procurement process with the Ghanaian construction industry (see Table 7-1). Further, the findings proposed capacity development through education, trainings/workshops and the introduction of e-business to support and improve the procurement process (see Section 7.3). To further improve the research process, research question 2 (see Section 1.6.3 in Chapter 1) moreover explored the support offered by foreign firms to improve skills and e-business technology capability development to support local firms to improve on their performance (see Section 7.3.1.1). The findings identified drivers to e-business technology transfer, furthermore, e-business technology capability development process outlines (see Figure 7-1). Conversely, research question 3 (see Section 1.6.3 in Chapter 1) explored and identified e-business barriers and impact (see Figure 7-2) based on the perception of respondents in the Ghanaian construction industry. They suggested that addressing the identified barriers would improve e-business technology transfer process. Finally, research question 4 (see Section 1.6.3 in Chapter 1) explored and identified fundamental requirements that can support e-business implementation process, these include: capacity development, legal/security and regulation system, national ICT/Internet infrastructure together with that of organisation's ICT/Internet infrastructure (see Section 7.5.1.1)

Based on the findings of the research as summarised above, the conceptual framework implemented earlier in the research (see Figure 3-2 in Chapter 3) can be modified using key issues that emerged from the analysis of the research findings. It is significant to note that the updated conceptual framework has been expanded to accommodate vital suggestions put forward by the respondents. In this regard, the key components of e-business technology transfer based on local firm's readiness to take up e-business, namely: capacity and capability

development, legal/security systems and ICT/Internet infrastructure, including culture were included in the modified conceptual framework as can be seen in Figure 7-3. As noted in the discussions, capacity and capability development for e-business technology transfer included the extent to which awareness is created in order for personnel to understand the underpinning philosophy of e-business; training and education, the development of ICT skills and technical capability (see Sections 7.2.1.1, 7.3.1.1, 7.4.1.1 and 7.5.1.1). Furthermore, legal/security is another requirement for e-business functionality, and the criteria that determine a robust legal and security system included, laws covering electronic transactions, reliability and confidentiality of data (see Section 7.5.1.1). The third requirement as per the analysis and synthesis of the research results is ICT/Internet infrastructure and the criteria for this element at the national level includes, National backbone infrastructure; National data centre and a secondary data facility for disaster recovery capability while at the organisational level includes; Internet connectivity, Local and Wide Area Network (LWAN), computers, Uninterrupted Power Supply (UPS) and significantly electricity supply which is necessary to provide the required energy to run the machines efficiently (see Section 7.5.1.1). Putting all these criteria together provides e-business output within the wider construction environment.

Meanwhile, it can be seen from Figure 7-3 the wider construction environment is provided as a platform within which e-business technology transfer activities can take place. It is seen that foreign firms operate within the wider construction environment likewise local firms, foreign firm's participation within the wider construction environment can influence e-business technology transfer through FDI collaborations with local firms who are moreover located within the wider construction environment. As noted with e-business technology transfer environment, it is suggestive through the CS findings that organisational culture is a key determinant in the success and sustenance of e-business technology within the construction industry in Ghana. It is argued in CS that cultural collaboration can enhance the process of technology transfer. It is moreover noted that apart from capacity and capability development and wider construction environment, FDI collaboration activities were not included in the conceptual framework implemented during the early stages of this research. These components were included based on the in-depth findings of the research.

The conceptual framework has considerably been expanded based on the understanding provided and the perception by the respondents within their limit of what actually constitute e-business technology and fundamental requirements to implement e-business within the Ghanaian construction industry which was informed through the findings of the research.

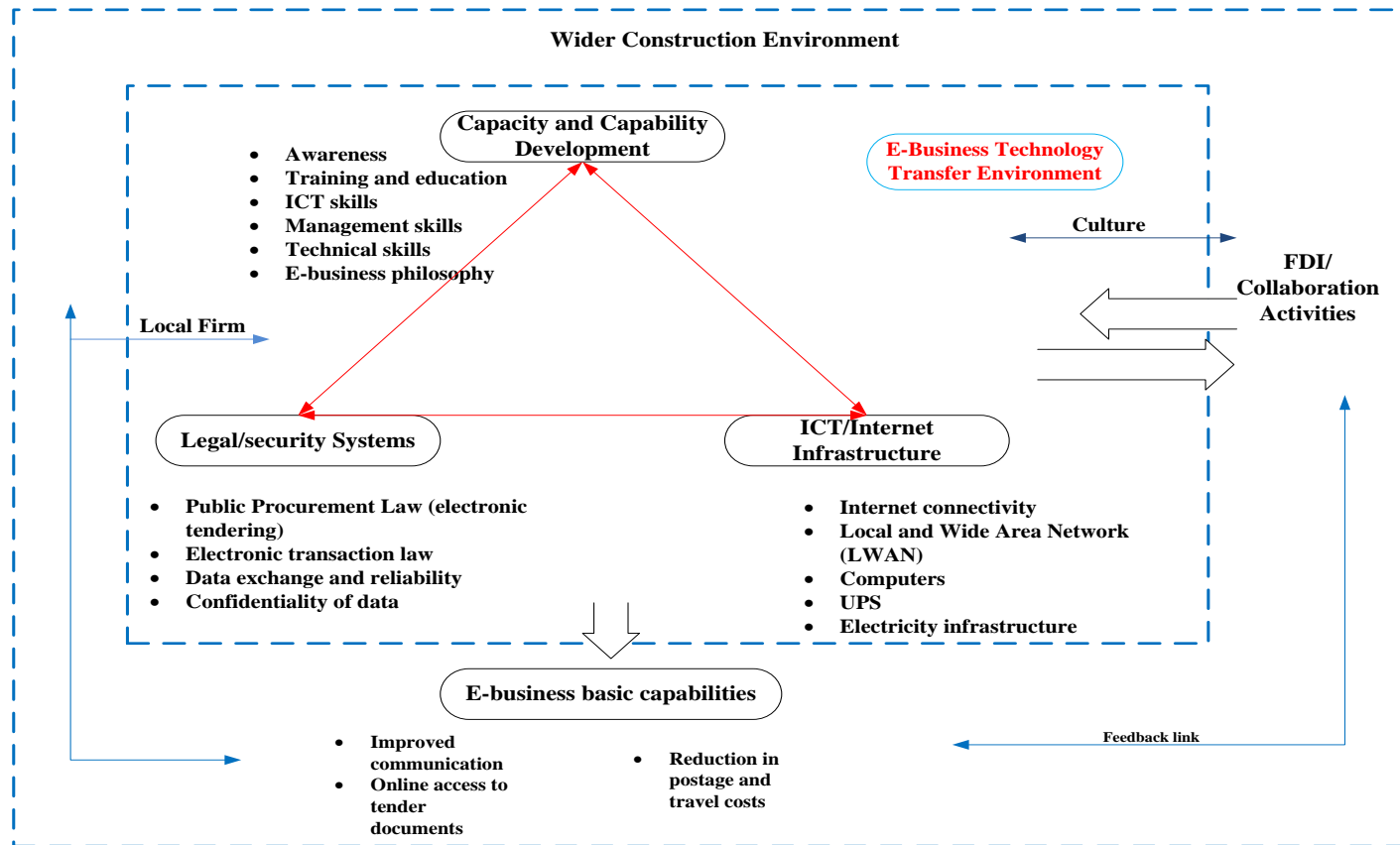


Figure 7-3 Modified conceptual framework for e-business technology transfer

7.8 Validation of the conceptual framework

Validation represents the process whereby a researcher provides the people on whom a research has been conducted an account of research findings and requests feedback on the findings (Bryman, 2004). In this research, the conceptual framework for the adoption of e-business technology was validated using construction experts and stakeholders in the construction industry in Ghana. The membership of the validation team was drawn from the case study organisations. To validate the conceptual framework for its suitability and applicability within the construction sector in Ghana, a five-point Likert scale varying from "Strongly agree to Strongly disagree" was designed with a weighting allocated to each point, where "Strongly agree" = 5, "Agree" = 4, "Not sure" = 3, "Disagree" = 2 and "Strongly disagree" = 1. The Five-Likert scale validation questionnaire was sent out to 17 (17) carefully selected members from the case study organisations. The selection of experts for the validation process was based on purposive sampling technique. According to Teddlie and Yu (2007), purposive sampling techniques involves selecting of units or cases based on specific purpose rather than randomly. The purpose is to invite experts with experience working in the Ghanaian construction industry with a specific role in working with both foreign and local firms and Ghana government office responsible procurement and e-GP project. Purposive technique was used deliberately to choose experts based on the qualities and expertise they possessed (Tongco, 2007). Accordingly, five-point Likert scale validation questionnaire with the modified conceptual framework together with the background to the conceptual framework were sent via email to the 17 selected experts. In this questionnaire they were asked to rank the conceptual framework in terms of its simplicity, clarity, applicability, usefulness and comprehensiveness. Furthermore, they were asked to provide comments which in their view can improve the conceptual framework and its implementation within the construction industry in Ghana (see Appendix - F for validation questionnaire template). The questionnaire survey was adopted for a quicken data collection from the selected experts from Ghana.

7.8.1 Validation process

The validation questionnaire sought to solicit expert opinions on the modified conceptual framework (see Figure 7-3) in terms of its simplicity, clarity, applicability, usefulness and comprehensiveness. To support the aim of this research, which seeks to develop a framework

for e-business technology transfer within the Ghanaian construction industry, the validation questionnaire was designed with relevant questions as noted above. The validation questions were designed in line with the philosophical stance of this research (see Section 4.3.4 in Chapter 4) and data collection techniques adopted for this research (see Section 4.7.1 in Chapter 4), in this context, the questions comprise both close-ended and open-ended. The close-ended questions seek to gauge the degree to which they agree to the statements provided in the pre-set five-point Likert scale questionnaire while the open-ended offered the opportunity to the selected experts to freely provide additional information which may be relevant but not found in the questions. See Appendix - F for the validation questionnaire used for data collection. As noted in Section 7.8, a total number of 17 questionnaires were distributed via emails to the selected experts. 15 questionnaires representing 88% were accurately filled and returned, hence used for the validation analysis.

7.8.1.1 Validation data analysis and results

The data collected from the validation questionnaire were analysed using the SPSS software package. In this instance, descriptive statistics were used to analyse the 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 Furthermore to simple to understand graphs. Moreover it provides what the study demonstrates (Najimu, 2011). Descriptive statistics was adopted to provide a clear understanding of the opinions of the selected experts regarding the conceptual framework in relation to e-business usage in the Ghanaian construction industry.

As indicated in Section 7.8 the experts were asked through a questionnaire survey to express the degree to which they agree or disagree with the conceptual framework base on its comprehensiveness, usefulness, applicability clarity and simplicity. As shown in Figure 7-4, 9 out of 15 experts representing 60% strongly agreed that the modified conceptual framework (see Figure 7-4) is comprehensive while 27% moreover agree that the framework is comprehensive in other word containing all the elements that is required to support e-business technology transfer. However, 2 out of 15 experts representing 13% disagree with the comprehensiveness of the conceptual framework (see Figure 7-4). On the usefulness of the framework, 8 out of 15 experts representing 53% strongly agree while 20% moreover agree that the framework is useful for the Ghanaian construction industry. In contrast, one expert constituting 7% was not sure about the usefulness while another 7% moreover disagree. As

illustrates in Figure 7-4 two (2) experts strongly disagree with the usefulness of the conceptual framework. When expert opinions were sought regarding applicability of the framework within the Ghanaian construction industry, 7 out of 15 and 6 out of 15 representing 47% and 40%, respectively, strongly agree or agree that the framework is applicable within the Ghanaian construction industry while two representing 13% stated not sure. The result regarding the clarity in Figure 7-4 demonstrated 11 out of 15 experts (73%) strongly agree that the framework is clear and the content can be understood. Conversely 27% of the experts moreover agree that the framework is clear. Lastly, the experts were asked to indicate the degree of agreement regarding the simplicity of the framework. The result demonstrated a positive response from the experts as shown in Figure 7-4. 7 out of 15 experts (47%) strongly agree while 33% agree that the framework is simple to understand within the construction industry and moreover by policy makers. In contrast, 3 experts (20%) disagree, they were of the view that the conceptual framework is not simple enough to understand. Furthermore, one expert made the following suggestion:

"...may I suggest the provision of some sort of a road map as a guide to help local firms within the industry in order to develop basic e-business capability to enable e-mail communications among local firms within the industry..."

The above stated suggestion according to the expert, by providing the fundamental requirement (see Figure 7-3), it is moreover significant to guide local firms to progress beyond having access to the fundamental requirement of e-business within the Ghanaian construction industry which is the main beneficiary of this research.

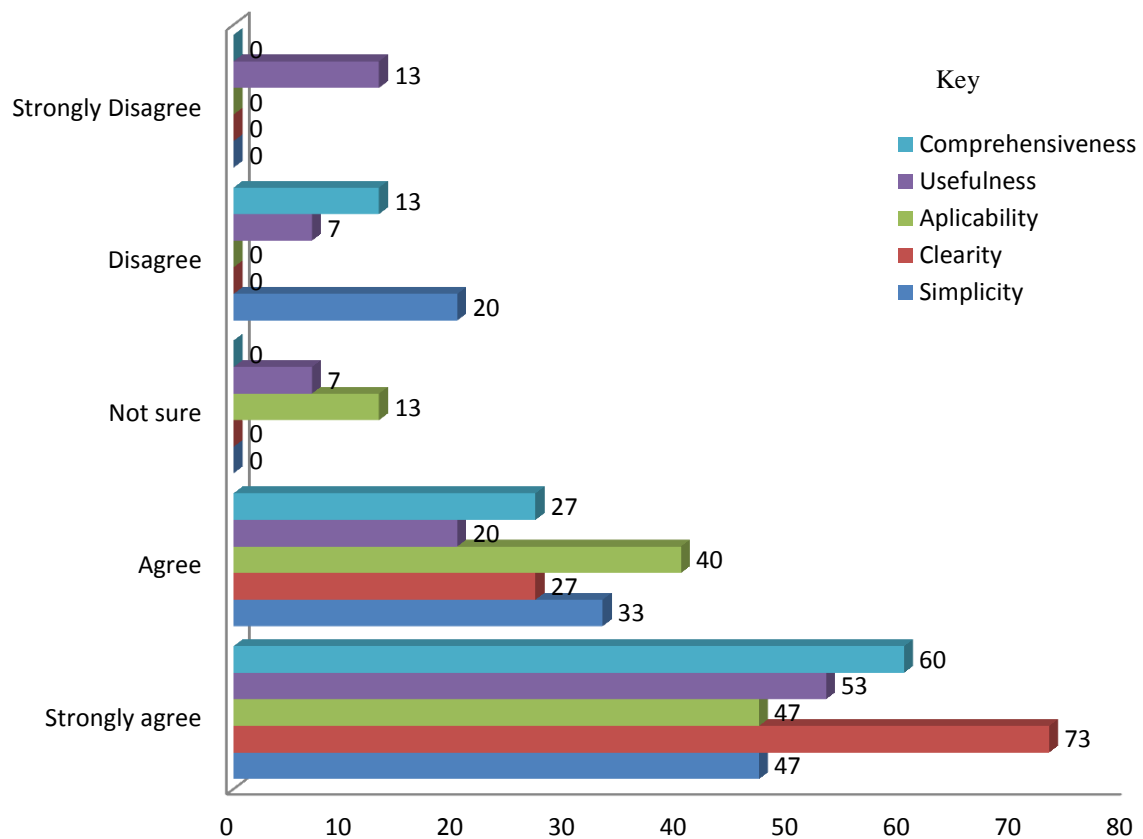


Figure 7-4 Results from validation questionnaire in percentage

7.9 Summary and link

This Chapter sought to analyse findings across the questionnaire survey presents in Chapter 5 and CS presents in Chapter 6 and summarised those findings through synthesis. Moving further, the conceptual framework implemented in this research earlier was updated and populated with key findings identified through synthesis of findings from questionnaire survey and CS. Furthermore, the validation results obtained from 15 selected experts through both close-ended and open-ended questionnaire was presented and discussed. The results indicated that, the framework on the whole was comprehensive, useful, applicable, clear and simple for implementation within the construction industry in Ghana. Additionally, one expert suggested a provision of a road map to support local firms to develop their basic e-business capability in terms of communications among themselves in the industry. The suggestion which is considered an significant aspect of developing e-business capability within the construction industry beyond the identification and provision of fundamental requirements for

e-business was conducted. See Appendix – G for details as to how the suggestion was conducted.

The next chapter further discusses the findings in relation to the achievement of the objectives established to achieve the aim of this research.

CHAPTER 8 : CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

This chapter sought to present conclusions and recommendations based on the key issues that were uncovered in the previous chapters. Chapter 2 of the study discusses key research issues which provided the theoretical basis for the preparation of data collection instruments. Furthermore, chapter 3 presents the conceptual framework for this research, following that the adopted methodology for the research was discussed and presented in chapter 4, while chapter 5 and 6 presents questionnaire survey findings and CS findings respectively. Chapter 7 presents a cross case analysis of the CS and questionnaire survey and key literature. Based on the results that emerged through synthesis of the findings of the CS and a questionnaire survey, the conceptual framework implemented during the early stages of the research was modified and expanded to reflect the key issues identified through synthesis. This chapter, therefore, summarised the findings of the research indicating how each objective of the research was achieved. This is then followed by the contribution to knowledge (theory and practice) within the Ghanaian construction sector. Finally, the chapter concluded by identifying limitations of the research, generalisation of results and recommendations for future research.

8.2 Addressing the objectives of the research

Five research objectives were formulated (see Section 1.6.2 in Chapter 1) primarily to facilitate the research process in order to achieve the aim of the research which is *"to develop a framework for e-business technology transfer to the construction industry in Ghana utilising foreign direct investment projects"* (see Section 1.6.1 in Chapter 1). Following that it was revealed in Section 1.4 in Chapter 1 that issues concerning the use of ICT systems and e-business technology to improve performance within the construction industry have been recommended. However, responses to addressing these concerns have only been subjected to limited academic research and in some case none at all. These issues concern limited academic research on e-business technology, which is considered undervalued and currently under implemented source of competitiveness within the construction industry in Ghana forms the specific gap identified for this research (see Section 1.4 in Chapter 1). Therefore, this research was designed to address the capacity and technological capability gap that exists

within the industry and the knowledge pertaining to using e-business in construction. In order to address the identified gaps and to achieve the aim of the research, five research objectives were formulated for this purpose (see Section 1.6.2 in Chapter 1). To achieve the objectives of the research, four key research questions were formulated (see Section 1.6.3 in Chapter 1) and used to elicit information from respondents. The following sections show how each of the research objective was achieved in the research.

8.2.1 Objective one

The first objective of the research (see Section 1.6.2 in Chapter 1) was "*to explore general ICT in relation to e-business, including drivers and barriers to construction e-business and the processes of e-business technology transfer through technology transfer principles*". This objective provided the extent to which ICT within construction was explored as part of the research process. The literature review conducted on ICT and e-business application within construction revealed some key ICT enablers in construction (see Section 2.4.2 in Chapter 2) furthermore to the impact of e-business in construction (see Section 2.4.3 in Chapter 2). It further revealed the extent to which barriers and drivers affect the implementation of ICT and e-business within the construction industry (see Sections 2.10.1 and 2.10.2 in Chapter 2). To further understand the real effect within the Ghanaian construction industry, these were taken forward in questionnaire survey and case study. Where the questionnaire survey explored e-business activities in construction (see Section 5.4.1 in Chapter 5) and showing in the order of significance the effect of drivers and barriers on construction based on the industry players opinions (see Sections 5.6.1 and 5.6.3 in Chapter 5). The case study results Conversely, revealed issues connected to foreign contractor support for skills development and e-business technology transfer to local firms (see Sections 6.7, 6.14 and 6.19 in Chapter 6). It is noted that the factors in the sections teased out drivers for e-business in relation to the strategies adopted by foreign firms which aimed at improving the capacities and capabilities of local firms. Furthermore to the ranking of drivers for e-business (see Section 5.6.1 in Chapter 5), results from the CS further revealed the following additional drivers: desire to develop skills; business sustainability; partnership and foreign firm collaboration and long term relationship. Analysis of barriers is shown in the results of the questionnaire survey (see Section 5.6.3 in Chapter 5) showing the perspective of respondents in respect of barriers to e-business construction. On a similar note, the CS results turned to corroborate some of the identified barriers to e-business construction and new ones identified in the CS. In contrast, it emerged from SC results that practitioners in the Ghanaian

construction industry are not *aware* of the potential benefits of e-business (see Section 6.8.1.1 in Chapter 6) furthermore to issues concerning unreliable electricity supply, a lack of national ICT infrastructure and high cost of e-business equipment are some of the key challenges facing local firms in the industry. The barriers came under four areas, namely: education and training; government; finance and management (see Figure 7-2 in Chapter 7). The understanding in these action areas (see Figure 7-2 in Chapter 7) provides the necessary input to addressing the identified barriers as part of the implementation process within the construction industry in Ghana.

8.2.2 Objective two

The second objective of the research was "*to assess the structure, procurement practices and the influence of foreign contractors through FDI on the development of local skills in the Ghanaian construction industry*". The second objective was addressed through detailed literature review and synthesis provided the chronological development of the Ghanaian construction industry. The detailed literature review moreover, gave insight into the structure of the construction industry outlining the development of the industry, tracing it to both pre and post-independence Ghana (see Sections 2.17.1 and 2.17.3 in Chapter 2). The literature review again illustrates the role foreign contractors played in developing capacities in terms of skills of local firm personnel (see Section 2.17.2 in Chapter 2). FDI in the Ghanaian construction industry and its economic impact on the Ghanaian economy has been revealed in the discussions in Sections 2.15.2.1 and 2.15.2.2. The findings demonstrated that foreign contractors have been in the forefront in capacity and capability development within the Ghanaian construction industry prior to independence. Objective two provided the basis to understand the Ghanaian construction industry soon after independence, the challenges in terms of personnel shortages, government interventions; including regulatory issues through to the current state of the construction industry and its economic significance to the entire Ghanaian economy have been identified (see Sections 2.17.3, 2.17.6, and 2.17.5 in Chapter 2). Conversely, the literature review revealed the challenges the procurement practices faced, this has necessitated the promulgation and passing into law the Public Procurement Act of 2003, Act 663 (see Section 2.18.3 in Chapter) in order to instil financial discipline, accountability and transparency in the procurement process with specific reference to the construction works procurement. Although the law was meant to achieve value for money, it failed to recognise the significant role of e-business in facilitating the process of achieving the primary goal of the law. These findings were confirmed in three SC (see Sections 6.6.1,

6.12.1 and 6.18.1 in Chapter 6). The CS demonstrated that the procurement process lacks basic technology in terms of computers and the Internet to support the process. The CS participants expressed concern, noting that lower level of basic technology appears to be the most significant issues that has negatively influenced performance and development of the construction industry (see Section 6.13.1.1 in Chapter 6). Further, CS results demonstrated that lack of skilled personnel to undertake procurement related activities are a major concern within local firms in Ghana (see Sections 6.6.1.4 and 6.18.1.3 in Chapter 6).

8.2.3 Objective three

The third objective of the research was "*to identify key fundamental requirements for implementing e-business technology within the construction industry in Ghana*". The objective provided the extent to which e-business technology transfer within the Ghanaian construction industry was explored. First, the third objective of the research was addressed through detailed literature review and synthesis to arrive at key findings which was carried forward in the questionnaire survey and three CS. The literature review established key components (see Section 2.12 in Chapter 2) that form the main focus revolving around what can be termed readiness to permit some level of basic e-business, details of which are outlines (see Sections 2.12.1, 2.12.2 and 2.12.3 in Chapter 2). Government document on e-Government Procurement (e-GP) project which is similar to e-business was reviewed and the findings (see Sections 2.19.1.1, 2.19.1.2 and 2.19.1.3 in Chapter 2) agreed with earlier findings. To further understand the real issues regarding capacity of local construction firms for e-business technology transfer, a questionnaire survey was conducted within the Ghanaian construction industry in order to determine the levels of e-business activities. The organisations surveyed demonstrated to have exchanged project programming documents electronically the results indicated that the capacity for these activities within contractor organisations is quite low. For example, cumulatively the majority, 69% of the organisations who participated in this survey indicated low volume of activities in tender documents. Similarly, 61% have moreover, indicated low activities in tender processing, while 63% recorded low activities in contract documents (see Section 5.4.1.1). The results from the questionnaire survey further revealed that on the issue of exchange of core documents electronically 58% of the organisations surveyed demonstrated low activities in human resource management, while only 42% of the respondent organisations exchanged human resource management documents electronically (see Section 5.4.1.2) and for marketing, 74% of them demonstrated low activities. Furthermore, the survey results indicated that

communication networks such as extranet, intranet and sky drive/cloud networks are quite unpopular (see Section 5.4.2.1). This perhaps may be the reasons for the low e-business activities identified in Sections 5.4.1.1 and 5.4.1.2. However, it is shown that the Internet is the most known and used e-business enabling technology among local Ghanaian construction firms/organisations and they chose project collaboration and management as the most significant activity to use the Internet for (see Sections 5.4.3.1 and 5.4.3.2). The survey result as presents in Section 5.5.3.1 demonstrates that issues regarding skills development are not taken seriously by the respondent organisations. The result demonstrates that, the staff learns new computerised skills through self-learning. This gives an indication that budgetary allocation for personnel development may not be adequate, in particular, in the small local construction firms. The low e-business activities revealed in the questionnaire survey results underscored the need for this research. Furthermore, the results confirmed the need to further investigate the primary requirements for e-business technology within the construction industry in Ghana. In this regard, the findings from CS outlines key factors that can be considered indicators to organisational readiness for e-business technology transfer to local firms within the Ghanaian construction industry utilising FDI collaboration in construction with foreign firms (see Sections 6.9.1, 6.15.1 and 6.21.1 in Chapter 6). The details of the results from the earlier sections were used to modify the conceptual framework implemented earlier in the research.

8.2.4 Objective four

The fourth objective of the research was "*to develop a framework for the adoption of e-business technology in the Ghanaian construction industry to help improve communication performance*". This objective provided the direction for achieving the aim of the research which is "to develop a framework for e-business technology transfer to the construction industry in Ghana utilising foreign direct investment (FDI) projects". This objective of the research was achieved through a literature review of key issues based on theories in e-business technology transfer. The discussions in Section 2.12 regarding e-business technology transfer in construction revealed capacity and capability, ICT infrastructure and legal framework as the main influential factors for e-business technology transfer. Similarly, synthesis of the literature in respect of e-business technology transfer in the Ghanaian context established three main fundamental requirements, namely: IT infrastructure or technology, legal and security framework and capacity development (see Sections 2.19.1.1, 2.19.1.2 and 2.19.1.3) which is similar to the discussions in Section 2.12. Based on the above findings, these separate elements were brought together through linkages in a collaborated environment

where a strategic links of requirements generation and capture was established. The conceptual framework was further modified using key findings as indicated in Sections 6.9.1, 6.15.1, and 6.21.1 in Chapter 6, and Sections 6.9.2, 6.15.2 and 6.21.2 in Chapter 6. As outlines and further synthesised in Section 7.7 in Chapter 7 (see Figure 7-3 in Chapter 7). These sections provided the details of the fundamental elements for e-business technology transfer to the local firms within the Ghanaian construction industry.

8.2.5 Objective five

The fifth objective was "*to validate this framework within the construction industry in Ghana by utilising industry experts*". The conceptual framework was validated utilising expert opinion through purposive sampling techniques (see Section 7.8 in Chapter 7). 15 experts were deliberately selected based on their experiences within the case study organisation in the Ghanaian construction industry. Opinions of the experts were gathered through both close-ended and open-ended questionnaire survey (see Sections 7.8.1 in Chapter 7). The results indicated that, the framework on the whole was comprehensive, useful, applicable, clear and simple for implementation within the construction industry in Ghana (see Section 7.8.1.1 in Chapter 7). Additionally, one expert suggested a road map to support local firms to develop their basic e-business capability in terms of communications among themselves in the industry (see Section 7.8.1.1 in Chapter 7). The suggestion which is considered an significant aspect of developing e-business capability within the construction industry beyond the identification and provision of fundamental requirements for e-business was conducted (see Appendix G).

8.3 Contribution to body of knowledge

Building on the existing body of knowledge on e-business in construction, it is worth noting that the research provided great insight and contribution to theory and practice to e-business capabilities in the construction industry in Ghana as shown in the subsections below.

8.3.1 Contribution to theory

Discussions in Section 2.17.4 on the current outlook of the Ghanaian construction industry demonstrates that the industry comprises about 90% local small firms which largely focused on manual activities within the industry. The literature on the improvement of the industry by

government through e-government procurement project (see Section 2.19.1 in Chapter 3) is still on the drawing board. However, it is of significance to determine the main issues through an in-depth investigation. In this vein, this research contributed first and foremost to the gap identified for conducting this research; lack of research into ICT and e-business system to improve performance within the Ghanaian construction industry (see Section 1.4 in Chapter 1).

Contributing to resolve the identified theoretical gap through this research provided an insight into the existing capacity and capability gap within the local firms operating in the Ghanaian construction industry. Furthermore, the research contributed immensely to the understanding of barriers such as low ICT skills and technical skills and inadequate national ICT infrastructure to support the deployment of e-business. Besides drivers are identified as skills development; business sustainability; partnership and foreign firm collaboration and long term relationship while the impact of e-business in the context of the Ghanaian construction industry relates to improved communication, reduction in postage and travel cost and online access to tender documents. Additionally, an insight into e-business development and implementation through the identification of the fundamental requirements of e-business technology transfer, namely: capacity and capability development; legal/security systems and ICT/Internet infrastructure in the context of the Ghanaian construction industry is a major contribution to theory and useful resources for references for publications in the subject area. Utilising acceptable mode of technology transfer specifically relocating principles and ideas from Foreign Direct Investment (FDI) in construction in Ghana as a medium for e-business technology transfer within the context of developing country particularly Ghana can be seen as a contribution to literature in the subject area. Therefore, the research contributed to the body of knowledge within the Ghanaian construction industry, similarly, to other developing country construction industries with similar characteristics.

8.3.2 Conceptual framework

The earlier conceptual framework (see Figure 3-2) that was implemented provides a theoretical basis for primary data collection through the identification of key issues to explore. With reference to this, it sought to bring together elements to support e-business technology transfer in the context of the Ghanaian construction industry. Synthesis of results from questionnaire survey, CS and literature review provided enough grounds to modify the earlier conceptual framework. Following the synthesis of the results of the research, the conceptual

framework was modified to include key fundamental requirements, namely, capacity and capability development, legal/security systems and ICT/Internet infrastructure (see Figure 7-3 in Chapter 7) which primarily can provide an industry leading capacity development for local firms to exploit the capabilities of e-business technology. The modified conceptual framework was validated through expert opinions which confirmed that the framework captured the key elements for the exploitation of e-business at both local firm and national levels in the context of Ghana. Therefore, the conceptual framework (see Figure 7-3 in Chapter 7) introduces a “*new concept*” of e-business technology transfer within the Ghanaian construction industry, which is largely influenced by similar existing theories/literature on e-business technology transfer within the construction industry. From a policy perspective, the conceptual framework can be used to develop strategies towards improving e-business technology capability of local firms within the construction industry in Ghana, as the conceptual framework provides key elements of e-business technology transfer. From a theoretical perspective, the conceptual framework contributed to theory through the identification of key components for e-business development that are considered fundamental to e-business capability development in the context of the Ghanaian construction industry (see Section 2.12 in Chapter 2).

8.3.3 Contribution to Practice

The research provided a new concept in improving e-business technology capabilities of local firms through collaboration with foreign firms in Foreign Direct Investment (FDI) in the construction project environment. The framework has elevated to another level the knowledge base within the industry by providing a strategic tool for practitioners to understand how to use the framework to work out practical solutions to improving e-business capabilities of local firms across the construction industry. Another benefit of the framework to the industry is the highlights of the key requirements provided in the framework, meaning that the knowledge is now available to practitioners as how to support local firms through education and capacity development utilising collaboration in the FDI environment in conjunction with L.I. 1547 Technology Transfer Regulations 1992.

8.3.4 Dissemination of the research results

As the research progresses, some initial findings of the research have been published in peer reviewed journals (in review), research report and presents at international research, academic and industry conferences (see Appendix - I for the list of publications).

8.4 Generalisation of results

It is worth noting that this research was conducted within developing country context, in particular, the Ghanaian construction industry utilising a mixed method for data collection. The findings are, however, suitable within the Ghanaian construction industry and applicable to local firms in collaboration with foreign firms in FDI project environment. However, research results of this nature can be generalised in a similar context, in particular, for e-business technology transfer under the condition where examples of FDI of other countries can be compared with Ghana.

8.5 Limitations of the research

It is a known fact within academic and research community that every research activity has its peculiar limitations and this particular research is no exception. It is moreover noted that research limitations form part of the research process, when the researcher is able to appropriately deal with any such limitations during the research process it improves the researcher's capability and experience in undertaking future research activities.

1. Securing time for interviews with appointed senior officers who were given the mandate by their respective firms was quite difficult. Working in a project environment for these firms requires them to spend their time on project details instead of any other thing that has no direct impact on project delivery time line. In most of the cases the respondents expressed varied opinions on the length of the interview time. While they generally feel 1½ hours of interview time was too long, others suggested having the interview in phases in order to limit the impact of the total time spent on a particular interview day. This limitation was overcome by the researcher through thorough negotiations with the respondents.

2. The second notable limitation of this research has to do with poor documentation culture that exist within the construction industry in Ghana and relevant government institutions. The implication was the difficulty in securing relevant documents for review in line with data collection techniques established for this research (see Section 4.7.1.3 in Chapter 4). However, the documents received in respect of government projects and initiatives in promoting e-business within Ghana were complemented by detailed literature.
3. Utilising FDI as a medium for e-business technology transfer to local firms within the construction industry was received by industry players as a new concept due to low levels of understanding of e-business and its potential benefits to the construction industry. Within the FDI setting there is an attempt to improve access to secondary data on collaboration activities. Although local firms demonstrated low knowledge in FDI collaboration and had failed to take advantage of L.I. 1547 Technology Transfer Regulations 1992 as previously noted in Section 2.15.2.1 in Chapter 2. The L.I. makes provision for technology transfer within the FDI in construction and other sectors within the national economy of Ghana. This limitation was overcome through literature and primary data collection within the Ghanaian construction industry.

8.6 Recommendations for improving e-business technology capabilities within local firms

This research sought to recommend strategies to improve construction project capabilities through e-business technology transfer within the Ghanaian construction industry utilising FDI in construction. Based on the results of the research, recommendations can be made for the consideration for policy and practice within the Ghanaian construction industry which is the main beneficiary of this research. The following are the main recommendations for consideration.

8.6.1 Improving the skills base of the local firms in the industry

The case study participants expressed the view for the necessity for qualified and skilled construction related professionals. The discussions demonstrated that a significant number of personnel working in the industry are not qualified to handle procurement and day to day project management activities. For example, it was revealed that procurement officers at the

entity levels are inadequate in handling procurement issues. Similar concern was expressed by the case study respondents that lack of skilled personnel in the construction industry has had a negative impact on the development of the industry (see Section 6.12.1.2) making the industry less competitive and unattractive for investment. It is obvious from the case study discussions that local construction firms are struggling in dealing with the non-availability of skilled personnel due to lower investment in the industry (see Section 6.18.1.2). It is, therefore, suggests that the skills that are relevant to preparing procurement documentation and that for ICT to support the exploitation of e-business within the construction industry should be sought for by local construction firms within the Ghanaian construction industry. Understandably, there is always a limitation of construction related skilled personnel within the industry, however, it is significant for local construction firms to recruit people with skills that can make them to be efficient in undertaking procurement successfully. Moreover, for the purposes of e-business, it is significant for the firms to employ people with some level of competence in ICT skills. To further improve the competencies of their staff, it is therefore, recommended that local construction firms must develop staff training schemes to support continuous capacity and capability development within the study area with emphasis of construction project management, quantity surveying which can enhance their skills in procurement and ICT skills for e-business technology deployment and application within the industry.

8.6.2 Enhancing the regulatory system for e-business technology transfer

Discussions with case study participants pointed out that legal and regulatory system is an significant aspect of e-business technology development. In essence a robust regulatory system would provide adequate security measures for the application of e-business within the Ghanaian construction industry. The case study participants further pointed out that within an e-business environment, security is vital to secure and protect data exchange process together with reliability issues where confidentiality of data is of a great concern. The significance of regulatory and security system for e-business deployment has been identified in previous research (Ruikar and Anumba, 2008). This suggests that e-business activities must be conducted in a system where there is trust, so security of business transactions and data transfer must be an integral part of e-business system. Therefore, it can be recommended that government must enact electronic transaction laws or enhance the existing laws and regulations to ensure that cyber fraud and other Internet related frauds are adequately

contained within the system. The system would then be regulated legally to ensure confidence while using it.

8.6.3 Expanding ICT infrastructure for e-business technology transfer

ICT Infrastructure was identified by the case study participants as a fundamental requirement for e-business technology transfer within the Ghanaian construction industry. Infrastructure for the Internet is of vital significance for the local firms if they implemented strategies to deploy e-business in their organisations (see Section 6.9.2.2.). It was noted that the availability of adequate infrastructure serves as a motivator for local firms to connect to the Internet at an affordable rate. It is, therefore, expected that the availability and affordability of the Internet would improve e-business activities among the local firms. Therefore, it can be recommended that the government expand infrastructure covering the Internet in order for local firms operating outside the national capital of the Republic of Ghana can have access and use it. As previously discusses, infrastructure for electricity which is essential to propel the Internet together with the right policies can speed up wider adoption of e-business among local firms (Iddris, 2012).

8.7 Recommendations for further research

This research was conducted utilising FDI as the main medium for e-business technology transfer from foreign firms to local firms within the Ghanaian construction industry. Although this area appeared new within the construction industry in Ghana, the findings can help in the development of e-business capabilities within local firms operating in the construction industry in Ghana. In this regard, there is the need to undertake further research in the following recommended areas:

1. Findings from questionnaire survey and CS demonstrated lack of knowledge in e-business. It is significant for the scaling up the capacity of local firms in order for them to overcome their limitations in e-business. It is, therefore, recommended that further research should to be conducted to fashion out a mechanism to help decentralise education and training of local firm across the construction industry in Ghana. It is expected that a research of this nature should be undertaken in conjunction with the Association of Building and Civil Engineering Contractors of Ghana (ABCECG).

2. This research implemented a conceptual framework which aims to help the implementation of e-business within the construction industry in Ghana. The conceptual framework presents three key elements (see Figure 7-3 in Chapter 7) which should be addressed both at national and firm levels within the construction industry. For the implementation of the conceptual framework within the industry, it is recommended that further research is undertaken to develop criteria for each of the three components of the conceptual framework to aid implementation. This is because the conceptual framework has elements of responsibilities that cut across both government and local firms.
3. There is the need to find common grounds within the Ghana investment law (Act 865) considering this research was conducted utilising FDI as the medium of e-business technology transfer to local firms. Considering that the research is quite new, it is therefore, significant to further investigate how to effectively integrate the various provisions within the Ghana investment law and the Public Procurement Act 663, principally provisions in respect to capacity development and Technology Transfer Agreements as provided in LI 1547.

8.8 Concluding remarks

This research presents in this thesis investigated e-business technology transfer through Foreign Direct Investment (FDI) in the Ghanaian construction industry. Consequently, the research implemented an e-business technology transfer framework which comprised three fundamental components, namely; capacity and capability development, legal/security systems and ICT/Internet infrastructure (see Figure 7-3 in Chapter 7) to support e-business implementation within local firms in the Ghanaian construction industry. This chapter (Chapter 8) discusses how the research objectives were addressed; showing key findings that emerged from the research (see Section 8.2). This chapter, moreover, described contribution to the body of knowledge, with emphasis on theory and practice within the Ghanaian construction industry (see Section 8.3). This chapter demonstrated the usefulness of mixed method design drawing from existing theories. As presents in Section 8.3.4 it was revealed that a mixed method design has contributed to knowledge in FDI in construction in Ghana. This final chapter of this thesis described limitation of the research and made recommendations for improving e-business capabilities within local firms utilising FDI within

the Ghanaian construction industry. This is then followed by recommendations for further research (see Section 8.7). This research has an interesting implication for research and e-business implementation within the Ghanaian construction industry. Further, it can provide input for policy development to better improve FDI collaboration within construction as provided by L.I. 1547 Technology Transfer Regulation 1992.

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APPENDICES

Appendix A – Participants invitation letter

School of the Built Environment
The University of Salford
Manchester
M5 4WT

September 19, 2012

MAIN STUDY

A Study of e-Business Technology Transfer via Foreign Direct Investment in the Ghanaian Construction Industry

My name is EKAS a PhD candidate at the School of the Built Environment, University Salford, Manchester. I am currently undertaking a research into e-business technology transfer to the construction industry in Ghana to improve general performance of the industry.

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI) projects as a medium. In this context e-business may be explained to mean conducting business using dedicated computer networks and the integration of all business activities through information and communication technologies. In this regard, I have implemented a set of interview questions to solicit your organisation's views about your understanding of e-business technology and its benefits, and moreover your views about the steps to follow in developing this undervalued and currently under implemented source of competitiveness within the construction industry in Ghana. This interview is designed to take maximum of one (1) hour to complete and highly considered as an significant contribution to this research.

I shall be most pleased if you could confirm your participation in this research through the above contact. Your response within two weeks of receipt of this letter is most appreciated. While thanking you for accepting to participate in this research your personal views and contributions are highly anticipated. I would like to inform you that I have taken all the necessary steps to protect the content of this interview and will be kept confidential and be used for the purposes of this research. However, you can withdraw your participation at any time you wish to do so.

For further clarifications or information about this research, please do not hesitate to contact me via my email as above or contact directly DBI, School of the Built Environment, University of Salford, Manchester, M5 4WT who is supervising this research.

Yours sincerely,

Eric Kofi Adzroe (PhD Candidate)
Email: e.k.adzroe@edu.salford.ac.uk

Appendix B - Participant information sheet

Research Title: A Study of e-Business Technology Transfer via Foreign Direct Investment (FDI) in the Ghanaian Construction Industry.

Name of Researcher: Eric Kofi Adzroe

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI) projects as a medium. Your firm's participation in this research contributes to the development a framework for the adoption of e-business technology in the Ghanaian construction industry to help improve performance and transparency in the procurement process, and this is considered to be beneficial to the entire construction industry in Ghana. This research poses no physical, social or mental risks to participants as it does not require the use of hazardous substances or radiation.

The entire interview process is expected to last one (1) hour. The interviewees shall be allowed to withdraw their participation from this research at any time they wish to do so. Any information provided prior to withdrawal from the interview process shall immediately be destroyed. Information provided by the participants shall be for the purposes of this research and shall be kept securely for the duration of this research.

The interviewees shall be informed about issues regarding protection and confidentiality of the information they will provide for this research. The confidentiality of the data collected and anonymity of the participants will be guaranteed. The participant can obtain further clarification, information or complaints regarding this research by contacting directly Dr Bingunath Ingirige, School of the Built Environment, University of Salford, Greater Manchester, M5 4WT who is supervising this research.

Eric Kofi Adzroe (PhD Candidate)
Email: e.k.adzroe@edu.salford.ac.uk

Dr. Bingunath Ingirige (Supervisor)
Email: m.j.b.ingirige@salford.ac.uk

Appendix C – Participant consent form

Title of Project: A Study of e-Business Technology Transfer via Foreign Direct Investment (FDI) Construction Industry.

Name of Researcher: Eric Kofi Adzroe

Contact of Researcher: e.k.adzroe@edu.salford.ac.uk

School of the Built Environment
The University of Salford
Manchester
M5 4WT

Statements	Please tick where appropriate		
	No	Yes	N/A
I have read and understood the participant information sheet for the above research and my participation in the research			
I have been given the opportunity to ask relevant questions about the research			
I agree to take part in the research interview			
I understand that taking part in the research interview include tape recording which I agree to			
I understand that information provided by me during the interview will only be kept for the period of this research			
I understand that information provided by me during the interview will be confidential and will not be disclosed to people outside this research			
I understand that my participation in this research is voluntary, I can withdraw from this research at any time and I do not have to give any reason(s), for why I no longer want to take part in this research and any information I have provided shall accordingly be destroyed immediately			
I hereby agree to take part in this research			

Name of Participant:.....Date.....Signature:.....

Name of Researcher:.....Date.....Signature:.....

Research Supervisor

Dr Bingunath Ingirige

m.j.b.Ingirige@salford.ac.uk

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Appendix D - Questionnaire

QUESTIONNAIRE SURVEY

1.0 Background

Please provide some information about your company and responsibility

1.1 Type of organisation

Please select one option that best describes your organisation

Consultant ☐ Main contractor ☐ supplier ☐ Manufacturer ☐ sub-contractor ☐ Fabricator ☐
plant hire ☐ other (please specify)

1.2 Work specialisation

Please select one option that best describes your work/profession

1.1.1 Please select one option that best describes your organisation, work or profession

Buildings works contractor ☐ Architect ☐ Building Material Supplier ☐ Property Developer ☐
☐ M&E Contractor ☐ Engineer (Specify) Civil Engineering contractor ☐ Facility Manager ☐
Quantity Surveying ☐ Maintenance contractor ☐ Trade Contractor (please specify)

1.3 Areas of work

1.2.1 Please select the type of construction work that your organisation undertakes:

Building work ☐ Civil Engineering work ☐ Building & Civil Works ☐ Residential ☐ other
(please specify)

1.4 Job Function

1.4.1 Please select one option that best describes your role:

Senior Management Staff ☐ Middle Management Staff ☐ Junior Management Staff ☐ other
(please specify)

1.5 Job role

1.5.1 Do you work as an IT specialist?

Yes ☐ No ☐

1.6 Size of Organisation (based on the number of employees)

How many people are employed by your business?

(Please complete based on the number of Full-time Equivalent staff numbers)

1-9 ☐ 10 – 49 ☐ 50 – 249 ☐ 250 and over

2.0 e-Businesses in Your Organisation

Please provide some information about the application of e-Business in your organisation.

2.1 e-Business Activities

2.1.1 Please state the degree to which the following activities/documents are computerised and exchanged electronically:

Activities/Documents	None	Low	Medium	High
Design				
Specifications				
Estimating				
Cost planning/cost control				
Tendering process				
Contract documents				
Project Programming				
Valuations & Final accounts				
Project Monitoring				
Materials procurement				
Labour procurement				
Plant procurement				
Subcontracting				
Purchase Orders/Invoices				
Administration Documents				
Other (please specify)				

2.1.2 Please state the core business activities / documents that are computerised / exchanged electronically

Core activities	None	Low	Medium	High
Human resource management				
Marketing				
Finance				
Purchasing (procurement)				
Distribution				
Accounting				
Project Management				
Facilities management				
Other (please specify)				

2.2 Communications Network

2.2.1 Please identify the type of the network you use:

Intranet [] Extranet [] Both Sky drives/Cloud networks [] neither []

2.2.2 Please identify the degree to which you communicate electronically internally and externally:

Activities	None	Low	Medium	High
Internal Communications				
External Communications				

2.3 Levels of e-Business Usage

2.3.1 If Internet technology is used in your organisation; please state the degree to which the following activities are undertaken:

Activities	None	Low	Medium	High
Product/Service promotion				
Electronic procurement (Purchase material & equipment)				
Bidding and tendering online (Whole project delivery)				
Project collaboration and management				
Customer relationship management				
Supply chain management				
Lessons learned documentation				
Other (please specify)				

2.3.2 Are you using the following enabling technologies for e-Business? If so, what is the degree of usage?

Activities	None	Low	Medium	High
Internet				
Cloud computing				
BIM				
CAD				

3.0 ICT Investment Advice and e-Skill Development

Please provide some information about how your organisation operates and maintains your e-business systems.

3.1 ICT Investment Advice

3.1.1 Please select all statements that apply to your organisation:

Obtain advice on IT investment from professional IT providers	
Obtain advice from an own IT department or IT practitioners	
Learn through a university or other research parties	
Implement IT investment through government/third party recommendations	
Other (please specify)	

3.2 ICT Expenditure

(Note that this is an optional question)

3.2.1 What is the average annual share of your IT budget, , including hardware, software, services and personnel, as a percentage of your total company costs in last 5 years?

1~4% [] 5~9% [] 10~14% [] 15~20% []

3.3 e-Skills Development

Rate the degree to which your organisation provides In-house to outsource IT training (starting off with no training)

3.3.1 Please select all statements that best reflects your organisation's situation:

Activities	None	Low	Medium	High
Staff learn new computerised skills through self-learning				
Hire IT practitioners to train your staff				
The staff attends training courses outside Your organisation				
Other (please specify)				

4.0 Drivers, Impact and Barriers of e-Business

Please provide some information about the drivers, impact and barriers of applying e-business in your organisation.

4.1 Drivers

4.1.1 Please indicate the reasons that your organisation engages in e-business:

Activities	None	Low	Medium	High
Your competitors moreover engage in e-business				
Your customers expect it from you				
Your supply chain expects it from you				
You believe the competitive Advantage of e-business				
Other (please specify)				

4.2 Impact

4.2.1 Please in order of significance, identify, how the following impact areas can influence your decision of implementing e-business?

Impact	None	Low	Medium	High
Growth of revenue				
Efficiency of business processes				
The procurement cost of supplying goods				
Quality of products				
Quality of customer service				
Productivity				
Management and control				
Accounting and administration				
Staff training				
Market reach				
Innovation				
Research and development				
Time and cost savings				
Organisational innovation				
Competitive advantage				
Expansion of partnership				
Visibility to supply chain				
Improving collaboration				
Other (please specify)				

4.3 Barriers

4.3.1 Please in order of significance, identify, how the following barriers can influence your decision to implement e-business?

Barriers	None	Low	Medium	High
Cost of investment				
Resistance to change				
Confidence in using new technology				
Lack of technical skills				
Legal barriers				
Interface with other systems				
Security of data transaction and submission				
Changeable IT technical needs of an organisation				
Modification of legacy systems				
Lack of power supply				
Basic competency in IT				
Availability of professional software				
Cultural influence				
Socioeconomic issues				
Lack of research in IT in construction (R&D)				

Other (please specify)				
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5.0 Improvement of e-Business

Please provide some information about potential improvement of e-business in your organisation.

5.1 Internal Resources

5.1.1 Please select all the statements below that best describe your organisation's belief in improving e-business implementation pertaining to internal resources:

More IT investment funds	
More expenditure in IT infrastructure	
Increase IT working staff or hire professionals to help	
More senior management involvement	
Better training for working staff	
Other (please specify)	

5.2 Business Processes

5.2.1 Please select all the statements below that best describe your organisation's belief in improving e-business implementation pertaining to business processes:

Automation of business processes	
Integration of different business processes	
Reengineering business processes	
Connect e-business value to business performance	
Other (please specify)	

5.3 Organisational Culture

5.3.1 Please select all the statements below that best describe your organisation's belief in improving e-business implementation pertaining to organisational culture:

Recognise the benefits and significance of using e-business	
Encourage staff to use e-business tools	
Commit to address issues/inhibitions when using e-business	
Change organisational culture to suit for e-business adoption and use	
Other (please specify)	

5.4 Business Goal

5.4.1 Please select one statement below that best describes your organisation's belief in improving e-business implementation pertaining to business goal:

Sell-side e-business policy, no need to integrate with the overall business goal	
e-Business policy integrated with the overall business goal	
e-Business policy incorporated as part of the overall business goal	
Other (please specify)	

6.0 Future of e-Business in Your Organisation

Please provide some information about the future of e-business with your organisation.

6.1 Future Investment in e-Business

6.1.1 Please select one statement below that best describes your organisation's commitment to e-business:

Plan to make an investment in 0~ 6 months [☐] Plan to make an investment in 6 months ~ 1 year [☐] Plan to make an investment in 1 ~ 1.5 years [☐] Plan to make an investment in 1.5 ~ 2 years [☐] No plans to make an investment [☐]

6.2 Launch of e-Business Policy

6.2.1 If your organisation has a plan for launching an e-business implementation policy, please indicate its type:

Short-term (up to 2 years) [☐] Medium-term (3~5 years) [☐] Long-term (over 5 years) [☐] Do not know yet [☐]

Appendix E – Interview guide

SEMI-STRUCTURED INTERVIEW GUIDE

1. Structure and procurement systems in the Ghanaian construction industry

- a. Please share with us how this whole business started and what type of administrative difficulties you have to deal with?
- b. Describe the procurement systems your organisation has been through.
- c. Since the commencement of your company, what are your views about the present situation of the construction industry in Ghana?
- d. Please identify areas that require improvement.
- e. Identify some basic technologies that are needed in the construction industry in Ghana

2. FDI Benefits to local contractors

- a. From this FDI/JV project, can you explain what benefit the Ghanaian construction employees gained working in the FDI?
- b. Please identify any new skills and practices acquired
- c. As a local partner in this FDI arrangement how has your firm's status is being enhanced?
- d. Describe how the construction industry can utilise FDI to promote technology transfer
- e. What are your views about technology like e-business as a tool for improving performance in the construction industry in Ghana particularly in the area communication for the purposes of collaboration and project management?

3. Operation of International Construction Firms in Ghana

- a. Could you please share with us how your firm entered the construction industry in Ghana?
- b. Do you (your firm) have Ghanaian contractors as your local collaborators on your current project(s)?

4. Application of e-business with international construction firms

- a. What type of technology do you use in your firm for project delivery, , for example,, collaboration and communication among the various local collaborators?
- b. Explain the benefits of utilising ICT element, such as e-business in the area of e-mail largely for communication and collaboration among project partners?

- c. Does your firm have a policy to support local collaborators to improve upon their basic technological capacity?
- d. From working experience, what in your opinion, constitute the basic requirements that a local collaborator need to establish e-business technology?
- e. In the context of the Ghanaian construction industry, describe the strategy to adopt when planning to establish e-business technology
- f. Describe how the government can support the construction industry to embrace ICT as a tool to help improve performance in the industry

Appendix F – Validation of framework



School of the Built Environment
The University of Salford
Manchester
M5 4WT

January 19, 2015

Dear sir/madam

An invitation to participate in the validation of a implemented e-business technology transfer framework

My name is Eric Kofi Adzroe a PhD candidate at the School of the Built Environment, University Salford, Greater Manchester UK. I am currently undertaking a research into e-business technology transfer to the construction industry in Ghana to improve performance.

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising Foreign Direct Investment (FDI) projects as a medium. In this context e-business may be explained to mean conducting business using dedicated computer networks and the integration of all business activities through information and communication technologies. In this regard, the attached framework was implemented through a rigorous research process. A mixed method was adopted, consisting of questionnaire surveys and semi-structured interviews. The framework as shown in the attached Figure consists of three key elements that were arrived at through the synthesis of key research results.

The validation process is considered as an significant process in achieving the aim for which the framework was implemented. Therefore,, your participation and feedback on the suitability or otherwise is most significant in the development of the final version of the framework. To achieve this, I have formulated a set of questions to solicit your expert opinion on the framework.

I would like to inform you that I have taken all the necessary steps to protect the content of the questionnaire and it will be kept confidential and be used for the purposes of this research. May I inform you that you can withdraw your participation at any time you wish to do so.

For further clarifications or information about this research, please do not hesitate to contact me or contact directly Dr. Bingunath Ingirige, School of the Built Environment, University of Salford, Greater Manchester, M5 4WT who is supervising this research.

Yours sincerely,

Eric Kofi Adzroe (PhD Candidate)
Email: e.k.adzroe@edu.salford.ac.uk

Dr. Bingunath Ingirige (Supervisor)
Email: m.j.b.ingirige@salford.ac.uk

Aim and objective of the research

Aim

The aim of this research is to develop a framework for e-business technology transfer to the construction industry in Ghana utilising International Joint Venture projects.

Research Objectives

To achieve the aim of the research, the following specific objectives have been formulated in order to facilitate the achievement of the aim of this research:

1. To explore general ICT in relation to e-business, , including drivers and barriers to construction e-business and the processes of e-business technology transfer through technology transfer principles;
2. To assess the structure, procurement practices and the influence of foreign contractors through FDI on the development of local skills in the Ghanaian construction industry;
3. To identify key fundamental requirements for implementing e-business technology within the construction industry in Ghana;
4. 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;
5. To validate this framework within the construction industry in Ghana by utilising industry experts and academia.

Description of the framework

Based on the findings of the research as summarised above, the conceptual framework implemented earlier in the research can be modified using key issues that emerged from the analysis of the research findings. It is significant to note that the updated conceptual framework has been expanded to accommodate vital suggestions put forward by the respondents. In this regard, the key components of e-business technology transfer based on local firm's readiness to take up e-business, namely: capacity and capability development, legal/security systems and ICT/Internet infrastructure, including culture were included in the modified conceptual framework as can be seen in the attached framework. As noted in the discussions, capacity and capability development for e-business technology transfer included the extent to which awareness is created in order for personnel to understand the underpinning philosophy of e-business; training and education, the development of ICT skills and technical capability. Furthermore, legal/security is another requirement for e-business functionality, and the criteria that determine a robust legal and security system included, laws covering electronic transactions, reliability and confidentiality of data. The third requirement as per the analysis and synthesis of the research results is ICT/Internet infrastructure and the criteria for this element at the national level includes, National backbone infrastructure; National data centre and a secondary data facility for disaster recovery capability while at the organisational level includes; Internet connectivity, Local and Wide Area Network (LWAN), computers, Uninterrupted Power Supply (UPS) and significantly electricity supply, which is necessary to provide the required energy to run the machines efficiently. Putting all these criteria together provides e-business output within the wider construction environment.

Meanwhile, it can be seen from the attached framework that the wider construction environment is provided as a platform within which e-business technology transfer activities can take place. It is seen that foreign firms operate within the wider construction environment likewise local firms, foreign firm's participation within the wider construction environment can influence e-business technology transfer through FDI collaborations with local firms who are moreover located within the wider construction environment. As noted with e-business technology transfer environment, it is suggestive through the CS findings that organisational culture is a key determinant in the success and sustenance of e-business technology within the construction industry in Ghana. It is argued in CS that cultural collaboration can enhance the process of technology transfer. It is moreover noted that apart from capacity and capability development and wider construction environment, FDI collaboration activities were not

included in the conceptual framework implemented during the early stages of this research. These components were included based on the in-depth findings of the research.

The conceptual framework has considerably been expanded based on the understanding provided and the perception by the respondents within their limit of what actually constitute e-business technology and fundamental requirements to implement e-business within the Ghanaian construction industry which was informed through the findings of the research.

Validation questions

Instructions to respondents:

Based on the background of the framework provided, please study the framework carefully and answer or tick as appropriate.

As provided in the table below, please tick **one** answer that best describe your opinion of the implemented framework.

	Strongly agree	Agree	Strongly disagree	Disagree	Not sure
The framework is simple to understand					
The contents are clear enough					
The framework is applicable in Ghana					
The framework is useful					
The framework is comprehensive					

Please provide comments or suggestions that in your opinion can be used to improve on the framework.

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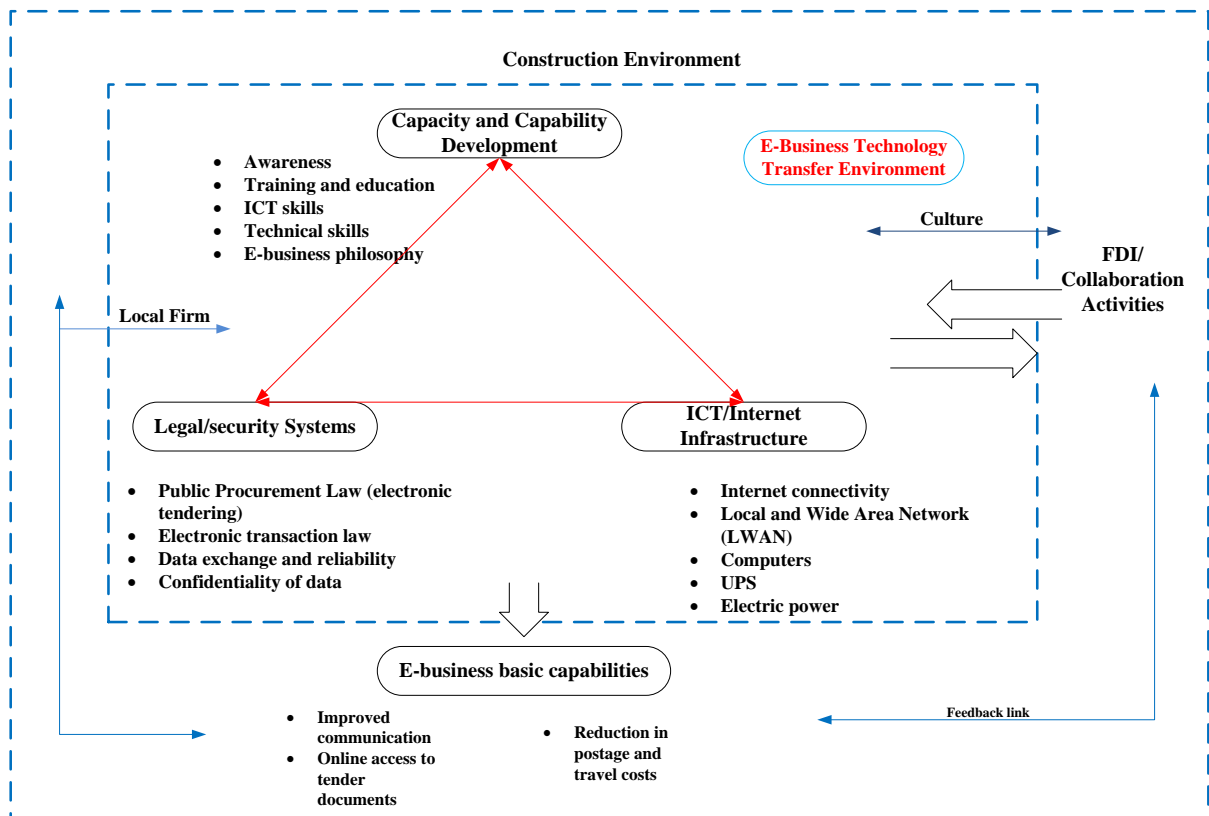
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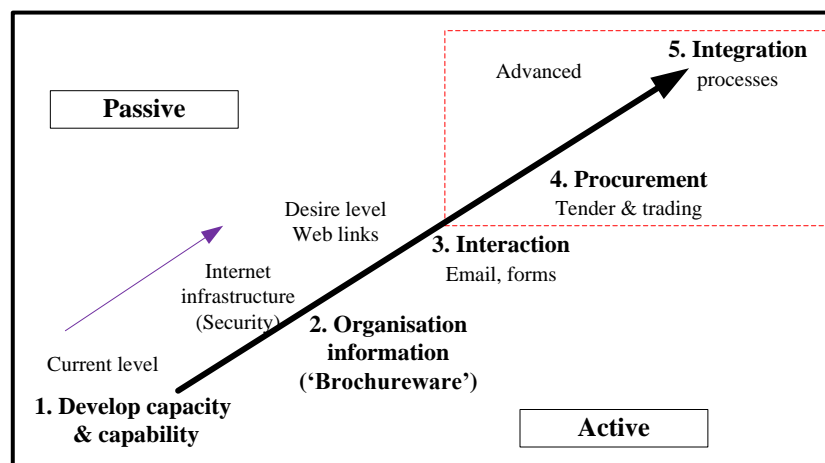
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The implemented conceptual framework

Appendix G- e-Business capability development road map

This process of e-business technology transfer is similar to the suggestion by Skyrme (2002) which state that e-business is the culmination of series of stages. Further, Skyrme (2002) proposed a step-wise model for e-business technology transfer. Skyrme's model is adopted in line with findings in this section to map-out e-business technology transfer strategy within the Ghanaian construction industry. The process and activities are in line with the Figure below. This is moreover in line with the implemented conceptual framework as shown in Figure 7-3.



Brief description of the process:

1. **Develop capacity and capability:** the starting point is to equip personnel with skills in ICT and technology knowhow to use the Internet at their work places.
2. **Organisation information:** many organisations may start their e-business presence by developing a basic website that can hold information about the organisation.
3. **Interactive:** at this stage the organisation's website can allow two-way communication, within and without. This commences enquires on products and request for invoices.
4. **Procurement:** this is an advanced stage in the development and implementation of e-business within the organisation. At this stage, the organisation is ready to conduct procurement activities with the capabilities of e-business and deploy e-commerce facilities to support online payments etc.
5. **Integration:** this is the highest stage where the organisation's processes are fully integrated with core business activities. At this stage the organisation can expand its

web presence to cover new business areas through customisation of web pages; report generation and quick information flow within the system.

Appendix H – Ethical approval memo



MEMORANDUM

Academic Audit and Governance Committee
College of Science and Technology Research Ethics Panel (CST)

To Eric Kofi Adzroe and Dr Bingu Ingirige
cc: Prof Mike Kagioglou, Head of School of SOBE
From Nathalie Audren Howarth, College Research Support Officer
Date 8th November 2012

Subject: Approval of your Project by CST

Project Title: A Study of e-Business Technology Transfer via International Joint Ventures in the Ghanaian Construction Industry

REP Reference: CST 12/33

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

A handwritten signature in black ink, appearing to read 'N. Audren', with a long horizontal flourish extending to the right.

Nathalie Audren Howarth
College Research Support Officer

For enquiries please contact:
College of Science and Technology
College Research Support Officer
The University of Salford
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Telephone: 0161 295 5278
Email: n.audren@salford.ac.uk

Appendix I – Published papers and report(s)

Journal paper in review

IMPROVING PROCUREMENT THROUGH e-BUSINESS TECHNOLOGY TRANSFER: PERSPECTIVES FROM THE GHANAIAN CONSTRUCTION SECTOR

Book chapter paper in review

INNOVATION IN E-BUSINESS: ISSUES RELATED TO ADOPTION FOR MICRO AND SME ORGANISATIONS

Research report in review

E-BUSINESS IN ONSTRUCTION: CIB SURVEY OF e-BUSINESS IN THE GHANAIAN CONSTRUCTION INDUSTRY. Report submitted to CIB Task Group 83 (CIB TG83)

Conference papers (peer reviewed)

ADZROE, E. K. & INGIRIGE, B. 2014. IMPROVING THE TECHNOLOGICAL CAPACITY OF THE LOCAL CONTRACTORS THROUGH e-BUSINESS TECHNOLOGY TRANSFER – THE CASE OF THE LOCAL GHANAIAN CONTRACTORS. *CIB W55/65/89/92/96/102/117 & TG72/81/83 International Conference on Construction in a Changing World. Heritance Kandalama, Sri Lanka, 4th-7th May 2014.*

ADZROE, E. K. & INGIRIGE, B. 2014. e-BUSINESS USE IN THE GHANAIAN CONSTRUCTIONINDUSTRY: THE DRIVERS. *CIB W55/65/89/92/96/102/117 & TG72/81/83 International Conference on Construction in a Changing World. Heritance Kandalama, Sri Lanka, 4th-7th May 2014.*

ADZROE, E. K. & INGIRIGE, B. 2013. EXPLORING e-BUSINESS TECHNOLOGY TO SUPPORT IMPROVEMENT IN THE INFRASTRUCTURE PROCUREMENT PROCESS IN THE GHANAIAN CONSTRUCTION INDUSTRY. *In: Proceedings of 11th International Postgraduate Research Conference 8-10 April 2013 University of Salford.*

Conference paper abstract

ADZROE, E. K. & INGIRIGE, B. 2014. E-BUSINESS TECHNOLOGY TRANSFER TO THE GHANAIAN CONSTRUCTION INDUSTRY – THE DYNAMISM OF TWO CULTURES. *In: Proceedings of 2014 College of Science and Technology Research and Innovation Showcase, MediaCity UK 18th June 2014 University of Salford.*

ADZROE, E. K. & INGIRIGE, B. 2012. . EXPLORING e-BUSINESS TECHNOLOGY ADOPTION TO SUPPORT IMPROVEMENT OF PROCUREMENT PROCESS IN THE GHANAIAN CONSTRUCTION INDUSTRY. *In: Proceedings of 2012 College of Science and Technology Research and Innovation Showcase, MediaCity UK 20th June 2012 University of Salford.*

Conference paper – Other (peer reviewed)

ADZROE, K. & GOULDING, J. S. 2004. AN e-READINESS FRAMEWORK FOR CONSTRUCTION MATERIALS PROCUREMENT. *In: Proceedings of the 4th International Conference of Postgraduate Research in the Built and Human Environment, April 1 – 2, 2004. University of Salford, UK pp 218-228.*