

**The Potential for Technology and Knowledge Transfers between Foreign
and Local Firms: A Study of the Construction Industry in Ghana.**

Ellis L.C. Osabutey ^a (Corresponding Author)

Karen Williams^b

Yaw A. Debrah^b

^aMiddlesex University, The Business School, The Burroughs, Hendon,
London. NW4 4BT, United Kingdom.

Tel: +44 (0) 20 8411 5282

e.osabutey@mdx.ac.uk

^bSwansea University, School of Business, Singleton Park, Swansea. SA2 8PP

Karen Williams: k.williams@swansea.ac.uk

Yaw A. Debrah: y.a.debrah@swansea.ac.uk

ABSTRACT

Multinational corporations (MNCs) and other foreign firms can be conduits for technology and knowledge (T&K) transfer to host countries in the developing world. Most of the existing research focuses on T&K transfers through FDI and are drawn from Asia not Sub-Saharan Africa (SSA), although SSA is increasingly receiving foreign investment. There is a paucity of research that gives insights into project-level T&K transfer issues in SSA countries. Using the Ghanaian construction industry as an empirical focus, this article explores T&K transfer potential. The findings reveal significant weaknesses in T&K transfer across industry subsectors and between foreign and local firms. This arises from the potentially complementary but dissimilar resource and knowledge bases. The weaknesses are compounded by the absence of coherent government T&K development policies.

Keywords: FDI, technology and knowledge transfer, construction firms, Africa, Ghana

1. Introduction

One of the major benefits of foreign direct investment (FDI) is the potential for foreign firms, in particular multinational corporations (MNCs), to transfer technology and knowledge (T&K) to local firms in the host countries. This is particularly the case in developing countries that are lagging behind the technology frontier (Pack & Saggi, 1997). In Lim's (2001) view, FDI is a conduit for transferring advanced technology to host countries. But Pack & Saggi (1997) suggest that because such inflows and the domestic abilities to utilise them are complex, considerable effort to promote assimilation is required.

The characteristics of local firms, with particular emphasis on their absorptive capacity and dynamic capabilities, are important determinants of effective transfers (Blalock & Simon, 2009; Girma, 2005; Gooderham, 2007; Spencer, 2008). Transfer, for example, requires frequent and intensive interaction between the recipient and the source (McDermott & Corredora, 2010). Local firms also need to overcome existing constraints to improve their absorptive capacity (Eapen, 2012). The bulk of research on T&K transfer has focused mainly on the absorptive capacity of local firms, paying relatively little attention to transfers between foreign and local firms. Sanna-Randaccio & Veugelers (2007) have, however, examined such transfers and observed that R&D decentralisation promotes T&K transfers (intra-firm and inter-firm) and centralisation limits external flows. While centralisation of R&D can prevent MNC T&K transfers both to and from local firms, decentralised R&D can result in reciprocal knowledge flows with the local competition. Centralised internal flows from parent to subsidiary remain unidirectional; decentralisation

leads to a bi-directional flow. This paper argues that such bi-directional transfers can take place when foreign and local firms interact (Eden, 2009) or work together at the project-level.

As indicated earlier, there are relatively few studies in the international business literature on T&K transfer issues in sub-Saharan Africa (SSA) with a particular absence of project-level analysis. Moreover, the available literature has not focused on an in-depth examination of local technology transfer issues and the potential for foreign-local knowledge transfers. This study attempts to fill some of these gaps in the literature. The current paper examines the potential role/contribution of foreign firms in T&K transfer in SSA, using the construction industry in Ghana as the empirical focus. It investigates why T&K transfers are low and whether and in what ways foreign firms contribute to T&K transfer in the Ghanaian construction industry. Specifically, it attempts to explore the following research questions pertaining to Ghana:

- Whether there are significant T&K gaps between foreign and local firms and why?
- How can the presence of foreign firms facilitate T&K transfer?
- Why would foreign and local firms derive benefits from collaborating?

The paper is organised as follows: Firstly, we review the relevant literature on technology transfer. Secondly, the research methodology is explained. Thirdly, the findings and empirical evidence are reported. Finally, we discuss the implications of the findings and draw some conclusions.

2. Theoretical and Empirical Literature

Technology has been defined in various ways in the business and management literature. Grosse (1996) refers to three main forms: **Product Technology, Process Technology and Management Technology**. *Product technology is the knowledge used to produce any product – the information that specifies the product's characteristics and uses. Process technology is the knowledge used to produce and organise the inputs and operate machinery – it relates to the process by which a given product or service is produced. Management technology is the knowledge used in operating a business – the managerial skills that enable a firm to compete by using its resources effectively* (Grosse 1996, p. 782). We adopt all three forms of Grosse's (1996) definition in the paper because it recognises technology and knowledge as integral components, which fits the conditions in the construction industry. Technology may be viewed as having both hard elements (construction outputs, materials, plant and equipment – product technology); and soft elements (skills, knowledge, organisation – management technology). The process technology, as described by Grosse (1996) combines product technology with management technology to produce outputs. All these processes as noted by Lee, Wang and Lin (2010) require a continuous flow and utilisation of data and information (knowledge).

Sahal (1982) similarly refers to technology as a 'configuration' and observes that technology relies on specifiable subjectively determined products and processes. The study of technology transfer cannot only focus on the product, because the product needs to be transferred with the knowledge relevant for its use and applications. Sahal's concept underlines the

inseparability of the technology and the related knowledge; technology transfer and knowledge transfer therefore go hand in hand (Li-Hua, 2004; Osabutey & Debrah, 2011).

T&K transfer has been a subject of considerable interest to groups such as government policymakers, international funding agencies, and business executives, because of its links to economic growth (Li-Hua, 2004). T&K transfers are seen as important mechanisms to promote capability building and innovation as well as technological development (van Egmond, 2012). Van Egmond (2012) notes that these mechanisms are influenced by the type of T&K, prior experience, complexity, partner protectiveness, control, cultural distance and organisational distance. The literature, for example, suggests that globalisation intensifies the competition between foreign and local firms (Gajendran, Brewer and Marimuthu, 2013). Where such firms are in direct competition with each other (offering similar products or services, on the same scale and for the same market); the local firm will need to imitate the behaviour of the foreign firm to be competitive. Thus local firms would need to become more innovative by adopting new T&K to compete or face the possibility of being displaced (Jenkins, 1990). T&K transfer from foreign firms to local firms can thus be measured by the productivity and growth or otherwise of local firms. Some studies have, however, shown that FDI can also negatively affect the productivity of local firms. Weak and nonexistent transfers to local firms has been attributed to limited hiring of local employees in higher-level positions within foreign subsidiaries, low labour mobility between local and foreign subsidiaries, insufficient subcontracting from foreign to local firms, little or no research and development (R&D) by foreign

subsidiaries and few incentives for multinationals to diffuse their knowledge to local competitors in the host country (Aitken & Harrison, 1999).

With respect to the literature on T&K transfer in Africa, Haddad and Harrison (1993), in a study of the Moroccan manufacturing sector, found that joint ventures benefitted from foreign investment. They did not find a significant relationship between FDI and productivity growth of local firms. Their findings are consistent with Dimitri's (1977). Woo (2009), on the other hand, found a positive effect of FDI on productivity using a large sample of 70 developing countries. It is, however, not clear how the 25 African countries in the sample contributed to the results. Researchers such as Haddad and Harrison (1993) advocate an investigation into why foreign presence generates positive spillovers in some countries but not others.

There is emerging literature that emphasises the impact of culture on learning and the adoption of new T&K (Lee, Trimi and Kim, 2013; Steers, Meyer and Sanchez-Runde, 2008; Tapanes, Smith and White, 2009). These studies argue that culture influences the way knowledge is sought and shared and therefore attitudes towards adopting new technology. New T&K absorption and implementation requires considerable effort from a developing country (Pack & Saggi, 1997). Human resources management practices that invest in employee's ability and motivation can contribute extensively to knowledge transfer (Minbaeva, Pedersen and Björkman, 2003; Minbaeva, 2008). In line with the knowledge management (KM) concept, a conscious effort to acquire, store, create, disseminate, and improve upon or add onto knowledge is a cross-cultural activity (Glisby & Holden, 2003). Thus an understanding of how formal and informal norms may influence T&K

transfers in high-context cultures, such as those in SSA, is important. The socio-cultural context both creates opportunities for interaction and shapes those interactions which may allow partners to learn through cross-cultural knowledge sharing, however, rational approaches to experiential learning are negatively influenced by weaknesses in the infrastructure in Africa (Kamoche & Harvey, 2006). Arguably, these weaknesses can restrict absorptive capacities.

KM processes are built upon the dynamic capabilities of firms and also support firms in the development of their knowledge base (Cepeda & Vera, 2007). Dynamic capability theory helps to explain how local firms in particular allocate their resources for T&K and innovation (Cetindamar, Phaal & Probert, 2009). It suggests that firms with limited resources also have limited capability or capacity to adopt new T&K. The absorptive capacities of local firms are important determinants of T&K transfer (Blalock & Simon, 2009; Eapen, 2012; Spencer, 2008). Eapen (2012) observes that T&K transfer begins with a clear search prior to the transfer and that repeated and intensive interaction is required for effective transfer (See also McDermott & Corredoira, 2010) . Thus T&K transfer relies both on the firm's absorptive capacity and a deliberate firm and governmental search, transfer and implementation of appropriate T&K.

In the FDI literature Findlay (1978) also argues for the possibility of a contagion effect, often referred to as externalities of efficiency spillovers, through which local firms could become more productive and efficient. Eden (2009) argues that informal transfers can occur which are not necessarily planned. Whether planned or not, T&K transfer is seen as requiring an

enabling environment and concerted effort from stakeholders to achieve this. Firm-level absorptive capacity, depicted by capacity/capability to utilise acquired knowledge, is also needed to allow potential spillover effects to occur (Todorova & Durisin, 2007). Absorptive capacity and spillover effects depend to an appreciable extent on the dynamic capabilities of local firms and they are linked to the wider environment in which they operate. Since construction projects are often more transient and vary tremendously (Dubois & Gadde, 2002), formal and informal transfers can be more difficult to achieve at project-level. Project based firms are characterised by temporary and unique micro-environment (Manley, 2008). The success of T&K transfer in emerging economies/SSA, particularly in the construction industry, will be more dependent on deliberate government and stakeholder policy actions. The exploration of project-level T&K transfer in construction is more complex and also differs from other types of FDI transfers. We review the international construction technology transfer literature next.

2.1 Construction Technology and Knowledge Transfers

Ngowi, Pienaar, Talukhaba and Mbachu (2005) view international construction as where a company, resident in another country, performs work in another country. A broader view of international construction encompasses domestic firms undertaking work or projects from foreign clients, or using human resources, materials, plant and equipment, and other construction inputs from foreign countries. Globalisation increases competition in domestic markets and also improves access to international markets (Gajendran, Brewer and Marimuthu, 2013). Therefore, although the construction industry is 'local'

in respect of its regulatory, procurement, political and social conditions (Ofori, 2003), it is enmeshed in the wider global business environment thus international business and technology transfer theories can also apply to international construction.

Much of the construction management literature, explores the benefits of the adoption and implementation of new technologies (Yang, Chen, and Wang, 2012). Construction firms, whether foreign or local, in internationalising their business need to understand their dynamic capabilities and be innovative (Teece, 2007). Ofori (1994a) observed that technology transfer should form part of a technology development programme. In order to promote technological self-reliance, the recipients should be involved in the transfer mechanisms. Suitable and hybrid technologies must be carefully selected to ensure that the technology is easy to use and transfer, fits with existing technologies, can use local resources and contribute to labour productivity and development of the organisation and the industry, whilst stimulating activities in other sectors (Ofori, 1994a).

The five main elements of international construction 'work' are defined by Howes & Tah (2003) as: design consultancy, contracting, equipment supply, construction products/materials and facility management. Official government information, however, often focuses on four key sectors: contracting; consulting; building material production; plant and equipment (Williams, 1997) in order to monitor their interests in international construction more closely by evaluating the individual subsectors separately. According to Mawhinney (2001), this split can help to explain the different approaches to the subject and the perceptible differences in the success of each subsector of

the industry. In this study, we make use of the official subdivision to evaluate the T&K deficiencies in the different subsectors.

Raftery, Pasadilla, Chiang, Hui and Tang, (1998) reviewed developments in the construction industry in several Asian countries. They observed the increased participation of foreign firms in infrastructure development. This is seen as a result of globalisation and the deregulation of markets necessitated by fiscal, technological and managerial constraints in developing countries and the financial and technical superiority of developed countries. Ofori (2000) observed that Raftery *et al.* (1998) focused on corporate development but argued that studies on construction industry development need to consider the entire industry. This is tackled by this paper through the analysis of industry subsectors and professional elements.

Foreign construction firms in developing countries are seen as bringing potential benefits to the host country (Barrett & Sexton, 2004; Bessant & Francis 2005; Carrillo, Robinson, Anumba and Bouchlaghem, 2006). The presence of foreign firms creates business opportunities for local firms and also enhances their potential to learn advanced design and construction technology (Ling, Ibbs and Cuervo, 2005; Ling, Pham and Hoang, 2009). However, van Egmond (2012) note that there is a need for local T&K development in developing countries to reduce overreliance on foreign firm. Therefore, studies argue that technology transfer should aim at local capacity building and the reduction of the reliance on foreign contractors and imported resources (Chatterji, 1990).

Technology transfer itself encompasses the transfer of physical assets, knowledge, and human capabilities to enhance the efficient organisation of a

construction project and services (Dunning, 1993). Embodied and disembodied knowledge are seen as the most important building blocks for T&K transfer (Barrett & Sexton 2004; Carrillo, 1996). Embodied transfer occurs through imports and the replication of building designs, equipment, materials and software for various design and construction methods. Disembodied transfer is essentially based on human skills and human capital seen as crucial for effective transfer, absorption and adaptation to new technologies.

Construction T&K transfer is complicated by cultural barriers and regulatory restrictions (Langford, 2000). This is further complicated by the unique construction output requirement and production process of each new project and by the fragmented nature of the construction industry itself (Kumaraswamy & Shrestha 2002). Ofori (1994a) suggests that in construction the transfer may occur via foreign-local firm joint ventures (JVs) of a long-term or project-specific nature. Sub-contracting arrangements (SCA) are also possible vehicles of T&K transfer but are seen as having some limitations because relationships are often unequal (Devapriya & Ganesan 2002). For this reason the World Bank prefers voluntary JV arrangements (Ofori, 1991; Ofori, 1994a; World Bank, 1986).

There is limited literature on project-level technology transfer particularly in SSA. Bakuli's study (1994) highlighted well intentioned but unsuccessful construction industry technology transfer efforts by the Kenyan government due to implementation difficulties and suggested foreign-local JVs as a solution. The capacity/capability implications were not evaluated and the study focused only on the contractor subsector as the unit of analysis. Carrillo

(1996) studied JV technology transfer in developing countries using twelve case studies across eight countries which included Nigeria and Lesotho as SSA countries. The study looked into the technology transfer mechanisms and found that no specific technology transfer mechanisms existed for the SSA countries. The study also used foreign contractors as its empirical focus with no evaluation of subsector T&K gaps and the potential transfers between foreign and local firms. This current study attempts to fill some of these gaps in the literature by evaluating the different subsectors and the T&K transfer potential between foreign and local firms.

2.2 Ghana's Construction Industry

Ghana has been selected as the focus for this study as it is one of the SSA countries experiencing strong and consistent economic growth over the last decade with increased FDI inflow (GIPC, 2010; Sutton & Kpentey, 2012; UNCTAD, 2011). Ghana is also among the seven African countries forecast to be among the 10 fastest-growing economies in the world over the next five years (Ernst & Young, 2012). Growth and productivity are significant for the purpose of this study because of the strong links between T&K transfer, productivity and economic growth (Elmawazini & Nwankwo, 2012; Osabutey & Debrah, 2012). Within Ghana, construction has been the fastest growing industry sector over the last decade (Anaman & Osei-Amponsah, 2007; Sutton & Kpentey, 2012) and the second largest contributor to industrial output after the manufacturing sector (Twerefou, Osei Kwadwo and Turkson, 2007). Productivity growth (related to industrial output) is also driven by technological change (Fu, Pietrobelli and Soete, 2011). In addition,

construction operation is multidisciplinary with both technical and managerial constituents and lends itself to project level analysis sought by this study. We also chose the construction industry because of its linkages with other sectors and economic growth (Giang & Pheng, 2011; Ofori, 2012). This underlines the importance of findings in this sector to other sectors in the economy

There is abundant literature that indicates that SSA requires rapid infrastructure development to cope with its developmental needs and indeed the attraction of foreign investments. However, particularly in the construction sector, local firms lack capacity to participate and compete with foreign firms for infrastructure development projects. Debrah & Ofori (2006), for example, noted that the majority of the local professionals lacked the requisite skills in Tanzania. Corkin (2012) has emphasised the total reliance on Chinese construction firms for construction in Angola. Aibinu & Odeyinka (2006) have investigated the negative impact of the absence of a national construction agency in Nigeria.

In Ghana, local firms also lack key resources and capabilities to undertake complex construction projects (Assibey-Mensah, 2008; Laryea, 2010; Osabutey, 2010). The state of the construction industry in SSA generally is characterised by under development and over reliance on foreign construction firms. Our respondents, most of whom have experience in other SSA countries, agree that, with the exception of South Africa, most local firms in the construction industry in SSA have challenges similar to Ghana. Ofori (2012) also confirms that Ghana's construction industry shares characteristics of construction industries in developing countries. Hence, the construction industry in Ghana provides a good platform for the analysis of T&K transfer

issues in Africa more broadly. In addition, it provides an African perspective to the extant international business literature on technology transfer in general.

3. Research Methodology

This empirical research employs qualitative methods of data collection and analysis with empirical evidence gathered through semi-structured interviews. Qualitative methods contribute to theory building by providing rich descriptions of real phenomenon which can provoke deeper thought (Weick, 2007). Although not widely employed in international business and management research, they move researchers away from ‘seeing what they already believe’ and allow the development of frameworks to facilitate richer conceptualisation and theory development (Doz, 2011). Doz (2011) points out that qualitative research may enable researchers to discover previously neglected phenomena or the importance of a theoretical perspective to a given phenomena. This is particularly relevant when studying a phenomenon such as T&K transfer in the construction industry in a SSA country, where existing empirical literature is limited. Qualitative methods, as confirmed by Birkinshaw, Brannen and Tung (2011), are also appropriate for the understating of the complexities of emergent and evolving phenomena spread over distance. In Ghana preliminary evidence revealed no existing or past collaboration between foreign and local firms on T&K transfer projects. This ruled out the use of multiple case studies focusing on T&K initiatives between foreign and local firms. The most appropriate method to fulfill our research objectives was therefore an evaluation of the experiences, views and perceptions of industry experts and practitioners. This approach was designed

to draw out complex stakeholder interactions (David & Sutton, 2011) and hence a semi-structured interview method which works well with a professional community was selected (Bernard, 2000).

A purposive sampling frame was developed from lists obtained from the built environment professional bodies and industry associations. Following Babbie (1995), this approach was adopted to allow the capturing of the views, perspectives and experiences from the key industry stakeholders. The sampling frame was expanded by ‘snowballing’ through interviews of important stakeholders arranged by earlier interviewees. This bolstered the depth and breadth of data to provide useful tangents to fulfil the research objectives. The interviewees were mainly experts and senior practitioners drawn from foreign and local construction firms, and executive officers from relevant public sector organisations and local institutions. The 64 interviewees are categorised in Table 1. The majority of the interviewees had worked for or collaborated with foreign firms and had varied foreign funded project knowledge or experiences.

Table 1 here

Exploratory discussions were held with some key stakeholders six months prior to the actual field work which took place between September and December 2008. Each interview lasted between an hour and two and a half hours. To update and confirm the empirical data, nine of the respondents in Table 1 above and two newly appointed professional body executives were interviewed again in September 2011. This improved the robustness of the data and the interpretation. Questions covered T&K deficiencies in local firms and the various subsectors, management expertise and competitiveness of

local firms, potential T&K transfer facilitation by foreign firms and potential benefits for collaborating with foreign firms.

Notes were taken for all interviews and over 70 per cent of respondents agreed to audio recording. Responses to each question were analysed by evaluating the similarities and differences between responses and identifying the key themes that emerged. Careful reading of transcripts led to emerging themes becoming the categories for analysis. Views supported by evidence(s) were critical in the analysis. The research questions were influenced by theory to enable us to develop higher order categories for analysis. The analyses of the data and evidence followed three content analyses processes namely: data reduction; data display; and drawing and verifying conclusions (Miles & Huberman, 1994).

4. Findings and Analysis of Empirical Evidence

4.1 Technology and Knowledge Gaps between Foreign and Local Firms

The interviewees were asked to identify and explain whether there are T&K gaps in Ghana and if so, their prevalence within the construction industry and its various subsectors in Ghana. They were also asked to explain why the gaps exist, the extent, that is either high or low, and how transfers from foreign firms could be facilitated. There was general agreement that all subsectors exhibited T&K gaps. On this issue all the respondents overwhelmingly pointed to the lack or absence of a coherent government policy that mandates or, at the very least, encourages project-level collaboration between foreign and local firms specifically for T&K transfer in Ghana.

Most interviewees argued the need for local construction firms to acquire competencies in the development of systems, practices and processes that would enhance their efficiency and effectiveness, and, therefore competitiveness by enabling local firms to promptly deliver quality outputs. It was argued that the achievement of these objectives requires firms to acquire relatively new technologies but this was difficult for local firms to achieve because of resource (financial, human resources – expertise, equipment, materials etc) deficiencies and lower capacities. These are consistent with findings in Tanzania by Debrah & Ofori (2006) and studies in Ghana by Assibey-Mensah (2008).

In Ghana, the application of new and modern technology is relatively lacking in local firms in comparison to foreign firms who tend to have superior resources and expertise and hence greater competitive advantage. Most International Competitive Bidding (ICB) requirements are, for example, not within the resource base of most local firms. Local consultancy firms are extremely small and the majority employ less than ten professionals. Such firms are deficient in emerging specialties, whereas foreign consulting firms often have cohorts of professionals with a wider skills-set that enables them to undertake huge projects speedily and synergistically. In both consulting and contracting there is also a visible ICT gap between foreign and local firms. Over 70 per cent of respondents agree that Ghanaian construction firms generally lacked expertise in project management and contract administration, which negatively affected their efficiency and profitability.

Most foreign firms have designed specialisation systems but this is lacking in most local firms. If you look at contracts administration, they [foreign firms] have specialists who look at how to exploit flaws in various contracts to make more profits. They have good information systems that create synergy and speed up projects which improves their competitiveness (Local Consultant Architect).

The view of some 53 per cent of the interviewees was that lax and poor standardisation and specifications within the industry did not also help effective T&K transfer. This view is consistent with Kolb's (1984) experiential learning cycle: if materials and designs were standardised, their repetitive use would lead to an experiential learning and professionals, practitioners, artisans and operatives could get better at their jobs given repeated learning opportunities. The interviewees commented that the majority of local firms were aware that adopting new technologies would improve their performance. Financial constraints together with limited guarantees for future jobs and inconsistent specifications and standardisation, however, do not encourage investment in new technologies. The role of specifications and standardisation as a construct of societal infrastructure has not been highlighted in the literature as contributing to the poor T&K within local firms. Whilst Ofori & Chan (2001) have emphasised the role of government in the development of the industry and technology transfer, respondents specifically reiterated the need for government policy to support standardisation of specifications for construction projects to facilitate planning and investment into related technologies. Due to the lack of a coherent policy for industry development and T&K transfer, technology gaps exist in the different subsectors of the industry in Ghana and this is explored below.

4.1.1 The Consulting Subsector

The majority of respondents agreed that project management expertise was lacking among the local practitioners. For example, expert urban designers, transportation economists and engineers are scarce in Ghana. Although the use

of software, such as AutoCAD and ArchiCAD, were becoming popular, the interviewees pointed to a general and significant gap between foreign and local firms in the use and development of software which contributed to the relative differences in the speed and accuracy of delivery of construction projects. Local construction professionals were not adequately abreast with energy efficient designs and most interviewees suggested that consultants could precipitate the use of new technologies through the standardisation of their design specifications. There was broad agreement that local consultancy firms lack the collection and aggregate of expertise required for timely, accurate, seamless and innovative services citing design and the use of new materials as well as energy efficiency and software use as key examples.

Among consultants there are significant T&K gaps in terms of catching up with new innovations in designs and the use of new materials: The use of a lot of glass; structural glass for instance, and the use of steel in modern buildings. There is also a whole area of energy efficiency, which no one in Ghana is paying attention to unfortunately. Most buildings are air-conditioned, but there are very few energy efficient buildings. ICT is also not fully exploited among Ghanaian consultants. Then, there are software for material handling and monitoring of fuel usage, time management and efficient running of construction projects but these are absent in the industry in Ghana. Consultants need such software to efficiently manage projects as project managers, for example (MNC Quantity Surveyor).

It was also suggested by the interviewees that the buildings subsector needs to update and standardise specifications as the lack of standardisation acts as a barrier for T&K development and also has cost implications:

In construction or architecture it is referred to as 'modular coordination', it [standardised specifications] cuts down waste considerably. Here in Ghana, it is not uncommon to buy a door and a frame that do not fit. In the absence of standard specifications producers and suppliers bring all sorts of inappropriate products onto the market (MNC Civil Engineering Consultant).

The majority of respondents were of the view that the technology gaps within the roads subsector were relatively low with local firms arguably able to produce outputs of comparable quality. This could be linked to revised and updated specifications in this sector as cited below:

We need to revise our specifications for the buildings sector in Ghana. Recently we revised specifications for civil engineering and road construction projects and now have a 2007 version and this has reduced the technology gaps considerably (MNC Procurement Consultant; local professional with tender review experience).

Arguably, the civil engineering and roads subsector also undergone limited technological change. However, in the buildings subsector most local practitioners/firms had failed to catch up with new product, processes and managerial T&K.

4.1.2 The Contracting Subsector

Most interviewees argued that project management expertise was lacking among local contractors. They added that poor financial management practices within local firms exacerbated financial difficulties, which in turn restricted their ability to access financing for their projects and the adoption of new T&K. Local firms also had to rely on more expensive local financing from commercial/retail banks as compared to their foreign counterparts. Quality control was seen as almost non-existent because regulators lacked enforcement capacity. Local contractors also did not have access to or use material handling equipment and project management software which could improve speed and accuracy of delivery. According to the interviewees, most local firms are unable to use ICT and lack the ability to handle relatively basic designs; complex designs are an even bigger challenge. On another level it was argued that:

The local contractors have a problem in the acquisitions of these equipments. They are aware of the alternative equipments for their operations, but lack the financial capability to procure them. Contractors need continuous flow of projects to encourage them to invest in new technologies (Quantity Surveyor, Contractors' Association Executive).

The lack of regular projects and delayed payments for completed projects adversely affected local contractors, even those with adequate financial management capability.

4.1.3 The Plant and Equipment Subsector

The majority of the interviewees agreed that although dealers are prepared to provide needed plant and equipment, there is a prevalent problem of their inappropriate use. Most local contractors are also unable to appropriately assess plant and equipment requirements for projects because of the lack of requisite knowledge; this often led to inappropriate and sometimes costly choices. Most local firms in Ghana are labour intensive and rarely use automated horizontal or vertical transportation. It was observed that:

What plant you choose for what situation is absolutely important. For instance, are you going to use a CAT 225 or CAT 213? The choice of plant is a technological thing and once you've decided on the plant, the efficient use of the plant becomes the next important thing. Cranes for vertical and horizontal transportation are hardly used. Then when it comes to tools, there are issues like how to use 'total station', 'dismat', etc: These are everyday tools and equipment which quite frankly not many firms use in Ghana (MNC Construction Management Consultant).

The choice and acquisition of a plant and equipment also depends on the level of knowledge and expertise of local senior managers and the prospects of future related projects:

If a senior manager thinks buying a dismat or crane is going to be beneficial because perhaps there is going to be flow of work; he would invest. What's the point in buying a crane if it might not be required on the next project? It might be costly and unfortunately we don't have a properly organised plant hire system in Ghana (Quantity Surveyor Consultant).

Since local firms do not have the financial resources to purchase plant or equipment, a properly organised plant hire system that can encourage firms to hire and use the right equipment was necessary. This is particularly the case in Ghana because most contractors are operating in a market where it is difficult

to plan for and invest in T&K for future projects; winning contracts is often dependent on political affiliations and influences. There are also T&K deficiencies in the transfer of maintenance and repair expertise from the dealers to local firms.

4.1.4 The Building Material Production and Supply Subsector

Most of the materials used in the construction industry are imported. Local building material production is becoming less viable because imports are often cheaper and of better quality: Some of the locally produced building materials did not meet the quality and specifications required. For example:

The quality of iron rods being produced are not always to the required quality standard. Mild steel is reasonably alright, but high tensile steel, for example, is not. When we wanted to use tensile steel on a project we got samples to test at Ghana Standards Boards and then we sent samples to our collaborators in South Africa and we were not happy with the results (Civil Engineering Consultant).

This reliance on imports means that the subsector's presence is dwindling further over time. The Building and Road Research Institute (BRRI) has been involved in developing local substitutes such as 'posolana cement' but, in view of the lack of government policy to create and support demand, they are unable to commercialise their products adequately to compete with imports. In addition, local raw materials such as lime, clay and bamboo have not been fully exploited as viable alternative building materials. As mentioned earlier, the control of material imports is largely unregulated. Some suppliers are importing and supplying curtain walling, laminated glass, and stainless steel. Often these materials are not properly tested to ascertain their suitability for use in the tropics. The local materials content of conventional buildings in Ghana was seen as alarmingly low:

In the works sector we have to look at predominant materials that are used, the sources of those materials, the material production companies and improvement in technological know-how. Currently our research indicates that for conventional

houses imported content is about 67%. We need to look into how collaborations can help us to develop some local substitutes (Building Consultant /Researcher).

Further on the development of local material substitutes:

The BRRI is playing that role, but there is no government policy backing. Brick, for example, is an extractive industry and all the products are local. We train people to produce them as substitutes for walling, but there is no government policy to help create demand. We expect government to come out with a policy, for example, that basic social infrastructure like school buildings, clinics, police stations, etc. within say 40kms of any brick production facility, should use brick products. This would create demand, which would lead to quality control. There is no such policy backing and the products do not move and skills acquired will not improve. If government policy creates demand there would be increased productivity and efficiency and subsequently innovation. Without that, the technology acquired may be lost (Past BRRI director and private consultant).

Such statements underline the lack of a deliberate and strategic government policy and the negative effects on the state of the local building material production subsector. Deliberate policies with follow up policy actions are seen as necessary for industry development.

4.2 Management Expertise and Competitiveness of Local Firms

It was evident that most local firms lacked the knowledge required to efficiently run their construction business i.e. the managerial functions, skills and the competences that enable a firm to compete through the effective and efficient use of resources. Table 2 highlights the areas of expertise and T&K lacking in local firms in Ghana identified from the transcripts of all the interviews. The findings show that the majority of local firms lack the requisite expertise in contract administration, which is often reflected in a deficient knowledge of design development, costing and the tendering process. All of these factors adversely affected the competitiveness of local firms during the bidding process. In addition, they also influenced negatively their ability to resolve disputes and conflicts with clients and other stakeholders.

Since contracts are often not well understood, variations in expected costs often exacerbated financial problems and growth prospects. Local firms also lacked project management expertise and were unable to employ appropriate software/control systems to improve completion times and reduce costs.

Table 2 here

In addition, the HRM function is largely neglected in most local firms. This has implications for the transfer of implicit knowledge through the human capital of the firms. Usually an employee in a general administrative capacity plays the role of a human resource manager with their responsibility almost entirely focused on employee remuneration. Strategic HRM, such as human resource planning, training and development, performance appraisal, and health and safety, are all largely ignored with consequent adverse effects on T&K transfer potential. Most local firms also lack financial management expertise, which often leads to poor financial control and budgeting. Quality control and environmental control management are largely ignored as well. Procurement and plant and equipment management deficiencies are also prevalent and the concepts of business development and strategic management appear to be missing from the vocabulary of many local firms. Most of these deficiencies are consistent with findings by Debrah and Ofori (2006), but contracts administration, strategic management as well as procurement and plant and equipment management were seen as additional deficiencies of local firms in this study. As a result local firms in most of SSA remain undeveloped and uncompetitive; T&K transfers appear to be low down their list of priorities.

4.3 Technology Transfer Facilitation by Foreign Construction Firms

A further area of empirical research explored how foreign firms could facilitate T&K transfer to local firms. Interviewees from both foreign and local firms shed light on this issue and were generally able to identify types of collaborations that could facilitate such transfers. These include JVs, subcontracting arrangements (SCAs), strategic alliances (SAs) or consortia (Ganesan & Kelsey, 2006; Ofori, 1991; Ofori, 1994a; World Bank, 1986). SCAs were seen as the most plausible option because of well-known current resource differences between foreign and local firms but respondents did not identify the limitations of unequal relationships in SCAs highlighted by Devapriya & Ganesan (2002). They pointed out that where provisos existed in contracts requiring foreign-local collaboration some T&K transfer often occurred. Respondents working for local firms pointed out that projects funded by foreign bilateral loans without such provisos rarely involved local professionals and firms and hence little or no transfer occurred. In such situations foreign firms were unwilling to transfer any T&K to local firms, even at the consultancy level. This is consistent with the literature that MNCs have no incentives to transfer T&K in such cases (Aitken & Harrison, 1999). Local professionals admitted they were sometimes weaker than the foreign companies in terms of ICT knowledge and applications, but emphasised that the knowledge base and capacity to learn to close the T&K gaps existed. Some local consultants outlined situations where they were only involved at the early stages (design and feasibility studies) of projects being only peripherally involved or given a data collection role by their 'supposed' foreign partner(s),

for example. Some foreign firms, according to the majority of respondents, make every effort to cut out local professional involvement:

In relation to the [Ministry] building... after we had done all the drawings, and put together all required documents, we sat down with them [consultants from China] for a whole week at the Ministry and went through all the drawings and documents. They took the drawings away, modified them a little bit. After they had done their drawings [from our drawings], without giving credit to us, they wrote to the minister that they no longer needed local involvement. We want to learn and improve but we were denied that opportunity (Civil Engineering Consultant).

There were no policies to coerce or encourage foreign firms to collaborate. This lack of local professional involvement often leads to the recall of foreign firms to deal with the maintenance and repair of infrastructure at later stages at high financial costs. Respondents emphasised that the industry needs policies to promote and encourage transfer and to fill T&K gaps in specific areas. With regards to SCAs, it is important, for example, to indicate the scope and quantum of the project to be subcontracted to ensure that local firms are not exploited. In order to improve T&K within the industry, some interviewees argued the need to develop projects aimed specifically at improving local capacity by involving foreign firms as project supervisors to manage local firms throughout a project. The selected local firms could then be given similar future projects to execute (See Carrillo, 1996).

Transfer schemes developed in stages would require monitoring and evaluation to ensure that objectives are being met and follow-up policies to ensure successful use of newly acquired T&K. For example, it was suggested that the transfer of new T&K could become a standard requirement of all subsequent government projects. In addition, foreign firms who employ local professionals could also be given tax rebates and preferential bidding advantages, with particular advantages accruing to firms employing locals at the middle and higher levels of management. Most interviewees also felt there

was a need to institute and enforce local content laws with respect to local employees and materials contents in projects to enhance T&K transfer.

There was a need to review the current policy of projects going to the lowest bidder, they argued, in order to favour the lowest bidder willing to transfer the T&K the host country needs. Training and development (T&D), T&K transfer and capacity building programmes all needed to be built into contracts. Currently firms with the lowest bids usually won the contracts and then often brought most of their employees and materials from their home countries. The host country could only benefit from the construction output with a future maintenance and repair burden. This meant any opportunities for local linkages, T&K transfer and capacity building as well as employment creation, etc., were lost. Limited foreign-local firm interaction also meant tacit knowledge transfer opportunities were lost to the detriment of the development of local expertise and industry at large. Respondents argued that this trend must be reversed to reduce overdependence on foreign firms and expertise. Most local consultants welcomed the involvement of foreign consulting and contracting firms in national construction projects but criticised their own lack of involvement, the low level of capacity building and the subsequent overdependence on foreign firms. This led to a lack of T&K transfers and industry development (Chatterji, 1990). Government policy and commitment was seen as necessary for change.

4.4. Potential Benefits for Collaborating Foreign Firms

Discussions of some of the benefits which foreign firms could derive from collaborating with local firms led to a number of examples. The Ghana

Investments Promotions Centre (GIPC), for example, already gives incentives to foreign firms investing in Ghana such as tax rebates and import duty waivers on plant and equipment and the use of free zones. In addition:

Consulting firms that come in and use a certain percentage of local expertise gain some marks [points] that makes it easier to enter into the Ghanaian market. Because they use our expertise they gain an advantage over other foreign firms in the bidding process, so each side benefits (Civil Engineering Consultant).

Local involvement is seen as having advantages for both local and foreign firms:

The Millennium Challenge Corporation of America insisted that there should be local collaborations and I represented the Ghanaian component. I must confess we learnt a lot from them [foreign experts and practitioners] but there are certain situations where they rely heavily on our local expertise (Procurement Consultant).

Other benefits mentioned by some interviewees included local socio-cultural and institutional knowledge and environmental knowledge. Transfer of local knowledge to deal with indigenous working practices, ministries and institutions, traditional authorities and communication with local indigenes can all influence project performance positively. Some examples of interviewee comments are given below:

Surveying in rural areas, for example, requires local involvement. Skin colour [race] alone can drive people away [some rural dwellers have not previously encountered foreigners], but if personnel of foreign firms collaborate, they gain because we speak the local [native] language and are familiar with the local terrain and hence can help and assist them to get the job done. (Geomatic Engineer).

Whenever foreign firms are bidding, they require some knowledge about local situations from local professionals and practitioners; we know more about local labour, where to get materials, how to go about certain issues, how to go about acquiring land etc..(Contractors' Association Executive)

There are local peculiarities that no matter how sophisticated you are as an engineer from California, you definitely will not know and ignore at your own peril. Particularly because the construction industry is environment-specific and local knowledge is crucial. If you are from the UK, you will need to know about the culture of the people in Accra to prepare a master plan. This is because architectural engineering planning is responding to socio-cultural activities of people and you are just translating that into space. So you have no other option than to collaborate with locals (Architectural Consultant).

Collaboration with local practitioners can enhance the success of projects by helping firms to navigate socio-cultural and institutional peculiarities. In addition, there are public relations advantages for foreign firms' collaborating with local firms or employing local people. A few interviewees suggested that foreign firms who recruit and train indigenous local people are in a better position to deal with local conflicts and issues that arise in the course of projects because their own employees could serve as mediators. In their view, some problems could be entirely avoided in this way.

Since construction is environment specific, foreign firms who collaborate with local ones can also learn how the local environment may respond to the use of certain materials or technologies. Climatic conditions, for example, may create construction difficulties; certain inputs/outputs that suit temperate regions may be unsuitable for construction in the tropics. Such knowledge can be gained by foreign firms through local collaboration and can be usefully transferred to other similar environments especially in the sub region of Africa:

Recently a foreign firm came in with no serious local involvement and their design was such that most of the external cladding was cardboard (almost 60%). They didn't involve local professionals and did not take into consideration our environmental degradation with regards to termite infestation. They ignored it and 3 or 4 years down the line termites set in and chopped about 50% of the external cladding. Their representatives [later] called on us to help them arrest the termite infestation. In a nutshell collaboration is in the interest of government [the client], local firms and foreign firms (BRRRI Researcher).

A two way T&K transfer can be beneficial to foreign firms as well as to local firms even in developing countries; a fact that has not been highlighted adequately in existing literature. Cost savings for foreign companies from such collaboration can be translated into more competitive bidding and arguably higher profits. In terms of human resources, labour costs in Africa may in

general be cheap, but further investment in T&D is often needed to enhance their productivity:

More often than not a lot of these contracting firms come in and stay. Taysec and others have been here for ages and Ghana becomes a base for operations for new business in the sub region. Sometimes they've ended up taking up human resources in Ghana to other sub regional markets and back to Ghana, because these individuals have acquired the skills and expertise needed by the foreign firms because they have been given additional training. This increases their profits (Senior Manager MNC Equipment Dealer).

A historical background of non-collaboration and its negative effects on the government [client], the local industry and to some extent the foreign firms themselves was generally highlighted by other interviewees. These examples illustrated how the lack of foreign-local collaboration does not only hinder T&K transfer potential but also increases both short-term and long-term construction costs for the foreign companies concerned.

4.5. Potential Benefits for Collaborating Local Firms

Most respondents identified the T&K deficiencies in local firms shown in Table 2. They agreed that they would benefit from collaborating with foreign firms by acquiring the skills and knowledge required to undertake larger and complex projects. This potential is often not met because there are no deliberate T&K transfer and capacity building policies and programmes and aid dependence made collaboration even more difficult:

The Bui Dam – the single heaviest and largest civil engineering construction project in Ghana in the last half century is being constructed with a Chinese Government loan. Despite the fact that it is a loan, a deliberate government policy should have been in place to ensure that there is technology transfer or partnership with Ghanaian construction firms. (Professional Body Executive):

Because local firms are poorly resourced collaborative opportunities could increase their resource base which would eventually lead to T&K transfer and capacity building. A civil engineering consultant indicated that there was some

collaboration at the consulting level with consequent transfer and increased resource base:

Yes, some of the foreign firms [at the consultancy level] do collaborate. The Indians are better, for example, the people who are doing the NI road. They have teamed up with local people to do the work here and this helped the local people to even purchase equipment. This is helping them because they are doing the design side by side (Civil Consulting Engineer)

There were various examples of projects implemented by foreign firms with no local involvement across subsectors, but they argued that the consultancy level enjoyed some collaboration with evident T&K transfer and capacity building:

In consultancy, it is better because the World Bank for example insists on that. Another example is the bilateral programme by DANIDA on projects like the roads, water, etc. They create allowance for training arrangements and invite four/ five Danish firms and in the bid document they insist that you team up with local consultancy firms. There, we, for example, can say we have learnt a lot. I have had the benefit of going to Denmark on three different occasions to understudy one lead consultant... There are areas that we are deficient; transport economics, traffic engineering, transport transformation planning, urban design, landscape architecture, structural engineering for bridge design etc. Those specialist programs are not taught at KNUST [Kwame Nkrumah University of Science and Technology, Ghana] so we are handicapped. In such cases we quickly fall back on the foreign experts and that has been very positive in terms of transferring knowledge and expertise to locals but there is still a lot of room for improvement (Urban and Planning Design Consultant).

Currently such initiatives were mainly driven by international institutions and not influenced by local government policy. The general view was that there is room for improvement in the consultancy subsector but other subsectors receive virtually no such collaborative opportunities. There is the need to develop a comprehensive T&K transfer and capacity building programmes that deals with human capital development as well as capacity and capability building of local firms to ensure beneficial collaborative arrangements. Respondents envisage that an extended benefit for local firms would be their potential to win contracts beyond the borders of Ghana within the sub region because some other SSA countries had even weaker uncompetitive local firms.

5. Discussion

This study highlights the significance of a range of factors that adversely affect effective T&K transfer. These include: the lack of project management expertise exacerbated by poor ICT knowledge and infrastructure, overreliance on foreign expertise and foreign inputs because of the absence of local substitutes, infrequent flow of contracts to local firms and limited foreign-local collaboration, inappropriate choice and use of plant and equipment, regulators who lack enforcement capacity and inconsistent standardisation and outdated specifications. These deficiencies highlight both the absence of a coherent government policy for the industry sector in Ghana and the need for more government involvement. In addition, our study underlines the potential and symbiotic benefits of foreign-local collaboration.

Most local firms in Ghana cannot compete with foreign firms because of their lower resource base. In addition, these local firms are neither willing to collaborate with each other nor large enough to meaningfully collaborate with foreign firms through JVs. These findings are consistent with those of Debrah & Ofori (2006) in Tanzania and Assibey-Mensah (2008) in Ghana. The majority of construction firms in developing countries are small-to-medium sized entities which lack resources. Considerable T&K gaps exist between foreign and local firms in the construction industry in Ghana. In order to address this problem, Ofori (1994a) argued that governments in developing countries need to support technology transfer programmes. This has been achieved in some developing countries. For instance, Carrillo (1996) pointed to schemes where a reputable foreign firm could act as a project manager to manage larger Nigerian contractors as had been the case with Mowlem

International (foreign firm) in the Malta International Airport project. Mowlem acted as the project manager and assisted four local contractors who had never previously undertaken projects on a comparable scale. The local contractors were put together as a joint venture to undertake the project from tendering to completion. The practitioners interviewed for our paper similarly argued the case for foreign firms to manage local contractors on specially designed projects to enhance T&K transfer. They suggested that policies need to be designed in stages with follow up policy actions to utilise the acquired T&K. Foreign firms will require incentives to support this type of T&K transfer and capacity building initiatives in order to increase knowledge stock within the industry in Ghana.

5.1 Managerial Relevance

Beyond the incentives that attract foreign firms to undertake projects or invest in Ghana, there also needs to be policy initiatives to encourage foreign-local firm collaboration. In addition, foreign firms need to be made more aware of some of the benefits they could derive from such collaborations as highlighted in this study. Foreign firms can benefit from local knowledge in dealing with political, socio-cultural, institutional and environmental issues. Future opportunities, the benefits of understanding local peculiarities and the advantages of developing African employees to work in similar environments all present a strong case for foreign-local collaboration.

Key areas of T&K deficiencies among local consultants were identified as: project management expertise, software development and usage, standardisation of design specification, and speed and accuracy of delivery.

Debrah & Ofori (2006) observed that professionals in the construction industry in Tanzania had similar skill deficiencies. Local knowledge deficiencies in ICT and project management, among others, could be bridged through collaboration with foreign firms and it is seen as important for government policies to encourage such collaboration. Among contractors, T&K deficiencies include construction project management, financial management, quality control, the efficient choice and use of plant and equipment, ICT and contract administration. In the plant and equipment subsector, T&K deficiencies currently exist in the transfer of maintenance and repair expertise from the dealers. Local building material substitutes are almost non-existent and the majority of input materials are imported because the few local production facilities are unable to compete and there is no government policy to support the development and growth of this subsector.

Whilst the T&K gaps between local and foreign contractors in general are huge, the gaps in the different subsectors vary and are larger in the buildings subsector than the roads subsector, for example. T&K gaps between local and foreign consultants, on the other hand, are relatively small. Financial constraints and the lack of guarantees for future contracts further hamper investment in T&K by local firms. As a result they continue to lag behind the technology frontier. Many authors have linked the development of the construction industry in developing countries to technology transfer (Fox, 2003; Ofori, 1994a; Ofori, 1994b; Ofori, 2000; Ofori & Chan 2001; Raftery et al., 1998) but the lack of financial and human resources within the local firms are key factors which impede construction industry development and T&K

transfer (Fox, 2003; Ofori, 1994a; Ofori, 2002). The government of Ghana currently does not have a T&K development and transfer agenda.

6. Conclusion

The paper has reviewed the current state of T&K transfer and utilisation within the construction industry in Ghana. The study revealed that the resource base (finance, expertise, equipment etc.) of local firms in Ghana constrain collaborative options. Local firms have resource limitations, particularly in the area of financing. This means that they are unable to compete with foreign firms and this contributes to the technological distance which reduces the potential foreign-local T&K flows. Partnering between MNCs and local firms is complicated by potentially complementary but dissimilar knowledge bases (e.g. technological vs. socio-cultural and institutional knowledge). The study sheds some light on how the presence of foreign firms could help to facilitate T&K transfer, but indicates that the absence of government policies and incentives to encourage foreign-local collaboration means that potential T&K transfers are not exploited and therefore are at an extremely low level currently. The study employs a subsector analysis of T&K gaps which reveals weakness in all subsectors but noted relative strengths in the consulting subsector. This paper also argues that collaboration between foreign firms and local firms can result in a symbiotic relationship with mutual benefits. Once again, however, it is important for governments to provide some further incentives to encourage this collaboration.

There is the need to aim government and industry policy at strategically developing local firms to ensure that they can meaningfully collaborate with

foreign firms through JVs. This development must look specifically at the financing of local firms, whose current sources of finance from local commercial/retail banks at exorbitant interest rates exacerbates their inability to compete. Currently, local firms continue to lack T&K to handle complex and large scale projects. This means the local construction industry in Ghana remains underdeveloped and uncompetitive. Technology and knowledge foresightedness backed by credible government policies are thus needed. Construction projects can be used for T&K transfer and capacity building in developing countries/SSA. However, in order to harness this potential the findings on Ghana show that a well thought out policy framework is required; the fact that local infrastructure cannot be repaired and maintained by local firms and professionals, for example, is symptomatic of general policy failure.

This study brings together pertinent international business, human resource, and construction management literature to analyse T&K transfer issues in Ghana in particular and Africa more generally. This study has moved the discussion of T&K in the extant international business literature to a new level namely project-level T&K transfer. The use of project-level T&K transfer extends mainstream international business research beyond the dominant focus on parent firm and subsidiary analysis as part of FDI. In addition, we contribute to the wider literature by looking at T&K transfer in the consulting, contracting, plant and equipment and the materials subsectors as suggested by Mawhinney (2001) and go on to evaluate the buildings and roads subsectors of the construction industry. Our subsector analytical approach reveals the complexities involved in T&K transfer to give a more detailed and holistic picture of T&K transfer in a developing country context. T&K has also been

viewed from product, process and managerial technology perspectives; again a more holistic approach to technology transfer than most previous studies which tend to focus on only one or two of the technologies. Above all our study goes beyond just identifying T&K gaps and related challenges to explain why and how to facilitate T&K transfers, particularly in SSA. In view of the scarcity of such studies in developing countries, this study enhances our understanding of the T&K transfer issues.

In respect of the limitations of the study, although the findings contribute to a widening of the literature base on T&K in SSA, there is a need for such studies to be expanded beyond single country case studies. The identification of key variables that could facilitate T&K transfer in the study will help to create a platform for more broadly based and longitudinal studies in the future. There is an urgent need to understand the reasons for the low level of T&K transfer in SSA, compared, for example, to the East Asia region, because of the link between technology development and economic development. This will then provide a basis for programmes to improve T&K transfer in the region to the benefit of both indigenous and foreign owned companies.

Acknowledgements

The preliminary version of this article was presented at the 39th Annual Conference of the Academy of International Business (U.K. and Ireland Chapter) in 2012. We thank the reviewers and participants for their invaluable comments.

References

- Aibinu, A. A., & Odeyinka, H. A. (2006). Construction delays and their causative factors in Nigeria. *Journal of Construction Engineering and Management*, 132(7): 667-677.
- Aitken, B. J., & Harrison, A. E. (1999). Do domestic firms benefit from direct foreign investment? Evidence from Venezuela. *American Economic Review*, 89(3): 605-618.
- Anaman, K. A., & Osei-Amponsah, C. (2007). Analysis of the causality links between the growth of the construction industry and the growth of the macro-economy in Ghana. *Construction Management and Economics*, 25(9): 951-961.
- Assibey-Mensah, G. O. (2008). Ghana's construction industry and global competition: A research note. *Journal of Black Studies*, 39(6): 974-989.
- Bakuli, D. L. (1994). Pitfalls in technology transfer: Kenya's construction industry. *World Development*, 22(10): 1609-1612.
- Barrett, P., & Sexton, M. (2004). The role of technology transfer in innovation within small construction firms. *Engineering Construction and Architectural Management*, 11(5): 342-348.
- Bernard, H. R. (2000). *Social research methods*, London: Sage.
- Bessant, J., & Francis, D. (2005). Transferring soft technologies soft technologies: Exploring adaptive theory. *International Journal of Technology and Management and Sustainable Development*, 4(2): 93-112.
- Birkinshaw, J., Brannen, M. Y., and Tung, R. L. (2011). From a distance and generalizable to up-close and grounded: reclaiming a place for qualitative methods in international business research. *Journal of International Business Studies*, 42(5): 573-581.
- Blalock, G., & Simon, D. H. (2009). Do all firms benefit equally from downstream FDI? The moderating effect of local suppliers' capabilities on productivity gains. *Journal of International Business Studies*, 40(7): 1095-1112.
- Carrillo, P. (1996). Technology transfer joint venture projects in developing countries. *Construction Management and Economics*, 14, 45-54.
- Carrillo, P. M., Robinson, H. S., Anumba, C. J., and Bouchlaghem, N. M. (2006). A knowledge transfer framework: PFI context. *Construction Management and Economics*, 24, 1045-1056.
- Cepeda, G., & Vera, D. (2007). Dynamic capabilities and operational capabilities: A knowledge management perspective. *Journal of Business Research*, 60, 426-437.
- Cetindamar, D., Phaal, R., and Probert, D. (2009). Understanding technology management as a dynamic capability: A framework for technology management activities. *Technovation*, 29, 237-246.
- Chatterji, M. (1990). *Technology transfer in the developing Countries*. London: Macmillan.
- Corkin, L. (2012). Chinese construction companies in Angola: A local linkages

- perspective. *Research Policy*, 37, 475-483.
- David, M., & Sutton, C. D. (2011). *Social research: An introduction*, London: Sage.
- Debrah, Y. A., & Ofori, G. (2006). Human resource development of professionals in an emerging economy: the case of the Tanzanian construction industry. *The International Journal of Human Resource Management* 17(3): 440-463.
- Devapriya, K. A. K., & Ganesan, S. (2002). Technology transfers through international subcontracting in developing countries. *Building Research and Information*, 30(3): 171-182.
- Dimitri, G. (1977). *Transfer of technology by multinational corporations*. Development Centre of the Organisation for Economic Corporation and Development, Paris.
- Doz, Y. (2011). Qualitative research in international business. *Journal of International Business Studies*, 42, 582-590.
- Dubois, A., & Gadde, L.-E. (2002). The construction industry as a loosely coupled system: implications for productivity and innovation. *Construction Management and Economics*, 20(7): 621-631.
- Dunning, J. H. (1993). *Multinational enterprises and the global economy*, Wokingham: Addison Wesley.
- Eapen, A. (2012). Social structure and technology spillovers from foreign to domestic firms. *Journal of International Business Studies*, 43(3): 244-263.
- Eden, L. (2009). Letter from the editor-in-chief: FDI spillovers and linkages. *Journal of International Business Studies*, 40(7): 1065-1069.
- Elmawazini, K., & Nwankwo, S. (2012). Foreign direct investment: Technology gap effects on international business capabilities of Sub-Saharan Africa. *Thunderbird International Business Review*, 54(4): 457-467.
- Ernst & Young. (2012). *Building bridges, Ernst & Young's attractiveness survey 2012: Africa*. Ernst and Young.
- Findlay, R. (1978). Relative backwardness, direct investment and the transfer of technology: A simple dynamic model. *Quarterly Journal of Economics*, 92, 1-16.
- Fox, P. W. (2003). Construction industry development: Analysis and synthesis of contributing Factors. *Unpublished PhD Dissertation*. Queensland University of Technology, Brisbane Australia.
- Fu, X., Pietrobelli, C., and Soete, L. (2011). The role of foreign technology and indigenous innovation in the emerging economies: Technological change and catching-up. *World Development*, 39(7): 1204-1212.
- Gajendran, T., Brewer, G., and Marimuthu, M. (2013). Internationalisation of construction business and e-commerce: Innovation, integration and dynamic capabilities. *Australian Journal of Construction Economics and Building*, 13(2): 1-17.
- Ganesan, S., & Kelsey, J. (2006). Technology transfer: international collaboration in

- Sri Lanka. *Construction Management and Economics*, 24, 743-753.
- Giang, D. T. H., & Pheng, L. S. (2011). Role of construction in economic development: Review of key concepts in the past 40 years. *Habitat International*, 35, 118-125.
- GIPC. (2010). *GIPC quarterly report: First quarter (2010) investment report*. Ghana Investment Promotion Centre. Accra.
- Girma, S. (2005). Absorptive capacity and productivity spillovers from FDI: A threshold regression analysis. *Oxford Bulletin of Economics and Statistics*, 67(3): 281-306.
- Glisby, M., & Holden, N. (2003). Contextual constraints in knowledge management theory: The cultural embeddedness of Nonaka's knowledge-creating company. *Knowledge and Process Management*, 10, 29-36.
- Gooderham, P. N. (2007). Enhancing knowledge transfer in MNCs: a dynamic capabilities driven model. *Knowledge Management Research and Practice*, 5, 34-43.
- Grosse, R. (1996). International technology transfer in services. *Journal of International Business Studies*, 27(4): 781-800
- Hadded, M., & Harrison, A. (1993). Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco. *Journal of Development Economics*, 42, 51-71.
- Howes, R., & Tah, J. H. M. (2003). *Strategic management applied to international construction*, London: Thomas Telford.
- Jenkins, R. (1990). Comparing foreign subsidiaries and local firms and LDCs: Theoretical issues and empirical evidence. *Journal of Development Studies*, 26(2): 205-228.
- Kamoche, K., & Harvey, M. (2006). Knowledge diffusion in the African context: An institutional theory perspective. *Thunderbird International Business Review*, 48(2): 157-181.
- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*, Eaglewood Cliffs, NJ: Prentice Hall.
- Kumaraswamy, M. M., & Shrestha, G. B. (2002). Targeting 'technology exchange' for faster organisational and industry development. *Building Research and Information*, 30(3): 183-195.
- Langford, D. (2000). The influence of culture on internationalisation of construction. *Presented at 2nd International Conference on Construction in Developing Countries*, Botswana. In A.B. Ngowi and J. Ssegawa (Eds): *Proceedings of the 2nd International Conference on Construction in Developing Countries*, Botswana, CIB TG 29, November, Faculty of Engineering and Technology, University of Botswana, pp. 12-21.
- Laryea, S. (2010). Challenges and opportunities facing contractors in Ghana. *Presented at West Africa Built Environment Research (WABER) Conference*, Accra, Ghana.

- Lee, A. H. I., Wang, W.-M., and Lin, T.-Y. (2010). An evaluation framework for technology transfer of new equipment in high technology industry. *Technological Forecasting & Social Change*, 77, 135-150.
- Lee, S.-G., Trimi, S., and Kim, C. (2013). The impact of cultural differences on technology adoption. *Journal of World Business*, 48, 20-29.
- Li-Hua, R. (2004). *Technology and Knowledge Transfer in China*, Aldershot: Ashgate.
- Lim, E. G. (2001). Determinants of and Relation between Foreign Direct Investment and Growth: A summary of recent literature. *IMF Working Paper WP/01/175*.
- Ling, F. Y. Y., Ibbs, C. W., and Cuervo, J. C. (2005). Entry and business strategies used by international architectural, engineering and construction firms in China. *Construction Management and Economics*, 23, 509-520.
- Ling, F. Y. Y., Pham, V. M. C., and Hoang, T. P. (2009). Strengths, Weaknesses, Opportunities, and Threats for Architectural, Engineering, and Construction Firms: Case Study of Vietnam. *Journal of Construction Engineering and Management*, 135(10): 1105-1113.
- Manley, K. (2008). Against the odds: Small firms in Australia successfully introducing new technology on construction projects. *Research Policy*, 37, 1751-1764.
- McDermott, G. A., & Corredoir, R. A. (2010). Network and composition, collaborative ties, and upgrading in emerging-market firms: Lessons from the Argentine autoparts sector. *Journal of International Business Studies*, 41(2): 308-329.
- Miles, D. C., & Huberman, A. M. (1994). *Qualitative Data Analysis (2nd edn)*, Thousand Oaks, CA: Sage.
- Minbaeva, D., Pedersen, T., Björkman, I., Fey, C. F., and Park, H. J. (2003). MNC knowledge transfer, subsidiary absorptive capacity, and HRM. *Journal of International Business Studies*, 34, 586-599.
- Minbaeva, D. B. (2008). HRM practices affecting extrinsic and intrinsic motivation of knowledge receivers and their effect on intra-MNC knowledge transfer. *International Business Review*, 17, 703-713.
- Ngowi, A. B., Pienaar, E., Talukhaba, A., and Mbachu, J. (2005). The Globalisation of the Construction Industry: A Review. *Building and Environment*, 40(1): 135-141.
- Ofori, G. (1991). Improving the Performance of Contractors in Developing Countries. *Construction Management and Economics*, 9, 19-38.
- Ofori, G. (1994a). Construction industry development: role of technology transfer. *Construction Management and Economics*, 12, 379-392.
- Ofori, G. (1994b). Formulating a long-term strategy for the construction industry of Singapore. *Construction Management and Economics*, 12, 213-217.
- Ofori, G. (2000). Globalisation and construction industry development: research opportunities. *Construction Management and Economics*, 18, 257-262.

- Ofori, G. (2002). Developing the construction industry in Ghana: the case for a central agency, Discussion Paper: Ministers of Roads and Transport and Works and Housing of Ghana, Accra, pp. 1-22.
- Ofori, G. (2003). Frameworks for Analysing International Construction. *Construction Management and Economics*, 21(4): 379-391.
- Ofori, G. (2012). Developing the construction industry in Ghana: The case of a central agency, Contribution to the deliberations in Ghana on how to improve the performance of the construction industry, Discussion Paper, Accra, pp. 1-19.
- Ofori, G., and Chan, S. L. (2001). Factors influencing development of construction enterprise in Singapore. *Construction Management and Economics*, 19, 145-154.
- Osabutey, E. L., & Debrah, Y.A. (2012). Foreign direct investment and technology transfer policies in Africa: A review of the Ghanaian experience. *Thunderbird International Business Review*, 54(4): 441-456.
- Osabutey, E. L. C. (2010). Foreign direct investment, technology and knowledge management in the construction industry in Africa: A study of Ghana. *Unpublished PhD Thesis*. University of Wales, Swansea: Swansea, pp. 441.
- Osabutey, E. L. C., & Debrah, Y.A. (2011). New perspectives on foreign direct investment and technology transfer in Africa: Insights from the construction industry in Ghana, E. Obuah, (Ed.) *12th Annual Conference of the International Academy of African Business and Development (IAABD)*. Edmonton, Canada.
- Pack, H., & Saggi, K. (1997). Inflows of foreign technology and indigenous technological development. *Review of Development Economics*, 1, 81-98.
- Raftery, J., Pasadilla, B., Chiang, Y. H., Hui, E. C. M., and Tang, B.-S. (1998). Globalisation and construction industry development: implications of recent developments in the construction sector in Asia. *Construction Management and Economics*, 16, 729-737.
- Sahal, D. (1982). The form of technology, In D. Sahal, (Ed.), *The transfer and Utilisation of Technical Knowledge* (pp 125-139). Lexington, MA: Lexington Publishing.
- Sanna-Randaccio, F., & Veugelers, R. (2007). Multinational knowledge spillovers with decentralised R&D: a game-theoretic approach. *Journal of International Business Studies*, 38, 47-63.
- Spencer, J. W. (2008). The Impact of multinational enterprise strategy on indigenous enterprise: Horizontal spillovers and crowding out in developing countries. *Academy of Management Review*, 33(2): 341-361.
- Steers, R. M., Meyer, A. D., and Sanchez-Runde, C. J. (2008). National culture and the adoption of new technologies *Journal of World Business*, 43, 228-260.
- Sutton, J., & Kpentey, B. (2012). *An enterprise map of Ghana*. International Growth Centre.
- Tapanes, M. A., Smith, G. G., and White, J. A. (2009). Cultural diversity in online learning: A study of the perceived effects of dissonance in levels of individual/collectivism and tolerance ambiguity. *Internet and Higher Education*, 12,

26-34.

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28, 1319-1350.

Todorova, G., & Durisin, B. (2007). Absorptive capacity: Valuing a reconceptualisation. *Academy of Management Review*, 32(3): 774-786.

Twerefou, D. K., Osei Kwadwo, A., and Turkson, F.E. (2007). Labour market flexibility, employment and income insecurity in Ghana. Working Paper 1/2007 *Employment Policy Working Papers Series*. International Labour Organisation: Geneva, Switzerland.

UNCTAD. (2011). *World Investment Report 2011: Non-Equity Modes of International Production and Development*. United Nations, Geneva.

van Egmond, E. (2012). Construction technology development and innovation. In G. Ofori, (Ed.), *New Perspectives on Construction in Developing Countries* (pp. 185-228). London: Spon.

Weick, K. (2007). The generative properties of richness. *Academy of Management Journal*, 50(1): 14-19.

Williams, D. (1997). Informal discussion on construction statistics, Department of the Environment Transport and Regions, (Ed.). London, UK.

Woo, J. (2009). Productivity growth and technology diffusion through foreign direct investment. *Economic Inquiry*, 47(2): 226-248.

World Bank. (1986). *The construction industry: Issues and strategies in developing countries*, Washington: World Bank.

Yang, L.-R., Chen, J.-H., and Wang, H.-W. (2012). Assessing impacts of information technology on project success through knowledge management practice. *Automation in Construction*, 22, 182-191.

List of Tables

Table 1

Composition of Participants of the study

Local Professional Consultants and Practitioners (engineers, architects, planners, quantity surveyors, etc)	28
MNC/foreign firms' Professional Consultants and Practitioners (engineers, architects, quantity surveyors, etc)	10
High Ranking Officers from Ministries, Departments and Agencies related to Construction in Ghana	15
Presidents of Professional and Allied Bodies related to the Construction Industry in Ghana	6
Industry Association Presidents related to the Construction Industry in Ghana	3
Senior Managers of Construction Equipment Dealers (MNCs)	2
TOTAL	64

Source: Constructed from the researchers' field notes

Table 2

Expertise lacking in most Local Firms in Ghana

Contracts Administration	Project Management	Human Management	Resource
<ul style="list-style-type: none"> • Design development • Costing • Tendering process • Dispute resolution 	<ul style="list-style-type: none"> • Control systems – time, costs, quality, variation etc. • ICT hardware & software knowledge and usage 	<ul style="list-style-type: none"> • Human resource planning • Training & development • Performance appraisal • Health and safety 	
Financial Management	Quality & Environmental Control Management	Procurement and Plant & Equipment Management	
<ul style="list-style-type: none"> • Financial control & budgeting • Arranging financing • Investment appraisal • Cash flow and profitability 	<ul style="list-style-type: none"> • Quality systems & standards • Environmental control systems & standards 	<ul style="list-style-type: none"> • Bills of quantities • Planning & negotiations • Supply chain management • Appropriate choice & management of fleet (hire or purchase) • Preventative maintenance 	
Business Development	Strategic Management		
<ul style="list-style-type: none"> • Developing new business opportunities, customer care marketing, growth, etc. 	<ul style="list-style-type: none"> • Situation analysis, strategy formulation, implementation and evaluation, etc. 		

Source: Constructed from the researchers' field notes