

Technology transfer potential in local and foreign-owned firms in emerging economies

Abstract

Technology transfer in international collaborations is challenging but can bring benefits to both local and foreign-owned firms in emerging economies. In this article we focus on conditions for potential technology transfer in emerging economies. We develop a configurational theoretical framework and empirically operationalise it using qualitative comparative analysis (QCA). Building on differences in absorptive capacity between these two kinds of firms and relying on data from the construction industry in Ghana, we develop a process model of technology transfer in emerging economies. Our model shows that technology transfer in local and foreign firms can be achieved through different combinations of human resource development (HRD) and knowledge management (KM) as well as international collaborations and networks. The model also explicates mechanisms leading to potential technology transfer. Based on the findings and the process model, the study makes several contributions to the absorptive capacity and technology transfer literature in emerging economies by shedding light on the underlying processes that foster a firm's ability to absorb technology in international collaborations.

Keywords

Technology transfer, absorptive capacity, human resource development, knowledge management, qualitative comparative analysis, emerging economies.

INTRODUCTION

Absorbing knowledge across national boundaries through international collaborations has been identified as a factor for gaining and sustaining competitive advantage (Argote & Ingram, 2000; Dávila, Durst, & Varvarkis, 2018; Teixeira, Rapini, & Caliarì, 2020; Penrose, 1973). Cohen and Levinthal (1990) propose that absorptive capacity depends on the learning of individuals and how well an organisation is able to integrate such knowledge into the organisation. However, they fail to provide a clear explanation of the mechanisms through which individual interactions result in knowledge absorption, leading to firm-level absorptive capacity. (Arndt, Aharonson, Jansen, Jiang, Cao, 2023). We propose that the “ability of a firm to recognize new, external knowledge, assimilate it, and apply it to commercial ends” (Cohen & Levinthal, 1990; p. 128) depends on its development of human resources that support the process of knowledge absorption and underlying knowledge management processes that allow the firm to internalise external knowledge. This ability may differ between local and foreign-owned firms (Cuervo-Cazurra and Rui, 2017).

Heterogeneity in firms’ absorptive capacities affects the potential of technology transfer from international collaborations. With their definition, Cohen and Levinthal (1990) shifted the focus in research on absorptive capacity to the process of absorbing external knowledge. While they offer some suggestions for the underlying organisational elements needed to do so, limited work has examined how firms, particularly in emerging economies, build absorptive capacity (Song et al., 2018). Penrose (1973) has problematized the issue of knowledge transfer of firms across locations. However, both the management and the international business literature show gaps in understanding how firms can improve technology transfer potential across borders (Arndt et al. 2023). Thus, uncovering firm-level configurations can explain how absorptive capacity can enhance

technology transfer. Drawing on the notion that absorptive capacity does not only require prior knowledge, but also an active effort to “assimilate and apply knowledge to commercial ends” (Cohen & Levinthal, 1990; p. 128), we suggest that firms that 1) actively support the technology transfer process and 2) may have prior experience with technology transfer, are more likely to successfully absorb the external knowledge. We also suggest that familiarity with the source or way of codifying knowledge is further nuanced by local/foreign ownership.

First, technology transfer potential requires individuals within firms to absorb knowledge and to internalize it within their organisations. We suggest that technology transfer works better when these individuals are supported by activities (e.g., motivation and training) that we categorize as human resource development (HRD). In addition, we argue that knowledge management (KM), e.g., knowledge sharing and group learning, can be effective in building organisational knowledge and making knowledge more accessible throughout an organization (López, Peón, & Ordás, 2006). Thus, we propose two conditions for successful cross-border technology transfer are HRD and KM.

Organizational learning is the process of improving actions through better knowledge (Fiol & Lyles, 1985). Organizational learning occurs through individual learning embedded in routines, systems, structures, culture and strategy. Therefore, organizational learning cannot be viewed simply as a mere accumulation of individual knowledge but a process of preserving knowledge over time through organizational memory (Hedberg, 1981; Akinici & Sadler-Smith, 2019). While organizational learning is considered an essential part of human resource management (Pucik, 1988), with few exceptions (e.g., Minbaeva et al., 2013), the characteristics of technology transfer and absorptive capacity have typically not been treated as endogenous to organisational processes. Extant research suggests that when employees possess the ability (e.g., due to

training and prior related experience) and are motivated (e.g., because of performance-based compensation and internal communication), they can recognize distinct and rare knowledge within networks (Bresman, Birkinshaw, & Nobel, 1999), which, in turn, facilitates technology transfer (Williams, 2009).

Zahra and George (2002) criticize existing work for applying quantitative measures (like R&D intensity, number of scientists working in R&D departments, etc.) that do “not fully reflect the richness of the construct” (p. 199) and neglects the role of individuals in firms, which is crucial for knowledge utilization and exploitation (Minbaeva et al., 2013). They continued by arguing that absorptive capacity has the character of a dynamic capability which suggests that firm-level processes related to higher-order learning such as KM and HRD may play a larger role than proposed by Cohen & Levinthal (1990). Given that absorptive capacity relies on routines and activities that allows the exploitation of the current knowledge base, as well as the training and motivation of employees, HRD can play a significant role in developing and maintaining knowledge and skills. It also adds to the dynamic character that Zahra and George (2002) attribute to absorptive capacity.

Second, the majority of technology transfer literature has focused on advanced economies (Chiva, Ghauri & Alegre 2014; Butler & Ferlie, 2020). Most studies that incorporate the absorptive capacity lens focus on external factors and do not fully explain the internal organisational elements necessary to build absorptive capacity (Cohen and Levinthal, 1990; Volberda, Foss, & Lyles, 2010; Arndt et al. 2023). We posit the central role of the individual in the form of HRD to maintain and build a knowledge base for technology transfer that we name KM (Chiva et al., 2014; Butler & Felie, 2020). Within an emerging economy context, there are few studies that adopt an absorptive capacity lens and often assume linear effects (Ivarsson & Alvstam, 2005; Dávila et al., 2018; Teixeira et al., 2020), yet they do not evaluate how absorptive capacity differs for both local and

foreign-owned firms operating in the same industry and country. Therefore, the aim of this paper is to better understand the conditions under which technology transfer potential is realised (or not) in local and foreign-owned firms within an industry in an emerging economy. Based on the preceding arguments, we answer the following research question: *How do firms (local and foreign-owned) develop absorptive capacity to enhance technology transfer potential in emerging markets?*

To answer our research question, we gained access to 30 large local and foreign-owned construction firms in Ghana to investigate technology transfer potential via international collaborations. We employed qualitative comparative analysis (QCA) (Ragin, 2014) to demonstrate the different conditions and likely paths that explain both the presence and absence of technology transfer potential. The context of our study, Ghana, is chosen because of its relatively low construction industry technology transfer (Osabutey, Williams & Debrah, 2014). Since we consider the ownership characteristics of firms to be important determinants for potential transfers (Blalock & Simon, 2009; Spencer, 2008) we focus on large local and foreign-owned firms.

Our findings identify stark differences between technology transfer potential in local and foreign-owned firms. First, we found more presence of technology transfer potential in foreign-owned firms with both good HRD and KM systems. In local firms, there is limited technology transfer potential regardless of the configurations of HRD and KM. We contribute to the literature by developing a process model to explain firm-level mechanisms that facilitate absorptive capacity that can lead to technology transfer (Cohen & Levinthal, 1990; Minbaeva et al., 2013; Song et al., 2018). We identify organizational practices that may contribute to better HRD and KM, which, in turn, may answer the question of how organizations can enhance technology transfer in international collaborations (Argote & Ingram, 2000; Cuervo-Cazurra & Rui, 2017).

The rest of the paper is organised as follows: first, we review the relevant technology transfer, absorptive capacity, HRD and KM literature. Second, the research methodology is described. Third, we present the findings and discussions and then finally conclude by evaluating the implications for theory and practice.

THEORY AND MODEL DEVELOPMENT:

CONFIGURATIONAL THEORISING OF TECHNOLOGY TRANSFER

We build a theoretical framework using configurational reasoning (Fiss, 2007; Furnari et al. 2021; Greckhamer et al. 2018; Misangyi et al. 2017). Core to this reasoning is that organisational phenomena are mostly causally complex in the sense that: (1) different, mutually non-exclusive combinations of conditions, or paths lead to a given outcome (equifinality tenet), (2) the effect of a condition on an outcome is dependent on the combination of conditions it is part of (multifinality tenet), and (3) the effect of a combination of conditions leading to an outcome is not indicative that the absence of that combination is systematically associated with the non-occurrence of that outcome. That is the absence and presence of a condition denotes two qualitatively different states of nature (asymmetry tenets).

Against this backdrop, we identify human resource development, knowledge management, and foreign/local ownership as essential conditions for an organisation to receive technology transfer (outcome). Hereafter, we construct our configurational modelling of technology transfer potential. Based on relevant literature we explain how and why the three conditions are crucial to technology transfer potential (Furnari et al. 2021). Recent literature has acknowledged the innovation of local firms in emerging economies to show the bidirectional technology transfer (Liu, Lu, & Choi, 2014; Osabutey, Papanastassiou, Jin, Navare, & Agyapong, 2023). These studies emphasise technology

exchange. We, therefore, examine the presence and absence of technology transfer for both foreign and local firms.

Combination of human resource development, knowledge management, foreign/local ownership

Absorptive capacity relates to organizational learning and inter-organizational learning which examines the learning relationships between actors and groups of organizations (Larsson, Lars Bengtsson & Sparks, 1998). Therefore, absorptive capacity is important for inter- and intra-firm technology transfer. Technology transfer refers to the transmission of product, process, and managerial knowledge from one organisation to another (Grosse, 1996). The effectiveness in transferring technology from and to firms have been considered as a key resource for developing and maintaining competitive advantage (Minbaeva et al., 2013; Björkman, Barner-Rasmussen, & Li, 2004; Gupta & Govindarajan, 2000). Technology transfer has primarily been discussed in the MNE – subsidiary context (Song, 2014; Zeng, Glaister, & Darwish., 2019). Scholars have also used absorptive capacity of local firms as an important determinant of technology transfer via foreign direct investment spillovers (Spencer, 2008; Blalock & Simond, 2009; Meyer & Sinani, 2009; Eapen, 2012).

International technology transfer depends on a subsidiary's absorptive capacity and the nature of relationships between firms (Minbaeva et al., 2013; Björkman et al., 2004; Butler and Ferlie, 2020). Absorptive capacity refers to a combination of dynamic organisational routines and processes that influences how firms acquire, assimilate, transform, and exploit new knowledge to sustain competitiveness (Griffiths-Hemans & Grover, 2006; Wales, Parida & Patel, 2013; Bouguerra et al., 2021). Since we are interested in firms' potential ability to receive new technology and given that absorptive

capacity relies on routines and activities that allow the exploitation of the current knowledge base, HRD can play a significant role in developing and maintaining knowledge and skills. HRD involves a planned integration and combination of training and development, organisation development and career development to improve individual, group, and organisational effectiveness (McLagan, 1989; Osman-Gani, 1999). The need for interactions between the knowledge bearer and receiver to enhance technology transfer suggests that social networks (Eapen, 2012), characterised by strong 'knowledge networks' (Minbaeva, 2013), are also essential for receiving technology transfer, and HRD is expected to facilitate the processes involved. HRD is therefore important in maintaining human capital and knowledge networks.

KM has been viewed as an essential competitive advantage of MNEs (Kogut & Zander, 1992; Tallman & Phene, 2007). Literature suggests various definitions of KM. For instance, Egbu (2000) defines KM as the processes through which knowledge is created, acquired, communicated, shared, applied, utilised, and managed to identify and exploit existing and acquired knowledge assets. KM can therefore be viewed as a complex social organisational process. Egbu (2000) further argues that KM is 10 per cent technology and 90 per cent people issues, which emphasises the link between KM and HRD. Subsidiaries develop new capabilities that allow them to receive technology transfer (Birkinshaw & Hood, 1998; Phene & Almeida, 2008). Although human resource practices promote absorptive capacity (Song, 2014), there is a need for studies that focus on HRD's specific role in human capital development and firm performance (Delaney & Huselid, 1996; Koch & McGrath, 1996; Winterton & Winterton, 1997). Recent relevant studies have noted that the human resource management/development (HRM/D) and KM were poorer in small/local firms compared to large/foreign firms operating in the same industry in emerging economies (Gooderham, 2007; Osabutey et al., 2014). This suggests a need to

examine the mechanisms of how HRD and KM in local and foreign-owned firms affect the technology transfer process.

Human resource development and absorptive capacity

We propose that the development of human resources is a condition required for enhancing absorptive capacity and therefore technology transfer potential. HRD includes a wide range of practices that aim to improve knowledge, skills, and abilities of employees. Since training, part of HRD, exposes individuals and organisations to new knowledge, it is an important element in developing a firm's absorptive capacity (Jansen et al., 2006) and an integral part of improving technology transfer potential to such firms.

The motivation to absorb new external knowledge is crucial in determining organisational outcomes (Gegenfurtner et al., 2009). Seyler et al. (1998) further suggest that firms need to motivate trainees to make behavioural decisions that will improve job performance outcomes. Firms often develop training programmes to improve their capacity to acquire and utilise new technologies (Neirotti & Paolucci, 2013). The absence of non-firm specific competencies would often lead firms to seek knowledge from external sources (Kor & Leblebici, 2005). Firms may, inter alia, utilise such new knowledge to increase productivity or stimulate innovation (Neirotti & Paolucci, 2013). Firms therefore complement technological needs with internal and external on and off-the-job training to absorb implicit and explicit knowledge (Laursen & Foss, 2003).

HRD and learning can occur through socialisation within communities of practice and participation in conferences, etc. (Bessant, 2008). A community of practice refers to a work-related or professional group of individuals who share mutual interests, challenges and problems and can effectively learn from each other through on-going interactions (Lave & Wenger, 1991). Professional bodies are an example of such communities and can

play an active role in the technology transfer process. The ties between individuals within such networks can enhance absorptive capacity and therefore technology transfer (Cross & Cummings, 2004; Martins, 2016). Firms that recognise the importance of external networks can encourage employees to join a community of practice or professional bodies by paying membership fees.

HRD literature explains that, to foster employee motivation and commitment, firms use training to respond to intrinsic and aspirational needs (Kuvaas & Dysvik, 2009; Nierotti & Paalucci, 2013). Individuals are motivated by their expectations of the outcomes of their actions (Bandura, 1997). Therefore, where training can lead to, for instance, promotion or remuneration, employees' motivation is likely to increase. On the other hand, the absence of HRD practices may prevent the absorption of new knowledge. Employees that are neither motivated nor able to learn about new technologies, are likely to reject them (Katz & Allen, 1982).

Knowledge management and absorptive capacity

We propose that KM is a condition for improving absorptive capacity within international collaborations. While the literature offers several methods to conceptualise and operationalise absorptive capacity (Zahra & George, 2002), few studies have questioned whether and how firms can enhance absorptive capacity by engaging in KM. With some exceptions (e.g., Minbaeva et al., 2013) scholars treat absorptive capacity as a given and as an exogenous determinant of knowledge processes.

Firms' ability to effectively absorb external knowledge depends on their internal knowledge production capability (Grigoriou & Rothaermel, 2017). Technology transfer is dependent on firms' ability to create, share and absorb new knowledge (Martins, 2016), for instance through interactions between colleagues (Smith & Tushman, 2005). Cohen

and Levinthal (1990) assert that the absorptive capacity of an organisation is dependent on the learning capability and absorptive capacity of these individuals. Firms can strengthen their absorptive capacity through informal KM mechanisms such as promoting tight-knit clusters or groups of employees or through formal KM systems such as boundary spanners (Cohen & Levinthal, 1990; Reagans, Zuckerman & McEvily, 2004; Grigoriou & Rothaermel, 2017).

Individuals are constrained by their limited capacity to acquire, store, and process knowledge, according to the principle of bounded rationality (Simon, 1991). To overcome this limitation, firms aim to become knowledge-integrating institutions (Grant, 1996), which requires the effective storage, organisation, and retrieval of organizational knowledge, also known as organizational memory (Stein & Zwass, 1995). Knowledge transfer occurs within organisations where knowledge is acquired, created, and shared (Martins, 2016), and creating an environment that fosters knowledge sharing is crucial (Bandura, 1997; Seyler et al., 1998; Grohmann, Beller & Kauffeld, 2014). This can be influenced by a variety of KM tools, such as the dissemination of locally harvested knowledge from subsidiaries to sister companies, enabling MNEs to access diverse “pockets of knowledge” (Elsahn & Benson-Rea, 2018:806). The most essential aspect of the KM process is ensuring that needed knowledge is transferred to individuals, groups and or locations (Alavi & Leidner, 2001).

Local/foreign-owned firms and absorptive capacity

Local and foreign firms engage in international collaborations (e.g., joint ventures, strategic alliances) that provide possibilities for receiving new technologies. HRD practices and internal knowledge sharing varies between different types of firms (Meyer, 2004). While absorptive capacity is often lacking in firms in emerging economies, foreign-

owned firms from advanced economies are generally expected to have more formal, developed HRD systems that can enhance ability to receive technology transfer via international collaborations. By investing in the training and development of employees, leading to high levels of skills and knowledge, firms can facilitate learning (Williams, 2009) and therefore technology transfer potential.

Our proposition that local and foreign-owned firms may differ in how they build absorptive capacity finds support in prior literature. Local firms in emerging economies require sufficient absorptive capacity to benefit from the introduction of newer technologies (Saggi, 2004), yet are often characterised by low absorptive capacity due to deficiencies in technical skills and capabilities (Arnold et al., 2000; Berger & Revilla Diez, 2008; Nguyen & Diez, 2019). As a result, local firms typically need to overcome resource constraints to improve the potential to receive technology transfer (Eapen, 2012). Clearly, with few exceptions, scholars have not sufficiently questioned how different types of firms can enhance their absorptive capacity. Yet, a greater understanding of how firms develop and apply absorptive capacity to engage in interorganizational learning is essential for firms in emerging economies.

METHODS

Our empirical work relies on the conceptualisation from previous studies on the construction industry (e.g., World Bank, 1986; Ofori, 1994; Ganesan & Kelsey, 2006; Osabutey et al., 2014) which identify project-based joint ventures, subcontracting arrangements, strategic alliances, and consortia as types of international collaborations that could facilitate technology transfer. The construction industry was chosen because construction projects are often transient (Dubois & Gadde, 2002). Consequently, the technology transfer process can be characterised by the changing micro-environment and

allows the evaluation of product, process and managerial technologies (Dubois & Gadde, 2002; Manley, 2008). Ghana, the empirical focus, is classified by The World Bank as a middle-income economy with relatively low construction industry technology transfer (Osabutey et al., 2014). The economy of Ghana has been characterised by innovation and technology outputs above the Sub-Saharan African average (World Bank, 2021; Osabutey et al., 2023). For more than a decade, before the outbreak of COVID-19, Ghana witnessed steady economic growth. For instance, in the year 2011, the country achieved 14% gross domestic product (World Bank, 2024). Ghana has also experienced technology growth in recent times, becoming one of the fastest-growing technology hubs in Africa (Senyo et al, 2023). Together, these specificities make Ghana an interesting context for our study. The study focuses on large construction firms in terms of size and turnover. We also divided the firms into either local or foreign-owned. We chose a mixed research approach to thoroughly understand contextual issues and provide a solid foundation for our ongoing theorization. Specifically, we adopted a combination of traditional qualitative and qualitative comparative analysis (QCA) as the main research approaches. We affirm these with a post-QCA case analysis. We deemed these approaches suitable and appropriate because they enabled us to gain a deeper understanding of our phenomenon beyond descriptive accounts. In addition, given our multifaceted research question, there was a need for research approaches that enable thorough investigation beyond simply establishing causation.

First, we conducted an in-depth qualitative study guided by an initial literature review to develop the constructs for our study. We then adopted QCA to understand technology transfer through a configural lens. QCA is a set-theoretical method (Beynon et al., 2021; Hughes et al., 2018; Standaert et al., 2021) for analysing complex causal and logical relationships between a combination of conditions and an outcome (Fiss, 2007;

Furnari et al., 2021; Ragin, 2014; Misangyi et al., 2017). Lahiri, Kundu and Munjal (2021; p. 16) suggest the use of QCA as a “new analytical tool” ... “gaining prominence in business scholarship” to offer a middle ground between the quantitative and traditional qualitative methods (Ragin, 2014) by focusing on a combination or configurational effect of constructs that lead to an outcome instead of a correlation. We chose the QCA method for the following reasons. First, QCA can account for complex relationships between constructs more than traditional quantitative methods such as regression (Greckhamer et al. 2018; Misangyi et al., 2017; Standaert et al., 2021). Second, QCA can support the investigation of underexplored phenomena (Beynon et al., 2021) and configurationally theorise them (Furnari et al., 2021; Seny Kan et al., 2016), which in our case is technology transfer in local and foreign-owned firms in emerging economies. Lastly, given our aim to investigate a combination of factors, we deemed QCA suitable because it can account for ‘synergistic relationships between variables’ as opposed to regression-based approaches that focus on linearity, single path, and additive effects of variables (Armanios et al., 2017; Beynon et al., 2021).

Construct Measurement

Given that multifaceted nature of our research, we draw on qualitative data and constructs from existing studies to create our survey questions. In line with our focus, and the overarching aim to understand the successful absorption of external knowledge in local and foreign-owned construction firms located in emerging economies, we focus on HRD, KM and technology transfer as the main theoretical constructs. Supported by our earlier qualitative data, we subsequently adapted items from empirically validated instruments in prior studies to measure each of our constructs. Items measuring technology transfer via international collaboration, namely new technology application, new technology and performance, and new technology and innovation were adapted from Cohen and Levinthal

(1990) as well Grohmann et al. (2014). Similarly, items measuring KM, namely knowledge creation, individual learning, rewarding new knowledge, group learning, storing knowledge, knowledge sharing, and external knowledge networks were adapted from Tripsas (1997), Grigoriou and Rothaermel (2017), Martins (2016), Smith and Tushman, (2005), Cohen and Levinthal (1990) as well as Bandura (1997). With regards to foreign/local ownership, we adapted the conceptualisation from Ramachandran (1993), Gupta and Govindarajan (2000) and Inkpen and Tsang (2005). Finally, items measuring HRD, namely reason for training, internal training, external training, organisation-led external knowledge networks, and motivation to train were adapted from Delaney and Huselid (1996) Koch and McGrath (1996), and Neirotti & Paolucci (2013). Table 1 presents details on each of the constructs as well as associated items.

Table 1: Constructs Measurement

| Constructs | Items |
|--|---|
| Technology Transfer potential (via International Collaboration) | |
| <i>New Technology Application</i> | Firm eager to use new technology and knowledge |
| | Firm eager to share new technology and knowledge |
| | Continuous use of new technology and knowledge |
| <i>New Technology and Performance</i> | New technology and knowledge improved performance |
| <i>New Technology and Innovation</i> | Adopt & adapt new technology and knowledge to similar jobs |
| | Ability to develop new technology and knowledge, processes etc. |
| | Improved innovative capability |
| | |
| HRD | |
| <i>Reason for Training</i> | Current and future requirements |
| | Help adapt to new technology and knowledge |
| <i>Internal Training</i> | In-house On-the-job |
| | In-house (in-house trainers) |
| | In-house (external local trainers) |
| | In-house (external foreign trainers) |
| <i>External Training</i> | Overseas training |
| | Distance learning |
| <i>Organisation-led External Knowledge Networks</i> | Overseas Conferences |
| | Encourage to join Professional body |
| | Payment of Professional subscriptions |
| <i>Motivation to Train</i> | T&D improves job class & Remuneration |

| Constructs | Items |
|---|--|
| KM | |
| Knowledge Creation | Firm eager to acquire & create new knowledge |
| | Firm encourage new methods, procedures. |
| Individual Learning | Individuals expected to continue to learn |
| | Ability to follow manuals to apply new technology and knowledge |
| | Systems to learn about new technology |
| Rewarding new Knowledge | Rewarding new technology and knowledge that increases productivity |
| Group Learning | Exchange ideas about technology and productivity |
| | Open admission and analysis of errors |
| | Lessons learned sessions |
| Storing Knowledge | Develop manuals for new technology |
| | Firm ensures technology acquired/created is stored |
| Knowledge Sharing | Encourage sharing new technology and knowledge from training |
| | Learn new technology and knowledge purposely to share |
| | New technology and knowledge quickly passed to app sections |
| Individual External Knowledge Networks | Belong to at least one Professional body |
| | Subscriptions payment for at least one body |
| Firm ownership | |
| Foreign/Local-Owned | How is the ownership of your firm best described (foreign/local) |

Data Collection and Analysis

Given that the construction industry and emerging country contexts have been underexplored in technology transfer research, we started with in-depth interviews to support the refinement and consolidation of the quantitative data collection measures. To support our sampling, we relied on Ghana's Ministry of Water Resources Works and Housing and the Ministry of Roads and Transport classification and register of contractors, which is based on their resource base (financial, equipment, human resource, etc.). This classification determines the value and complexity of projects contractors are eligible to bid for. Our choice is motivated by earlier studies that expected larger firms to possess HRM/D and KM systems (Gooderham, 2007; Osabutey et al., 2014). Lists from both the Ministry of Water Resources Works and Housing and the Ministry of Roads and Transport provided an appropriate sampling frame for our study. We chose the construction industry

because we could study product, process, and managerial technology integrally (Grosse, 1996; Osabutey et al., 2014). The sampling frame relied on researchers' experience of the industry and target firms (Morgan & Smircich, 1980) and allowed the creation of representative and information-rich data needed to fulfil research objectives.

We collected qualitative data through semi-structured interviews from two local and two foreign firms (Interview Questions Outline in Appendix A). In each firm, we interviewed three senior managers on international collaboration opportunities, HRM/D and KM systems, processes, and practices and how these related to technology transfer potential. To achieve our aim of configurational understanding of how HRD and KM of foreign/local-owned firms could influence technology transfer potential within an industry, we also collected quantitative data using a survey based on constructs developed in Table 1 to complement the qualitative data. The firm ownership and HRD sections were completed by senior managers whose responsibility includes HRD. The KM and technology transfer sections were completed by five construction professionals in each firm. Generally, the questions attempt to evaluate the extent to which a given phenomenon is perceived on a five-point Likert scale. Useful responses from 10 foreign-owned and 20 local-owned firms were included in the study.

We conducted two phases of data analysis: qualitative data analysis and QCA data analysis. In the first phase, the qualitative data analysis was conducted using established interpretive qualitative data analysis techniques. We conducted the data analysis by recursive identification of patterns, first through categorization and then abstraction (Gioia, Corley & Hamilton, 2013). Common themes were identified, and categories were assigned. We followed a systematic and rigorous approach of deriving first-order, second-order, and aggregate concepts in three coding cycles. Applying this form of interpretation helped structure the categories, concepts, and dimensions of technology transfer practices

in a way that allows traceability of emerging theoretical constructs with the data collected (Gawer & Phillips, 2013). During the second phase of the data analysis, we conducted the QCA data analysis. We used the crisp-set (csQCA) — a form of QCA that uses Boolean algebra principles to analyse binary data sets (Ragin, 2014). In our study, the dataset was dichotomized because respondents were asked to indicate the presence or absence of interested constructs in their organisational context. Hence, we use csQCA to calibrate the data from ‘0.0’ to ‘1.0’, where ‘0.0’ means full non-membership and ‘1.0’ means full membership. We run four csQCA analyses: two using macro-variables for the conditions (for presence and absence of technology transfer via international collaboration) and two composing the detailed constituents of the three macro-variable conditions (Human Resource Development, Knowledge Management, and Foreign/Local ownership).

To affirm our findings, we conduct a single case study analysis using a typical case; a firm initially foreign-owned which had been divested to 100% Ghanaian ownership (2009/2010) for over a decade (at the time of writing the case). Such additional empirical analysis corresponds to what is referred to as post-QCA analysis (Schneider & Wagemann, 2012). This resembles Rihoux's et al (2021) QCA-'causal process tracing'¹ mixed methods (See Box 1). Core references to process tracing are George & Bennett (2005) and Beach & Pedersen (2019). We conclude the empirical study with a post-QCA analysis (Schneider & Wagemann, 2012) which consists of carefully selecting a case firm (Box 1) with a unique ownership history and significant HRD, KM and absorptive capacity to buttress our QCA findings.

¹ Core references to process tracing are George & Bennett (2005) and Beach & Pedersen (2019).

FINDINGS

Themes from the Qualitative Data

The qualitative study revealed four key themes eliciting differences between foreign and local firms: (1) International collaboration opportunities, (2) HRM/D and KM systems and practices (3) International knowledge networks, and (4) Absorptive capacity. With regard to international collaboration, we found that most local firms, unlike their foreign counterparts had limited or no international collaboration opportunities. As explained by one local manager, “... *we have not collaborated on a project with a foreign firm for the past three years that I have worked here...but there have been very few such opportunities in the past... I think most local firms have not [had such opportunities] ... there are no incentives or policies to encourage that.*” Drawing from this, we adapted the absorptive capacity measures to incorporate the limitation of international collaboration opportunities for local firms in emerging countries.

In terms of HRD practices, responses from both local and foreign firms asserted that “...*most local contractors... do not value human resource management and training and development...*” and that most local firms “...*did not have a structured knowledge management system*”. Foreign firms demonstrated more presence of both efficient and effective HRD and KM systems and practices than their local counterparts. Given that this finding is consistent with prior studies (e.g., Gooderham, 2007), we largely maintained prior measures of HRD and KM. While foreign-owned firms had “*access to knowledge from the parent company and international networks*”, local firms did not. Local firms were rarely approached for collaboration or knowledge sharing by foreign entities. Foreign firms also showed commitment to “*supporting employees to join local and international professional bodies than their local firms*”. Consequently, foreign firms were embedded in wider and richer international knowledge networks than local firms. In comparison with

local firms, foreign firms demonstrated more commitment to developing employees' "ability to acquire and utilised new technology and knowledge". We incorporate such support and commitment into the research items. Ultimately, the absorptive capacity and therefore technology transfer potential were much higher in foreign firms than in local firms. We use the survey data to further explicate more meaning from these initial findings. Insights from our qualitative analysis prompted us to consider three explanatory variables in the design of our questionnaire. *HRD* practices including international knowledge networks, *KM* systems including individual external knowledge networks, and foreign/local ownership. These three factors jointly contribute to absorptive capacity associated with *Technology Transfer Potential* (via international collaborations).

Scale Reliability of Measures

We performed initial reliability analysis of the measures before moving into the csQCA. From the results, the Cronbach's Alpha scores for the constructs are Technology Transfer [0.793], HRD [0.879], and KM [0.916]. We use mean values of HRD, Technology Transfer, and KM. Such composite measures are used in some studies for knowledge flows within MNEs (see Gupta & Govindarajan 2000). There are relationships between these variables. Technology Transfer has strong and significant positive correlation with KM (0.763), moderate and significant positive correlation between HRD and KM (0.537) and an appreciable correlation (but not significant) between Technology Transfer and HRD (0.385).

Analysis of technology transfer in emerging economies using csQCA

Using the csQCA, we analyse the macro-variables and their relationship with technology transfer potential. Our analysis aims to explain how the three conditions, namely, Foreign/Local owned firms, HRD, and KM combine to explain the potential absorption of new technology taking place through international collaboration. The analysis reveals one

causal path (Table 2) indicating that the potential absorption of new technology through international collaboration may be the consequence of the combination of more HRD, more KM, and ownership mainly under foreign investors' control. This confirms our conceptualisation that superior HRD, and KM of foreign firms enhance their absorptive capacity and technology transfer potential.

Table 2: General model explaining technology transfer potential through international collaboration in emerging economies.

| Configuration | Solution 1 |
|---|---------------|
| Foreign/local (local ●/foreign ∅) | ∅ |
| Human resource development (more ●/less ∅) | ● |
| Knowledge management (more ●/ less ∅) | ● |
| Consistency | 1.00 |
| Raw coverage | 0.28 |
| Unique coverage | 0.28 |
| Overall solution consistency | 1.00 |
| Overall solution coverage | 0.28 |

Black circles indicate the presence of a condition, and circles with “/” indicate its absence (or negation). Large circles indicate core conditions; small ones, peripheral conditions. Blank spaces indicate redundant condition.

We were interested in both the presence and absence of technology transfer potential because we are convinced of the importance of understanding conditions associated with the presence or absence of technology transfer potential. Thus, we run another csQCA analysis where the outcome is simply the negation of the outcome assessed in Table 2. Interestingly, this analysis yields two causal paths (Table 3). The first causal path shows that no matter the level (more or less) of HRD and KM, there is an absence technology transfer potential within companies dominantly held by local investors. This might be because the opportunities for international collaboration among locally owned companies are so low. The second causal path stresses the idea that there could be an absence of technology transfer potential regardless of foreign/local ownership. Therefore, even for more HRD, low engagement in KM would inhibit technology transfer potential.

Thus, firms, whether foreign or local, with good HRD practices but weak KM systems, may still not experience technology transfer through international collaborations.

Table 3: General model explaining the absence of technology transfer potential through international collaboration in emerging economies.

| Configuration | Solution | |
|--|----------|------|
| | 1 | 2 |
| Foreign/local (local ●/foreign ∅) | ● | |
| Human resource development (more●/less ∅) | | ● |
| Knowledge management (more ●/less ∅) | | ∅ |
| Consistency | 0.90 | 1.00 |
| Raw coverage | 0.78 | 0.21 |
| Unique coverage | 0.60 | 0.04 |
| Overall solution consistency | 0.90 | |
| Overall solution coverage | 0.82 | |

Black circles indicate the presence of a condition, and circles with “/” indicate its absence (or negation). Large circles indicate core conditions; small ones, peripheral conditions. Blank spaces indicate redundant conditions.

These first two analyses bring out two important results. First, they show that in the context of emerging countries, typically in Sub-Saharan Africa, the technology transfer due to international collaboration may take place more in foreign-owned firms with both good and active HRD and KM systems (see Table 2). Second, in some firms owned by local investors, there is absence of technology transfer potential regardless of their level of engagement in HRD and KM (see Table 3).

We strengthen these first significant results by considering common dimensions of firms in terms of HRD and KM, i.e., we disaggregate the two macro-variables. This helps us to focus on five essential activities of HRD and seven of KM. Thus, the two new models that we analyse are geared towards understanding the combination of twelve conditions in presence (or absence) of potential technology transfer through international collaboration within the firms.

Table 4 suggests that the analysis of the decomposition of the two macro-variables, HRD and KM, yields five causal paths associated with technology transfer potential through international collaboration. Solutions 2 to 5, which expand solution 1 in Table 2, are representative of a category of companies mostly held by foreign investors. Those firms invest in HRD and/or KM activities. For instance, solution 2 reflects firms more active in HRD than in KM activities. Solution 3 appears to be the opposite of solution 2 because in solution 3 there is more focus on KM than HRD activities.

Table 4: Extended model explaining technology transfer potential through international collaboration in emerging economies.

| Configuration | Solution | | | | |
|--|----------|------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 |
| Foreign/local (local ●/foreign ∅) | ● | ∅ | ∅ | ∅ | ∅ |
| Human resource development (more ●/less ∅) | | | | | |
| Reason for Training | ∅ | ∅ | ∅ | ● | ● |
| Internal training | ∅ | ● | ∅ | ● | ● |
| External training | ∅ | ● | ∅ | ∅ | ● |
| Organisation-led external knowledge networks | ∅ | ∅ | ∅ | ∅ | ● |
| Motivation to train | ∅ | ● | ∅ | ● | ● |
| Knowledge management (more ●/less ∅) | | | | | |
| Knowledge creation | ∅ | ∅ | ● | ● | ● |
| Individual learning | ∅ | ∅ | ● | ● | ● |
| Rewarding new knowledge | ∅ | ∅ | ∅ | ● | ● |
| Group learning | ∅ | ∅ | ● | ● | ● |
| Storing knowledge | ∅ | ∅ | ● | ● | ● |
| Knowledge sharing | ∅ | ∅ | ● | ● | ● |
| Individual external knowledge networks | ∅ | ∅ | ∅ | ● | ● |
| Consistency | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Raw coverage | 0.14 | 0.14 | 0.14 | 0.14 | 0.28 |
| Unique coverage | 0.14 | 0.14 | 0.14 | 0.14 | 0.28 |
| Overall solution consistency | | | | 1.00 | |
| Overall solution coverage | | | | 0.85 | |

Black circles indicate the presence of a condition, and circles with “/” indicate its absence (or negation). Large circles indicate core conditions; small ones, peripheral conditions. Blank spaces indicate redundant conditions.

Solution 4 illustrates the centrality of HRD and KM activities to the technology transfer process. Yet not all human resource activities are intensive, i.e., external training

and organization-led external knowledge networks. Finally, solution 5 represents companies with intensive efforts in all HRD and KM activities. These results significantly exemplify the need for both HRD and KM to enhance technology transfer potential. Solution 1 indicates that there is a category of local firms, i.e., those mostly held by local investors, that can build technology transfer potential with low engagement in HRD and KM activities. This suggests that a certain level of both activities remain essential to technology transfer.

Results of our last csQCA analysis exhibited in Table 5 indicate that the absence of technology transfer potential is more complex for locally owned firms (see solutions 2, 3, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 17, and 18) and foreign firms (see solutions 1, 4, 7, and 12). The condition that appears to be common among foreign firms with absence of technology transfer potential is lower organization-led external knowledge networks.

Table 5: Extended model explaining the absence of technology transfer potential through international collaboration in emerging economies.

| Configuration | Solution | | | | | | | | | | | | | | | | | | |
|--|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |
| Foreign/local (local ●/foreign ∅) | ∅ | ● | ● | ∅ | ● | ● | ∅ | ● | ● | ● | ● | ∅ | ● | ● | ● | ● | ● | ● | |
| Human resource development (more ●/less ∅) | | | | | | | | | | | | | | | | | | | |
| Reason for Training | ● | ∅ | ● | ∅ | ● | ∅ | ∅ | ● | ● | ● | ● | ● | ● | ∅ | ● | ● | ● | ∅ | |
| Internal training | | ∅ | ● | ● | ● | ∅ | ∅ | ● | ∅ | ∅ | ● | ∅ | ● | ● | ● | ∅ | ● | ● | |
| External training | ● | ∅ | ● | ∅ | ∅ | ● | ∅ | ● | ● | ∅ | ● | ● | ● | ● | ∅ | ● | ● | ● | |
| Organisation-led | | | | | | | | | | | | | | | | | | | |
| External knowledge networks | ∅ | ∅ | ● | ∅ | ● | ● | ∅ | ∅ | ● | ∅ | ● | ∅ | ● | ∅ | ● | ● | ● | ● | |
| Motivation to train | ● | ● | ● | ● | ● | ● | ∅ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Knowledge management (more ●/less ∅) | | | | | | | | | | | | | | | | | | | |
| Knowledge creation | ∅ | ∅ | | ∅ | ∅ | ∅ | ● | ● | ∅ | ∅ | ∅ | ● | ● | ● | ● | ● | ● | ● | |
| Individual learning | ∅ | ∅ | ● | ∅ | ∅ | ∅ | ● | ● | ● | ● | ● | ● | ● | ● | ∅ | ● | ● | ● | |
| Rewarding new knowledge | ∅ | ∅ | ● | ∅ | ∅ | ∅ | ● | ∅ | ∅ | ● | ● | ● | ∅ | ● | ● | ∅ | ● | ● | |
| Group learning | ∅ | ∅ | ∅ | ∅ | ∅ | ∅ | ∅ | ∅ | ∅ | ● | ∅ | ● | ∅ | ● | ● | ∅ | ● | ● | |
| Storing knowledge | ∅ | | ● | ∅ | ∅ | ∅ | ● | ∅ | ● | ∅ | ∅ | ● | ∅ | ● | ∅ | ● | ∅ | ● | |
| Knowledge sharing | ∅ | ● | ● | ∅ | ∅ | ∅ | ● | ∅ | ∅ | ● | ∅ | ∅ | ∅ | ∅ | ● | ● | ∅ | ● | |
| Individual external knowledge networks | ∅ | ∅ | ∅ | ● | ∅ | ∅ | ● | ∅ | ∅ | ∅ | ∅ | ∅ | ● | ● | ● | ● | ● | ● | |
| Consistency | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Raw coverage | 0.08 | 0.08 | 0.08 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | |
| Unique coverage | 0.08 | 0.08 | 0.08 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | |
| Overall solution consistency | | | | | | | | | | 1.00 | | | | | | | | | |
| Overall solution coverage | | | | | | | | | | 0.91 | | | | | | | | | |

Black circles indicate the presence of a condition, and circles with “/” indicate its absence (or negation). Large circles indicate core conditions; small ones, peripheral conditions. Blank spaces indicate redundant condition.

This suggests that one of the key determinants of technology transfer potential among foreign firms is the fact that they have access to richer and wider knowledge networks, which the local firms generally lack. It is also worth noting that as seen in the qualitative findings this wider knowledge network is also international. Table 5 also emphasizes that for local companies even when there are evident good HRD and KM practices and systems technology transfer may still not be achieved. We buttress these findings with a carefully selected single case study in Box 1.

Post-QCA Case Study Analysis

Box 1: Excellence through HRD, KM, absorptive capacity, and technology transfer potential

The case firm became a 100% Ghanaian owned construction firm after foreign divestment in 2009/2010. After over a decade of Ghanaian ownership the firm preserves a dedicated local and expatriate management team. A fifth of the current employees have been with the firm for more than 25 years (good source of organisational knowledge). The firm is a front runner in specialist construction technology and knowledge within the national and sub-regional markets.

HRD practices from the period of foreign ownership have been maintained and they continue to employ educated professionals who constantly receive training and development. Employees attest to annual performance appraisals which identify and deliver training and development needs linked to career development and progression. For sustained competitive advantage, the firm stays up to date with emerging technologies and provides related skills development for employees. The capacity building ethos from the period of foreign ownership has been continued. Employees are supported to be members of local and international professional bodies (communities of practice). They also attend relevant short courses and conferences and are mandated to share new technology and knowledge through seminars, reports, on-the-job and off-the-job training. Such new technology and knowledge are logged into the firm's KM system.

The KM system is deemed important for several significant reasons. Since construction operations are transient, technology and knowledge acquired may not be readily used for current and immediate future projects. In addition, the individual who acquired the technology may not be working with the firm when the knowledge is needed. The KM system, which is on a secured intranet, has different sections for the key processes and activities. These are reviewed and updated during and after a project in line with changing product, process or managerial technology and innovation. The system captures the name of any person who inputs or updates information on a technology or knowledge. This allows new users to know who to contact for clarification or further

explanation, if needed. Expectations to engage with the KM system forms part of the performance appraisal. Knowledge bearers are therefore always willing to give more insight into information on the KM system. Previous employees with a given knowledge either share the knowledge or are hired as consultants on related projects. KM has shown to be an important source of performance improvement and competitive advantage of the firm. The use of the KM system encourages knowledge sharing and teamwork and is essentially an embedded organisational culture inherited from the period of foreign ownership. In addition to the KM system, the firm maintains archives inherited from the period of foreign ownership and retain the services of an archival manager. The archives, inter alia, stores designs, reports, meeting minutes, etc. (knowledge repository) from previous projects.

The current local and foreign management team maintains national and international knowledge networks inherited from the period of foreign ownership. Prior relationships and communication with individuals and the previous parent foreign firm has sustained knowledge flows. The firm maintains HRD and KM systems with high absorptive capacity and technology transfer potential to maintain competitive advantage. It is not surprising that they remain a model of construction excellence (to both local and foreign firms) combining international knowledge and local experience to undertake large, complex projects.

DISCUSSION

We set out to understand conditions for achieving technology transfer in foreign and local firms in emerging economies. Based on our findings from the qualitative data and the QCA analysis, we develop a process model of technology transfer potential in emerging economies (see Figure 1). While we uncover different pathways to technology transfer potential in emerging economies, our process model outlines a unifying pathway. The model posits that for technology transfer potential to occur in emerging economies, local and foreign firms (left box) need to develop international collaborations and networks (centre box), which in turn help enhance their HRD and KM capabilities and vice versa. Thus, we emphasise that international collaborations and networks alone are not sufficient to successfully absorb new technology, but that both firm-level HRD and KM are also important elements for technology transfer. In addition, the process model posits that there is a relationship between HRD and strengthening absorptive capacity as well as KM and knowledge enhancement practices. This means that

international collaborations and networks can enhance KM, which ultimately enhances knowledge enhancement practices for technology transfer potential. Again, there is a mutually exclusive relationship between knowledge enhancement practices and the ability to strengthen absorptive capacity as improving the former also influences the latter. Therefore, achieving technology transfer potential in emerging economies requires a combination of HRD, KM and their respective mechanisms (i.e., strengthening absorptive capacity, and knowledge-enhancing practices to achieve technology transfer) and international collaborations and networks.

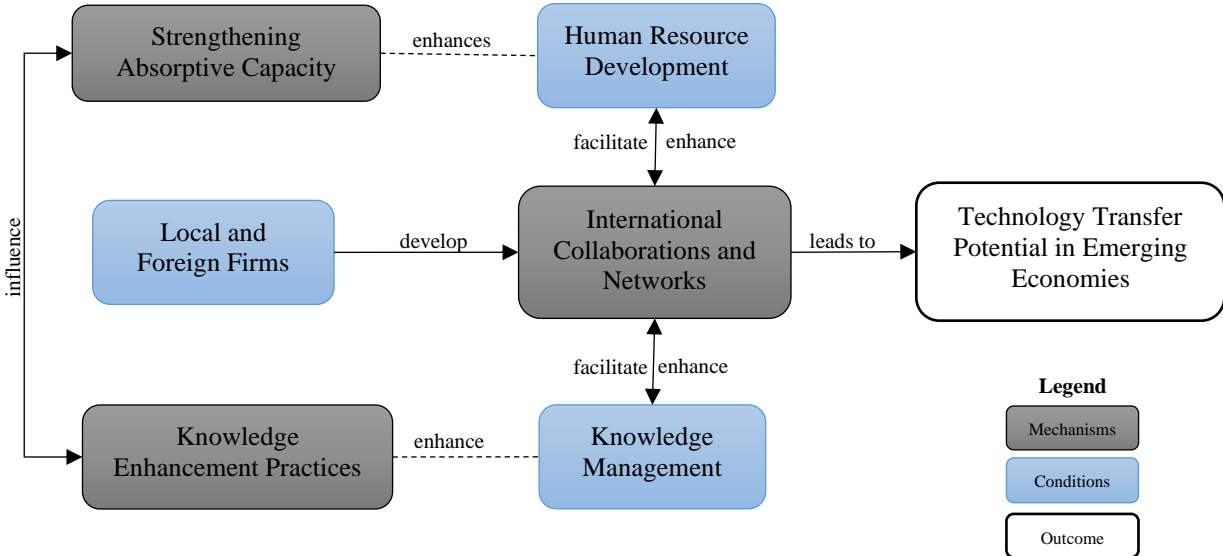


Figure 1: A process model of technology transfer potential in emerging economies

Theoretical Implications

In addition to our configurational theorising of technology transfer, this study makes four key theoretical contributions. First, the study develops a process model (see Figure 1) that unpacks how technology transfer occurs in local and foreign firms in emerging economies. So far, there is limited theorization of how technology transfer unfolds in emerging economies. While the majority of the existing studies (e.g., Ivarsson & Alvstam, 2005; Minbaeva et al., 2013; Dávila

et al., 2018; Teixeira et al., 2020) point to individual factors responsible for technology transfer, this study moves a step further to explicate the underlying process through which it occurs. By this, our study makes a significant contribution to the technology transfer literature. Second, the study contributes by extending the absorptive capability literature (Cohen & Levinthal, 1990; Arndt et al., 2023). Specifically, the study examines two internal organisational mechanisms that help develop purposeful absorptive capacity, namely HRD and KM. The study shows that successfully absorbing new external technology requires a firm to develop its human resources and use KM to internalize this new knowledge. Penrose (1973) assumes that knowledge transfer occurs when firms discover a profit opportunity. Our study suggests that the decision to absorb new knowledge may be more complicated as it requires various organisational systems. As such, we extend Cohen and Levinthal's (1990) perspective on the role of individuals in the process of absorbing knowledge, by showing that organisational systems, here HRD and KM, are important factors that support the knowledge absorption process. The study also explicates the link between strengthening absorptive capacity and knowledge-enhancing practices as mechanisms through which HRD and KM indirectly influence each other towards achieving technology transfer.

Third, the study further departs from existing literature to explain the underlying mechanisms and interactions between core variables and how they lead to technology transfer. Specifically, this study contributes to the HRD and KM literature by extending how HRM influences the technology transfer process (Minbaeva et al., 2013) and answers a call from Song (2014) to formulate and examine new HRD conditions. In this study, we looked at reasons for training, internal training, external training, motivation to train and organisation-led external knowledge networks. In the same sense, we examine KM conditions such as knowledge creation, individual learning, rewarding new knowledge, group learning, storing knowledge, knowledge sharing and individual external knowledge networks. By doing so, this study

contributes by complementing and extending previous research on technology transfer and the role of HRM/D (Pfeffer & Veiga, 1999; Evans & Davis, 2005; Minbaeva et al., 2013). Our study aligns with Song (2014) that such studies have largely ignored factors that directly relate to the technology transfer process such as training and development. Identifying and including different factors for developing human capital (Delaney & Huselid; Koch & McGrath, 1999) allowed us to stress the importance of training and development activities. In addition, this study amplifies the rather ignored role of KM in the technology transfer literature. The study emphasises the importance of HRD activities that underscore both internal and external training and the development of external knowledge networks. It also highlights that KM systems within firms, which enhance their ability to acquire, create, store, share and reward learning, are essential for increasing absorptive capacity and therefore the technology transfer potential. We further extend the assertion that foreign-owned firms invest more into HRM/D and KM systems to enhance technology transfer potential than local firms (Ramachandran, 1993) to suggest that the embeddedness of foreign firms into wider and, arguably, richer knowledge networks contribute to their superior absorptive capacity and therefore technology transfer potential. This supports the idea that the dynamics of technology transfer vary across network types (Inkpen & Tsang, 2005) but also emphasises that network types depend on foreign/local ownership.

Lastly, the study contributes by accentuating the importance of foreign/local ownership in an emerging economy context. The study shows that the low opportunities for international collaboration for local firms in emerging economies may inhibit their technology transfer potential. Whilst good HRD and KM systems enhance technology transfer potential for both local and foreign-owned firms, the absence of collaborative opportunities and good organisation-led and international knowledge networks for local firms explain their rather poor technology transfer potential. The contribution of the study to the literature on technology transfer, absorptive capacity, HRD and KM is enhanced particularly around the unique

contextual aspects (both the construction industry and emerging markets). We explain that industry dynamics matter. For example, construction projects are transient and characterised by rapidly changing micro-environments (Dubois & Gadde, 2002; Manley, 2008) which accentuates the significance of KM. In addition, in emerging markets where state institutions do not function as expected and are considered weak (Khanna & Palepu, 2006) with most construction industry bodies ill-equipped to address technology transfer issues (Osabutey and Croucher, 2018) internal firm level processes related to HRD and KM are critical. Our results show that HRD and KM are pivotal in building absorptive capacity in the context of emerging economies. Comparing with studies by Liu et al. (2014) on China and Osabutey et al. (2023) on Ghana, we conjecture that a well-built absorptive capacity could improve local innovation capability.

Practical and Managerial Implications

This study was motivated by low technology transfer within the construction industry, reluctance of local firms to invest in HRM/D and KM systems. There is the need for managers to understand that the reasons why technology transfer potential are not always sufficiently realised are more nuanced. Our findings and process model offer a holistic and unique medium for practitioners to implement technology transfer in emerging economies. Our post-QCA case analysis suggests that both foreign and local firms should consciously invest in KM by ensuring that projects have embedded elements of how to create, store, share, and reward new knowledge. To augment HRD, training and development should be part of the organizational culture. Employees should also be sponsored also attend relevant short courses and conferences and be encouraged to share new knowledge during scheduled in-house seminars. In addition, foreign and local firms should engage with relevant communities of practice. Above all, KM and HRD systems should be a core part of performance appraisal.

Effective transfer may sometimes only be measurable when and/or if the firm gets the opportunity to use the technology. This perhaps highlights the need for KM systems to maintain organisational memory since individuals who received the technology may no longer work for the organisation when the use of the technology is required. Our findings emphasise that the combination of KM and HRD systems support technology transfer potential. More importantly, managers must understand that learning via international collaboration is enhanced through good HRD systems of recipient firms. Another practical/managerial implication is that absorptive capacity and therefore technology transfer potential into a given industry is dependent on the joint effect of KM and HRD systems in both foreign and local collaborating firms.

Managers interested in new technologies need to continuously work on enhancing the quality, variety, and quantity of knowledge networks of the firms and its individuals. Our findings suggest that rather than leaving engagement with knowledge networks to individuals, organisations should deliberately support and work towards developing external knowledge networks to purposefully pursue new technologies. The explanatory factor for effective technology transfer differences is that foreign firms are connected to rich knowledge networks which local firms lack. This is because absorptive capacity and effective technology transfer depend on the nature of embedded knowledge networks. Even for foreign firms operating in developing/emerging countries poor organisation-led international external knowledge networks would inhibit technology transfer potential. Foreign firms should therefore also ensure that their embeddedness in an industry in a foreign country should not lead to disengagement with their external knowledge networks.

CONCLUSION

This study sought to address the research question dealing with how HRD, KM and local/foreign-owned firms explain the presence or absence of industry-level technology transfer potential through international collaboration in an emerging economy context. Our study has shown that existing literature has overlooked the configurational aspects of technology transfer potential. To address this, we develop a process model as a novel lens to understand how technology transfer in emerging economies unfolds. Our study also shows that good firm-level HRD and KM systems within an industry together enhance absorptive capacity and technology transfer potential for both foreign-owned and local-owned firms. Meanwhile, the absence of collaborative opportunities and good knowledge networks for local firms explain poor technology transfer potential. We also provide insights into how the nuances of knowledge networks within an industry environment influence technology transfer potential even for foreign firms.

The study departs from existing literature to address the research question from a configurational perspective. Specifically, the study applied QCA to uniquely enhance our understanding of the configurations under which technology transfer potential may or may not be realised. In addition, the study emphasises how QCA allows an in-depth exploration of important technology transfer issues, particularly in under-researched emerging economies. Whilst our study is novel in the configurational approach and how we analyse the relationship between the presence and absence of technology transfer potential in both foreign and local firms within an industry in an emerging economy, we recognise some limitations in the scope and scale of data used. Moreover, our study is limited by the focus on a single case (i.e., Ghana's construction industry), though the findings can be applicable to other countries in emerging markets with similar characteristics. These limitations present interesting avenues for future research. Future studies may find it interesting to have a better balance of the number of foreign

and local firms as this could enrich our understanding. Future studies could enlarge the sample and geographical coverage to uncover more technology transfer nuances in developing countries which remain under-researched. Exploration of other industries together or separately could also reveal industry effects.

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Appendix A

Interview Questions Outline

Drawing from your knowledge and experiences in this company, could you please throw detailed light on the following key questions on international collaboration opportunities, Human Resource Management/Development (HRM/D), Knowledge Management (KM)?

International Collaborations

- Could you please describe what kinds of international collaboration (joint ventures, subcontracting arrangements, strategic alliances, consortia, etc.) opportunities has your company been involved in.
- Could you please recollect and elaborate, with notable examples, on how often your company is involved in such international collaboration opportunities?
- Could you please describe in more detail a recent/current international collaboration?
- In your opinion what new technology or knowledge did your company gain from the international collaboration opportunity. Some specifics will be useful.

Human Resource Management/Development (HRM/D)

- Could you please describe the human resource management (HRM) functions in this company and how you ensure efficient management of your employees?
- Could you please explain what kinds of human resource development (HRD) practices through training and development activities (internal/external) does your company undertake, prioritise and why?
- Could you please describe how do you recognise and reward training (internal/external)?
- Could you please describe a recent/current training and development programme that your company is involved in?
- Could you please explain how do you support your employees to engage with communities of practice in their professional fields?
- Could you please evaluate how you think your commitment to HRM and HRD influences technology transfer potential in this company?

Knowledge Management (KM)

- Could you please describe how you company manages knowledge?
 - How does your company create new knowledge?
 - How does your company acquire new knowledge?
 - How does your company share new knowledge?
 - How does your company use new knowledge?
 - How does your company reward new knowledge?
 - How does your company store new knowledge (to maintain organisational memory)?
- Could you please describe a recent/current knowledge management programme or activity?
- Could you please evaluate how you think your commitment to knowledge management has influenced technology transfer potential in this company?