Revisiting FSAs and CSAs in Sub-Saharan Africa: Evidence from Ghanaian Firms

Abstract

Sub-Saharan Africa (SSA) is widely perceived as a region of countries with low technological capabilities and weak complementary assets competing on basic country specific advantages (CSAs) and relying on imported foreign technology. In this paper we argue against this perception. Integrating the extended concepts of Location Bound (LB) and Non-Location Bound (NLB) Firm Specific Advantages (FSAs) within a "revisited" CSAs/FSAs matrix, we provide evidence that home-market grown LB-FSAs and their transformation to NLB-FSAs are induced by domestic Ghanaian firms' strategic and export orientation.

Keywords: Technology sources, firm-specific advantages (FSAs), country-specific advantages (CSAs); complementary assets; Africa; Ghana

Introduction

Rugman and Verbeke (2001; 2003) analysed the importance of location bound (LB) and non-location bound (NLB) firm specific assets (FSAs) for both domestic firms and subsidiaries of foreign Multinational Enterprises (MNEs) to compete in international markets. Furthermore, Hillemann and Gestrin (2016), accentuated the role of complementary assets in redefining country specific advantages (CSAs). Studies so far on Africa and Sub-Saharan Africa (SSA) have failed to give significant credence to the region's presence and development of FSAs as a source of firms' competitiveness (Dong *et.al.*, 2022).

Evidence suggests that SSA economies rely more on imported forms of technology through licensing from Advanced Economy Multinational Enterprises (AMNEs) rather than from indigenous sources of knowledge (Lall & Pietrobelli, 2005; Osabutey, Williams & Debrah, 2014;). One condition that makes technology transfer from AMNEs unproductive in Africa is the underdeveloped or weak complementary assets of the region (Dunning & Lundan, 2008; Bartels & Koria, 2014; Osabutey & Croucher, 2018). SSA in particular performs poorly in research and development (R&D) indicators such as number of engineers in R&D or R&D as percentage of GNP (Lall & Pietrobelli, 2005; Osabutey & Jackson, 2019).

In this paper we explore the development FSAs in the context of an SSA country, namely Ghana. According to the World Bank Ghana is considered a "rising star" in the SSA region. "GDP per capita grew by an average of 3 percent per year over the past two decades putting Ghana in the top ten fastest growing countries in SSA" (World Bank, 2021, p.8). Nevertheless, Ghana's' overall technological performance ranked the country 112th among 132 countries and 12th among the 23 SSA countries in 2021 (WIPO, 2021). It is thus evident that countries like Ghana should accelerate the development of their complementary assets in order for locally based firms to access the resources needed to generate genuine LB-FSAs to enhance their

competitiveness (Elsey, 2020; Liang, 2017). At the same time, it is well-documented that vibrant exporting firms, mostly small and medium enterprises (SMEs), are key players in SSA's competitiveness drive (Bartels & Koria, 2014; Fu, Emes & Hou, 2021: World Bank, 2021). Studies by Ibeh (2003) and Van Biesebroeck (2005) suggest that African SMEs adopting exports as their main route of internationalisation largely rely on home country and regional business environments (Rugman, Verbeke & Nguyen, 2011; Wei & Nguyen, 2020a,b). The World Bank (2021) praises Ghana's outstanding export performance, driven mostly by SMEs, but at the same time points towards the lack of diversification in its exports (being almost exclusively agricultural products, such as cocoa). Hence, the absence of complementary assets created through collaborations with the other stakeholders of the economy, such as government and knowledge institutions, compromise exporting domestic firms and SMEs in particular from achieving in full their competitiveness potential (Oyelaran-Oyeyinka, 2014).

Our analysis relies on a sample of 247 domestic firms and foreign MNE subsidiaries located in Ghana to empirically test the factors that contribute to the development of LB and NLB - FSAs. The paper contributes to the existing literature in the following distinctive ways: *First*, it offers a fresh perspective on the integration of complementary assets in the FSAs and CSAs framework, grounded within the extended concepts of LB and NLB FSAs, by interplaying the analysis between both domestic firms and foreign MNE subsidiaries (Rugman & Verbeke, 2001; 2003; Lee, Narula & Hillemann, 2021). *Second*, it pays special attention to how the exporting orientation of Ghanaian domestic firms, and in particular SMEs, impacts the transition from LB-FSAs to NLB-FSAs, contributing thus to the discussion on how the exporting domestic firms in developing countries can enhance their competitiveness. *Finally*, it contemplates, within the FSAs and CSAs framework, the contribution of strategic typologies

in exploring how configurations of LB and NLB FSAs are affected by different types of strategies (Furnari *et al.,* 2021).

The rest of the paper is organised as follows: We undertake a literature review and develop the hypotheses to be tested. We follow that with the methodology for the study and present the empirical results. We then discuss our results, conclude, and set an agenda for future research.

CSAs, FSAs and complementary assets

In the International business literature the significance of CSAs and FSAs and their interaction is addressed in the "classic" CFA/FSA matrix, originally introduced by Rugman (1981) which has since been further developed and revisited, as presented in Table 1 (Rugman & Verbeke, 2001; Rugman, Verbeke & Nguyen, 2011; Narula & Verbeke, 2015; Hillemann & Gestrin, 2016; Li & Oh, 2016; Lee, Narula & Hillemann, 2021). Within the original CSA/FSA matrix CSAs are of generic and static nature and include lower production costs or abundance in resources, whilst FSAs include "both proprietary know-how (unique assets) and transactional advantages" (Rugman & Verbeke, 1992, p. 762). This implies that access to generic home-country CFAs helps firms to develop FSAs, which as Rugman, Verbeke and Nguyen (2011) argue, can be relatively easily transferred, deployed, recombined, and profitably exploited in home regions with similar institutional and economic characteristics (Luiz & Ruplal, 2013; Luiz, Stringfellow & Jefthas, 2017; Osabutey & Croucher, 2018).

Recent work has focused on the interaction between CSAs/FSAs and, in particular, how their combination can lead to a revised CSA/FSA framework (Hitt *et al.,* 2021; Luiz *et al.,* 2021). For example, Basuil and Datta (2019) stress that countries with greater CSAs react with a firm's FSAs in determining the size of an acquisition, whilst Georgallis *et al.,* (2021) argue that different types of FSAs can affect a firm's perception of a country's CSAs and eventually

influence their decision of whether to enter a particular market. One important contribution in the development of the re-conceptualisation of the "classic" CSAs/FSAs framework is the extension of CSAs "so as to explicitly include complementary assets" (Teece, 1986; Rugman & Verbeke, 2001; Collinson & Rugman, 2008; Hillemann & Gestrin, 2016, p. 769). Wei and Nguyen (2020b) clarify that complementary assets can be generated by an array of actors including suppliers, research institutions and universities, amongst others. Inclusion of complementary assets in the CSA/FSA framework extends the notion of generic CSAs to a more complex one which is the outcome of "better resources and institutions" (Luiz, Stringfellow & Jefthas, 2017, p. 85; Wei & Nguyen, 2020a). Similarly, improved FSAs extend beyond "proprietary know-how" and are considered as "knowledge bundles that can take the form of intangible assets, learning capabilities and even privileged relationships with outside actors" (Rugman & Verbeke, 2003, p. 127). FSAs can be distinguished in LB-FSAs and NLB-FSAs. According to Rugman & Verbeke (2001, p. 241) LB-FSAs "can be defined as FSAs that benefit a company only in a particular location (or set of locations)," whilst NLB-FSAs "are defined as FSAs that can be exploited globally". Although FDI is considered as the most preferred means to transfer NLB-FSAs, licensing is also a means that an MNE can use to exploit its NLB-FSAs "especially when the technology licensed is not any longer the technology on which the firm's survival and future growth depends" (Rugman, Verbeke & Nguyen, 2011, p.763). Thus, domestic firms from developing and emerging markets may access MNEs' NLB-FSAs through licensing in order to internationalise into markets demanding products of an established technology. This practice is confirmed in recent studies by Nyeadi (2022) and Newman *et al.* (2020) who showed that technology and knowledge transfer linkages exist between MNEs and firms in Ghana and other SSA countries[1].

[1] Earlier work by Osabutey and Croucher (2018) showed that local firms in Ghana hardly benefited from foreign technology transfer, whilst Appiah-Adu, Okpattah and Djokoto (2016) noted that outsourcing and technology transfer generally influenced capability and performance more in foreign firms than domestic firms.

Alternatively, the presence of complementary assets can lead to the strengthening of home-market grown LB-FSAs and transform them into NLB-FSAs, boosting the competitiveness of firms (Boehe, 2016; Lee, Narula & Hillemann, 2021). For example, Abdulai, Thomas & Murphy (2015), looking at the influence of industry-university interactions on industrial innovation in Ghana, found that only co-operative collaborations and knowledge-based networking of businesses support innovative improvements and incremental innovations in the Ghanaian industries. Earlier, Sampath & Oyelaran-Oyeyinka (2010) used empirical data from public sector institutions in Nigeria and Ghana and confirmed that the quality of physical infrastructure, knowledge infrastructure, institutions, and incentives for innovation contributed to successful innovation.

However, a country's complementary assets are not freely accessible by all firms, including subsidiaries of foreign MNEs, and not all firms may be able to leverage their home-country LB-FSAs (Hennart, 2009; Hillemann & Gestrin, 2016; Buckley, 2017).

**************Insert Table 1 here**************

Factors such as cultural distance (Lee, Trimi & Kim, 2013); experience of investor in a particular country; intellectual property rights (Lee *et.al.*, 2011); international experience of the local firm (Park & Ghauri, 2011); and size of firms (Luo & Park, 2001) can affect the potential of firms to access complementary assets. O'Regan, Ghobadian and Sims (2006) and Zhang and Pearce (2012) looked at how the strategic types of foreign MNE subsidiaries interact with complementary assets applying the Miles and Snow (1978) typology. In the literature

there is extensive discussion on the contribution of typologies and, in particular, of Miles & Snow in addressing organisational complexities (Furnari *et.al.,* 2021; Haveman *et.al.,* 2021). This typology defines four strategic profiles of firms according to their choices in terms of market and product development. *Prospectors* often explore their business environment and usually take risks to innovate and grow. *Defenders* focus on maintaining their market positions and give priority to exploitation; they compete by improving efficiencies in their operations. *Analysers* adopt a hybrid position, engaging in various levels of exploration and exploitation and sustaining a pattern of consistent and balanced reaction to environmental change. *Reactors,* considered the least viable, are often inconsistent and unstable and low on exploitation and exploration (Anwar *et.al.,* 2021; Maury, 2022; Uwizeyemungu *et.al.,* 2022). There has been galvanising research since the paradigm was introduced by Miles & Snow in 1978 (DeSarbo *et al.,* 2005). For example, recent work by Knight *et al.* (2020) extend the Miles and Snow and other similar typologies to stress the importance of entrepreneurial orientation in export-oriented SMEs in Norway. Earlier, Hagen *et al.*, (2012) applied the Miles and Snow typology on Italian SMEs and their results showed that the entrepreneurial and growth-oriented SMEs share the characteristics of *prospectors* and *analysers*. Griffith (2011) found that lenders tend to prefer exporters that are *analyser*s, as they are perceived as experts in their industry and thus bear less risks for loan repayments. Camelo-Ordaz *et al.,* (2003) found that *prospector*s seek and utilise resources that enable innovation, while *analyser*s tend to use resources that strengthen the efficiency of their product development, and *defenders'* direct resources towards greater specialisation, whereas *reactors* may be less well placed when they are reacting to environmental conditions. Kang & Jun (2012) consider that *analysers* focus more on building reputation and manufacturing capacity than achieving first-mover advantages as might *prospector* firms.

Thus, drawing on the early work of Rugman & Verbeke (2001; 2003) and more recently on Hillemann and Gestrin (2016) and Wei and Nguyen (2020b) on complementary assets and LB and NLB FSAs, we apply the Miles and Snow typology and we assess the differentiating impact of strategic orientation of firms in inducing home-country originated LB-FSAs and /or relying on foreign sourced NLB FSAs.

This then brings us to the first set of hypotheses:

H1: *Different strategic types of firms based in Ghana (domestic and subsidiaries of foreign MNEs) are likely to have a differentiating effect on the reliance on home country LB-FSAs.*

H1a: Ghanaian domestic firms, prospectors and reactors are more likely to contribute to home-country LB-FSAs.

H1b: Ghanaian domestic firms, defenders, are more likely to maintain access to foreign NLB-FSAs.

H1c: Ghanaian domestic firms, analysers, are more likely to induce the growth of home-country grown LB-FSAs.

Exporting firms and technology sourcing in SSA countries

Ramamurti (2009) characterises exporting firms from emerging economies as *infant MNEs* which usually start their internationalisation in neighbouring markets. Usually, firms in the early stages of internationalisation are likely to depend on home-country CSAs, which would usually be expressed in terms of mature products or services relying on their comparative lower production costs or resource abundance. For example, Fjose, Grunfeld & Green (2010) noted that SMEs in Sub-Saharan Africa have increasing exports to both other African countries and external to the continent, with the share of raw material exports significantly above any other continent.

According to Rugman & Nguyen (2014) EMNEs first expand in their home regions, using FSAs that are generated from their home-country CSAs. Access to technological sources is widely acknowledged as essential for a firm to compete internationally by augmenting its home sourced FSAs and turning them into NLB-FSAs (Chudnovsky, Lopez, & Pupato, 2006; Nuruzzaman, Singh & Pattnaik, 2019). As a result of the evident technology gaps, domestic firms in developing countries require foreign technologies, thus foreign NLB- FSAs, to enhance their international and regional competitiveness (Hoekman *et.al.,* 2007; Osabutey *et.al.,* 2014). Consequently, the lack of complementary assets prohibits firms from these countries from attaining the necessary absorptive capacity for effective technology transfer, eventually compromising their export potential (Cohen & Levinthal, 1990; Liang, 2017; Nguyen & Diez, 2019). It is not therefore surprising that the slower adoption rates of new technologies by firms in developing countries is due to limited access to complementary assets (Krammer *et.al.,* 2018). For example, Appiah *et.al.,* (2019) provided evidence on how the absence of governmental support affects negatively the export behaviour and international competitiveness of Ghanaian SMEs in the horticultural sector. Van Biesebroeck (2005), using a panel of manufacturing plants in eight countries in SSA, earlier confirmed that exporting firms rely more on technological sources compared to non-exporters. Subsequently, recent research asserts that firms in Africa reflect a duality in their export behaviour. Thus, in respect to a South-South internationalisation, they are expected to rely on generic CSAs when competing regionally, whilst they will mostly rely on foreign NLB-FSAs when competing globally (Zhao, Papanastassiou, Pearce & Iguchi, 2021). Similarly, Larsen & Witte (2022) showed that business models embedded in informal economies facilitate regional exports of firms in SSA. However, at the same time they found that new product or service development motivates firms to register formally (with registration being a type of complementary asset)

which is a clear indication of the positive impact of commercialised innovation to the internationalisation of African firms. Thus, complementary assets in emerging markets improve a firm's own technological resource base to increase the probability of commercial success in international markets (Dong *et.al.,* 2022; Sutherland, Anderson & Hu, 2020). Following Boehe (2016) and Wei & Nguyen (2020a,b), we argue that the geographical orientation of exporting firms in Ghana would have a differentiating impact on the development of LB-FSAs sourced by the home-country complementary assets (Oyelaran-Oyeyinka, 2014).

Based on the above analysis we formulate the following sets of hypotheses:

H2: The geographical destination of the exports of firms located in Ghana will have a differentiating effect on the development and use of home-country LB-FSAs.

H2a: Ghanaian domestic firms exporting to other African (regional) markets are more likely to impact positively on the development of home- country grown LB-FSAs

H2b: Ghanaian domestic firms exporting to outside of Africa markets (global) are more likely to maintain the use of foreign NLB-FSAs.

Data and Methods

In SSA there is insufficient attention paid to complementary assets and, as Oyelaran-Oyeyinka (2014) emphasises, the transformation of African economies requires notable structural changes. Thus, there are omissions in the literature with respect to the growth of LB-FSAs through interaction with complementary assets in Africa (Robson *et.al.,* 2009). To that extent the presence of foreign MNEs does not always act as an enabler in accessing and developing technological resources and infrastructure (Appiah-Adu, *et.al*, 2016; Osabutey & Jackson, 2019). For example, Osabutey *et.al*, (2014) established that the presence of foreign firms in

Ghana did not lead to the expected technology transfer in the construction industry, whilst Appiah-Adu, *et.al,* (2016) noted that outsourcing and technology transfer generally benefited the innovative capability and performance more in foreign firms than in domestic firms.

In this paper we focus on Ghana. Ghana was chosen as the empirical focus because it exhibits a relatively sustained political and institutional stability with structural reforms that facilitate trade openness and SME innovation, digitalisation and internationalisation (Adomako et. al., 2020; Ayakwah, Damoah & Osabutey, 2021). The country has also experienced a rapidly changing business environment which influences the export performance of firms and the development of complementary assets (Robson et.al., 2009; Appiah et., a., 2019; World Bank, 2019, 2021). To this end, the Global Innovation Index (GII) shows that Ghana performs above the regional SSA average in four pillars, namely: human capital and research; infrastructure; knowledge and technology outputs; and creative outputs (WIPO, 2021) This is buttressed by a recent study by Senyo & Osabutey (2020) which highlights Ghanaian government-driven policies and initiatives to enhance digitalisation, innovation and internationalisation.

Data analysed in this paper derive from a questionnaire survey conducted in 2015. We pilot-tested the instrument to refine a few questions to suit the empirical focus. We targeted and administered questionnaires to 500 business units with the help of sampling frames drawn from lists obtained from the Ghana Business Directory and membership directories from the Association of Ghana Industries, National Board for Small Scale Industries, Association of Insurance Companies and Ghana Banking Association, as done by Williams, Colovic & Zhu (2017) in a related internationalisation study. The approach was also inspired by other studies in the African context (Hearn, Strange & Piesse, 2017; Bartels & Koria, 2014). Data was collected from domestic firms and subsidiaries of foreign MNEs in both the private and public sector, operating in financial services, insurance, manufacturing, education, health, etc. Respondents consisted of managing directors, chief executive officers (CEOs) and

functional/business unit managers. To ensure credibility of respondents were asked to stamp the questionnaires or attach their complementary cards to the filled questionnaires. Overall, we received 393 valid responses from 247 firms in Ghana, a response rate of 49.4%. About a third of the firms are from the finance sector (31.9%). The sample consists of a significant number of small firms (42.9%), as well as large firms (24.8%), in terms of their employment size. About 13.8% of firms are foreign MNE subsidiaries, whilst the vast majority are domestic firms (86.2%). The MNE subsidiaries that responded to the survey were among the largest global MNEs that have invested in Ghana, both in manufacturing and services. The sample profile is shown in Table 2.

*************Insert Table 2 here************

Variable measurements

In order to capture LB and NLB FSAs the dependent variables are different types of technology sources, while our main independent variables are the strategic type and export orientation of the sampled firms (Lee, Narula & Hillemann, 2021, fig.1). All variables were extracted from the questionnaire survey.

Technology sources

For the identification of LB and NLB FSAs we adapted the questions related to technology sourcing from Zhang & Pearce (2012) and Zhang *et al.*, (2018). It is well acknowledged that the terminology on assessing innovation, knowledge and technology sourcing derives from research on manufacturing (Papanastassiou, Pearce & Zanfei, 2020). Thus, in constructing the survey questionnaire we also followed the UK Innovation Survey of 2010-2012 (ONS, 2015) to confirm the appropriate use of terms in order to ensure that terminologies used to capture

technology sourcing were reflecting both manufacturing and service industries, and also to *identify* sources of complementary assets. We further triangulated the use of terminologies with academic papers and international reports that analyse innovation in service firms. For example, Rodriguez *et al.,* (2017) in their analysis of knowledge intensive business services in Spain apply R&D expenditure and use interactively terms like technology and innovation. Similarly, Kang & Kang (2014) use the term technology purchasing in the analysis of Korean service firms, whilst Driffield *et al.,* (2019) argue that knowledge intensive services have technology sourcing motivations in the locations they invest in overseas. Recent innovation reports from the European Commission and OECD also relate technology sourcing, not only with manufacturing but also with service industries (Amoroso *et.al.,* 2021). With all this in mind we capture home LB-FSAs and foreign NLB-FSAs by distinguishing among five different technology sources: technology developed using resources, exclusively, accessed from the home country of the firm, i.e. home development (HOMEDEV); technology imported and licensed from another firm (LICENSED); technology acquired from another part of the firm, i.e. internal acquisition (ACQUISITION); technology developed in collaboration with other firms, i.e. external firm collaboration (OTHERFIRM); technology developed in collaboration with scientific institutions, i.e. external institutional collaborations (INSTITUTION). The respondents were asked to grade the importance of their technology sources using four-point Likert scale (See Appendix A with the survey question used in the analysis). In Figure 1 we illustrate the interplay between LB and NLB FSAs and types of firms, i.e. domestic Ghanaian firms and foreign MNE subsidiaries. In line with the literature, LICENSED is considered as foreign imported technology (for both domestic Ghanaian firms and foreign MNE subsidiaries) representing an NLB-FSA. HOMEDEV and ACQUISITION are also considered as NLB-FSAs (as they can be exploited overseas) for the subsidiaries of foreign MNEs. On the other hand, HOMEDEV, ACQUISITION, OTHERFIRM and

INSTITUTION are home grown LB-FSAs for domestic Ghanaian firms and host-country grown LB-FSAs for foreign MNE subsidiaries (deriving from accessing Ghana's complementary assets).

**********Insert here Figure 1********

Independent variables

Strategic type: We identify the strategic type of each firm by applying Miles and Snow (1978) typology of strategic orientation. It is a good framework for explaining how firms adapt to market, technological and strategic change and it is very useful in examining firms operating in a rapidly changing business environment (Knight *et.al.,* 2020). Respondents are asked about the extent to which their business unit at the local level engages in each of the strategies (a Likert scale variable ranging from 1-not at all involved to 4-this is all they do) as follows (question 15 of the questionnaire survey):

1. ***Prospector*:** We value being first with new products, markets and technologies, even though not all efforts prove profitable. We respond rapidly to early signals concerning areas of opportunity.
2. ***Analyser*:** We are seldom first to market with new products. However, by carefully monitoring the actions of major competitors, we are a fast follower, bringing a more cost-efficient or perhaps more innovative product into the market very rapidly.
3. ***Defender***: We attempt to locate and maintain a secure niche in a relatively stable product or service area. We try to protect our niche by offering higher quality, superior service, lower prices, etc. We ignore industry changes that have no direct influence on current areas of operations.

4. ***Reactor***: We are usually not as aggressive in maintaining established products and markets as our competitors. Rather, we respond in those areas when forced to by environmental pressures.

Export orientation: Building on the arguments of Ramamurti (2009) that developing countries firms first internationalise in their neighbouring economies, we develop hypotheses 2a and 2b (H2a-H2b) and we capture the export orientation of firms located in Ghana. We differentiate between two types of export markets i.e. other African-regional markets (AFRICA) and the non-Africa, international markets (NONAFRICA) (Agyenim-Boateng *et.al.,* 2015; Collier, 2006).

Control variables: Consistent with prior research we include as control variables, **firm size, firm age**, **a country-of-origin dummy (C-o-O)** in order to distinguish between domestic and foreign owned firms, and a **sectoral dummy** (Zhang & Pearce, 2012; Latifi, Nikou & Bouwman, 2021). With regard to the sectoral difference, we capture the impact of the five sectors (in Table 2) with four sectoral dummies: manufacturing, finance, education, and trade (Imboden, 2006; Senyo & Osabutey, 2020; Scott-Kennel & Saittakari, 2020).

We are using the C-o O dummy to control for foreign affiliates (FOREIGN), following other empirical studies that want to discern differences among various types of firms in response to the dependent variable and are part of the same sample (Un & Cuervo- Cazurra, 2008; Larsen & Witte, 2022).

Firm size, in terms of employment, is included as a control variable, as larger firms may have more opportunities to collaborate with other firms or institutions, or access better resources than smaller firms, to generate new technologies (Gilsing, Cloodt & Bertrand–Cloodt, 2016; Osabutey & Croucher, 2018). Following Gilsing *et.al.,* (2016), firm size is measured as the natural logarithm of the number of employees of a company. To this end, and as in previous

studies, size for foreign subsidiaries captures the size of the particular subsidiary that the questionnaire was received from (Lee *et.al.,* 2020). The impact of **age** can be significant in terms of access to technological sources, particularly for newly established firms competing globally (Stuart, 2000) as the age of a firm affects technology and R&D investment (Coad, Segarra & Teruel, 2016) and innovation and performance in developing countries (Zhang *et.al.,* 2018; Latifi *et.al.,* 2021), with the ability of younger firms to access and develop technological sources labelled as the "learning advantages of newness" (Autio *et.al.,* 2000, p.919). Age is calculated as the difference between the date of establishment and the date the survey was conducted and is measured in years.

Common method bias

We use multivariate regression analysis to analyse the influence of export pattern and strategic type of the SMEs on technology sourcing. We used a self-administrated questionnaire to collect data. The disadvantage of such an approach is well documented as it is related to issues of common method bias (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). To overcome such weakness, we had taken both procedural and post-hoc statistical approaches, as suggested by Richardson, Simmering and Sturman, (2009) and Podsakoff, MacKenzie, and Podsakoff, (2012). First, we used a mix of single informant and multi-informant approach. Over a third of the responding firms provided multiple responses, ranging from two to eight respondents. By aggregating the multiple responses from the same firm, the risk of common method bias is greatly reduced. Secondly, we used different response formats across questions; Third, we made efforts in the questionnaire design, as well as data collection, to ensure respondent anonymity and confidentiality. Fourth, we adopted Dillman's (2007) Tailor Made Design method to ensure the reduction in item ambiguity and psychological separation, which includes adding numerous items that are not associated with the variables used, with the effect that it

made it impossible for the respondents to have the tendency of guessing the linkage between independent variables and dependent variables. Then we applied Lindell & Brandt's (2000) post hoc marker variable technique where the smallest or second smallest correlation coefficient serves as a proxy for common method bias. We partialled out the second smallest observed correlation (R=--.002; Table 2) from the initial correlation matrix, using Lindell & Whitney's (2001) approach. No changes of significance were found beyond the previously significant correlations after this correction. This indicated that there was no threat from common method bias in the results, as suggested by Malhotra *et al.,* (2006).

Table A.1 in the Appendix presents the means and standard deviations and correlation coefficients of all the variables. As can be seen there are no coefficients between the independent variables that are higher than 0.5, therefore no problem for multicollinearity exists according to Hair *et al.,* (2009). Further checks during the multi-regression procedure using the *variance inflation factor* (*VIF*) also confirmed that none of the VIFs exceed 10.

Results

The baseline multiple regression testing H1 and H2 includes all firms in the sample i.e., domestic firms and foreign subsidiaries of MNEs, and consists of empirical results for five models, with each one of the five types of technological sources as dependent variables. The results for the baseline multiple regression analysis are presented in Table 3. Results in Table 3 provide strong support for H1 and partial support for H2. The findings are elaborated in detail as follows. Model 3.1 in Table 3 uses HOMEDEV as dependent variable, i.e., the variable indicating technology is exclusively sourced from the home country and thus it captures a LB-FSA. The results support that PROSPECTORS or REACTORS positively induce HOMEDEV

(b=.233, and .198, p<.05 respectively). The importance of regional export African markets (AFRICA) has also a statistically positive impact on HOMEDEV (b=.381, p<.01).

********** **Insert Table 3 here**********

Model 3.2 shows support for H2 as it reflects the impact of export destination i.e., that of NONAFRICA on LICENSED i.e. the variable indicating a foreign NLB-FSA. Our findings also confirm a positive and statistically significant relationship with ANALYSERS indicating that this strategic type of firm may be replacing DEFENDERS in a more complex and ambitious way (REACTOR negatively affects LICENSED (b=-.146 and p<.10). There is also a strong and positive result for NONAFRICA on ACQUISITION (b=.330, p<.10, Model 3.3 in Table 3). Model 3.3 shows a strong result for PROSPECTORS and AFRICA. The results indicate that the importance of the African market (AFRICA) positively impacts ACQUISITION (b=.308, p<.01). Adopting a PROSPECTOR strategy is also positively affecting ACQUISITION (b=.158, p<.10 respectively). The dummy for foreign affiliates, i.e., FOREIGN, is insignificant. However, the strong positive results for ANALYSERS reinforce the previous findings on the emerging dynamism of this role, and the positive result for NONAFRICA shows probably an evolutionary process in FSAs, where home-market grown LB-FSAs are transformed into NLB-FSAs in order to compete for non-African export markets (Boehe, 2016). This result contradicts H2 as we expected non-African exports to be associated with foreign acquired technology such as licensing (as found in 3.2).

Similar to the previous outcome and against H2, in model 3.4, where OTHERFIRM is the dependent variable, i.e., the variable indicating technology is developed in collaboration with other firms, the results indicate the statistically significant positive impact of NONAFRICA on OTHERFIRM (b=.541, p<.01). Adopting a REACTOR strategic type has also a positive effect on OTHERFIRM (b=.147, p<.05). AGE also has a statistically positive impact on OTHERFIRM (b=.005, p<.10). Model 3.5 in Table 3 uses INSTITUTION as the dependent variable, i.e., the variable indicating technology is developed in collaboration with scientific institutions Results indicate NONAFRICA is positively associated with INSTITUTION (b=.411, p<.05). Adopting an ANALYSER strategic type is also positively associated with INSTITUTION (b=.166, p<.05 respectively). Finally, the statistically insignificant results for FOREIGN in all models suggests that foreign ownership does not have an impact as our sample includes both subsidiaries of foreign MNEs and domestic firms in order to capture the effect of home developed sourced technology for foreign MNEs we run an interaction term.

Overall, the results for the baseline regressions show consistent support for H1 and partial support for H2. The latter is confirmed by the statistically significant positive result on LICENSED in 3.2 but is at the same time rebutted by the strong positive results of NONAFRICA on home-sourced LB-FSAs as found in regressions 3.3-3.5.

In order to test Hypotheses 1a-1c, as well as H2a and H2b, we run the regression models only for domestic firms and for domestic SMEs. As in Ghana, 92 per cent of enterprises are SMEs and are estimated to contribute about 70 per cent of GDP, generating approximately 85 per cent of employment (Li *et.al.,* 2021; UNCTAD, 2022).

Results are presented in Tables 4-5.

********** **Insert Tables 4-5 here**********

Results for domestic firms and domestic SMEs are presented in Tables 4 and 5. As it can be seen in model 4.1 both PROSPECTORS and REACTORS have a positive and statistically significant impact on HOMEDEV, confirming H1a (b=.194, p<.10 and b=.221, p<.05 respectively). We also notice that the statistically significant positive result for AFRICA also confirms H2a (b=.324, p<.05). These results remain significant for domestic SMEs (Table 5) in model 5.1. Thus, our findings clearly show that domestic firms in Ghana, that are of a more dynamic strategic type, assert a significant impact on the use of home-developed sources of technology in their pursuit of home-market grown LB-FSAs. The negative and statistically significant result for size, in model 4.1 in Table 4 (b=-.098, p<.05), indicates that smaller firms can impact the generation of home-developed technologies, possibly suggesting that home-developed technologies are easier to access and maybe more affordable (Dooley *et.al.,* 2016)

With regard to LICENSED, a foreign sourced NLB-FSA, we see that results for DEFENDERS are insignificant in model 4.2 in Table 4 and we thus find no support for H1b. The positive and statistically significant results for REACTORS in both samples of domestic firms in models 4.2 (b=.142, p<.10) and 5.2 (b=.018, p<.10) suggest that this strategic type is still associated with NLB-FSAs when possibly under competitive pressures. If we assume that license fees can be expensive and thus not all firms will be in a position to afford them, it is not surprising that large domestic firms are associated with LICENSED as confirmed by the positive and statistically significant result seen in Table 5, model 5.2 (b=.158, p<.05).

In relation to ACQUISITION, the positive and statistically significant results for ANALYSERS in models 4.3 (b=.198, p<.05) and 5.3 (b=.191, p<.10) in Tables 4 and 5 respectively, confirm H1c as this strategic type relies on complementary home-based assets to meet the competitive pressures derived from competitors. Results for ANALYSERS in models 4.5 (b=.166, p<.10) and 5.5 (b=.184, p<.10) in Tables 4 and 5 respectively provide further

support for H1c as they have a significant impact on technology sourced from INSTITUTIONS.

With regard to H2b, we witness a statistically significant and positive result for NONAFRICA in models 4.3 and 4.5 (with b=.508, p<.05 and b=.391, p<.10, respectively) where the dependent variable is a technological source reflecting complementary home-country assets i.e., models with ACQUISITION and INSTITUTIONS. Although these results practically do not support H2b, they show that domestic firms in Ghana that are in their trajectory of internationalisation are driven by augmenting their LB-FSAs from resource-based FSAs to knowledge-based FSAs as asserted by Wei and Nguyen (2020b), in support of Rugman and Verbeke (2001). These results are further reinforced for the domestic SMEs subsample as presented in models 5.3-5.5 in Table 5. Finally, the statistically significant and positive results for REACTORS in models 4.4 (b=.134, p<.10) and 5.4 (b=.181, p<.05) provide further support for H1a.

Overall, the findings for domestic firms (and SMEs in particular) confirm H1 where we observe the differentiating impact of strategy type on the development of home LB-FSAs. In addition, the results further endorse that domestic firms depart from relying on foreign NLB-FSAs and, with the use of home-country complementary assets, develop knowledge-based LB-FSAs. The latter constitutes the driving force in their internationalisation process in global and regional markets.

Robustness tests

It is evident in our study that the financial sector (nearly 32% of firms surveyed) is dominating our sample. The financial sector consists of traditional banks as well as more modern financial institutions related to fintech (Senyo, & Osabutey, 2020) with significant advances in mobile

banking and marketplace lending fuelling the growth of the finance sector in Ghana (Economic Commission for Africa, 2020; UNCTAD, 2022). This agrees with the Accenture report (2015) which demonstrates the burgeoning innovation in financial services in Africa. Recent reports by the OECD confirm that finance and other services are among the most innovative and technologically intensive industries globally (Amoroso *et.al.,* 2021). Thus, in order to confirm the robustness of our results, we replicated the multiple regressions for all SERVICES which included Finance, Trade, Education and IT services and for the FINANCE sector separately. Results are presented in Tables 6 and 7

********** **Insert Tables 6-7 here**********

As can be seen in models 6.1 in Table 6 for all SERVICES and 7.1 in Table 7 for FINANCE, we find support for H1 and H2. In particular, for all SERVICES PROSPECTORS have a statistically significant positive impact on HOMEDEV (model 6.1, b=.314, p<.05) in support of H1, whilst in support of H2 we find a statistically significant (and positive) relation between AFRICA and HOMEDEV (model 6.1, b=.385, p<.05). In support of H2 we also observe the statistically significant positive result for NONAFRICA on LICENSE for all SERVICES and FINANCE (samples in model 6.2 and 7.2 respectively). The statistically significant positive result for FOREIGN in model 6.3 in Table 6 for all SERVICES on ACQUISITIONS (b=.589, p<.001) reflects the flexibility of foreign subsidiaries to access NLB-FSAs from other parts of their MNE network. Finally, notable is the statistically significant positive result for DEFENDERS on INSTITUTIONS for the FINANCE subsample (model 7.5 in Table 7), which suggests that even the most conservative of strategic types has an impact on developing domestic market complementary assets. The robustness of the results for SERVICES and FINANCE therefore confirms the patterns we observed for the complete sample.

Discussion

The existing literature suggests that countries in SSA did not prioritise investments in science and technology in the 1980s and 1990s (Mugabe & Ambali, 2006) to engender the creation of home-based complementary assets (Osabutey & Croucher, 2018) which could interact with production, diffusion and the use of new and economically useful technology necessary for enhancing competitiveness within a global context (Kaplinsky *et.al.,* 2009; Fu *et.al.,* 2021). As a consequence, SSA is widely perceived as a region of countries with low technological capabilities and weak complementary assets competing on basic CSAs and relying on imported foreign technology (Lall & Pietrobelli, 2005).

We build on Rugman & Verbeke's (2001; 2003) extended concepts of LB and NLB- FSAs, Hillemann & Gestrin's (2016) distinction between home-country (domestic) and host-country (foreign) sourced FSAs, and we adopt the Miles and Snow typology in order to investigate how the strategic profiles of firms in Ghana are associated with the development of home-country LB-FSAs. Our results confirm the generation of home LB-FSAs deriving from complementary assets embedded in the country's actors i.e., other firms and institutions. To this end, and focusing on the subsamples of domestic Ghanaian firms SMEs, we notice that all strategic types (with *defenders* being an exception) have an impact on the development and use multiple LB-FSAs, signalling a clear departure from the sole reliance on foreign licensed technology. This evidence suggests that Ghana, a SSA country, is going through a technological transformation where home- LB-FSAs are being driven by different strategic types of domestic firms (World Bank, 2021).

Our results on the impact of export orientation on NLB and LB- FSAs suggest that exporting to regional African markets leads to the development of LB-FSAs. Chironga *et al.,* (2011) classify Ghana as a *transition* economy and, as they observed, there was a surge of export of

manufactured goods to other African countries. Firms are therefore apt to develop innovations and technologies at home embodied in products that would suit the conditions and demands of their regional export markets in the form of LB-FSAs (Hennart, 2012; Eyring *et.al.*, 2011; Khanna *et.al.*, 2005). At the same time there is evidence that exporting to international markets further contributes to the transformation of home-country LB-FSAs and home-country grown NLB-FSAs (Ramamurti, 2009; Boehe, 2016). It is also evident in our study that the service sector contributes to the development of in-house technological innovations suitable for both their regional and international markets in alignment with the global trends in the service sector (Lins et al., 2021). Interestingly, our results on the finance sector (nearly 32% of respondent firms) indicate that exporting to regional markets transforms LB-FSAs into NLB-FSAs, whilst exporting to international markets relies on foreign NLB-FSAs (in the form of licensing). Finally, the weak overall results on licensing on the one hand raise concerns over the technological appropriateness of the activities of AMNEs, and on the other hand may reflect the weak institutional environment that does not encourage technology transfer (Osabutey & Jackson, 2019).

Conclusion, Implications and Research Opportunities

Our study contributes to the literature on the CSA and FSA framework in the context of SSA in the following considerable ways: *First*, we draw on the extended concepts of LB and NLB-FSAs and we show that strategic types of Ghanaian firms have an impact on the emergence of home-country originated LB-FSAs, whilst foreign-originated NLB-FSAs are not found to be associated significantly with any strategic type. *Second*, within a "revisited" CFA/FSA matrix, we show that regional African exports induce home-country grown LB-FSAs, suggesting that effective access to complementary assets offers the potential of transformation of home-country grown LB-FSAs into home-country grown NLB-FSAs. *Finally*, we confirm the

explanatory rigour of typologies in understanding the differentiating impact of the strategic orientation of firms on the generation of locally developed FSAs.

Furthermore, our findings reveal that foreign subsidiaries operating in Africa tend to depend on their MNE's NLB-FSAs. It is evident that MNE subsidiary managers need to evaluate and adopt locally developed technologies and innovations relative to foreign technologies for enhancing their competitiveness in regional markets. The fact that they do not, may also suggest that foreign subsidiaries do not have access to Ghana's complementary assets (Buckley, 2017). One potential explanation is that managers of foreign affiliates, in particular, may wrongly assume that developing countries remain sources of primary resources and cheap labour with totally inept innovative capabilities and choose to ignore them (Hymer, 1972; Bresciani *et.al.,* 2016). This confirms missed regional opportunities for scale and scope derived from exploring national innovative capabilities (Rugman *et.al.,* 2011). Jackson (2013) affirms that with respect to Africa there is a need to depart from the general pejorative view that indigenous and locally developed FSAs are backward or non-existent. He argues that knowledge creation and utilisation in Africa cannot afford to marginalise indigenous voices in influencing domestic technology, knowledge and innovation particularly. as this negative perception on the quality of local capabilities is not limited to Africa but rather concerns other emerging and developing economies (Suter *et al.,* 2021).

While the implications of such findings raise a number of questions, our study also signposts directions for future research to explore. More empirical studies are needed in testing a "revisited" CFA/FSA matrix to help understand how complementary assets can contribute to the development of LB- FSAs and their transformation into NLB-FSAs in the context of developing countries (Hillemann & Gestrin, 2016). Furthermore, the literature on exporting

will also benefit from a "revisited" CFA/FSA matrix as it can generate informed policy recommendations with regard to the competitiveness of domestic exporting firms and SMEs. Particularly in improving institutions that can facilitate technology transfer and generation. Finally, future research should investigate how the strategic orientation of firms may affect their capacity to access complementary assets. In conclusion, our findings call for wider studies on African internationalisation and the related effects of complementary assets on LB and NLB- FSAs development.

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Table 1: Definitions of CSAs, FSAs and complementary assets

Term	Definition	Source	Notes
Firm Specific Advantages (FSAs)	FSAs that include "both proprietary know-how (unique assets) and transactional advantages"	Rugman & Verbeke, 1992, p. 762	Referred as "generic" in Rugman and Verbeke (2001)
FSAs (improved)	Knowledge bundles that can take the form of intangible assets, learning capabilities and even privileged relationships with outside actors	Rugman & Verbeke, 2003, p. 127	"Improved" is added by the authors to underline the evolution in the definition of FSA. Hillemann and Gestrin, 2016 apply the term "classic" for the original FSA/CSA (Rugman, 1981) matrix and "revised" in their proposed matrix
Non-Location Bound (NLB) FSAs	FSAs that can be exploited globally, and lead to benefits of scale, scope or exploitation of national differences	Rugman & Verbeke, 1992, p. 763	The distinction between NLB and LB FSAs has been used in a number of papers by Rugman and Verbeke and co-authors as well as by other authors (this work is extensively cited in the paper). Further types of NLB and LB FSAs can also be found in Collinson and Rugman (2008), Rugman, Verbeke and Nguyen (2011), and Lee, Narula and Hillemann (2021)
Location Bound (LB) FSAs	FSAs that benefit a company only in a particular location (or set of locations), and lead to benefits of national responsiveness.	Rugman & Verbeke, 1992, p. 763	
Country Specific Advantages (CSAs)	Refer to a nation's factor endowments and can include for example low labour costs. They are assumed to be exogenous	Rugman & Verbeke, 1992, p. 763	They are referred as "generic" in Hillemann and Gestrin, 2016, p.769 or "environmental' in Collinson and Rugman (2008)
Complementary assets	Resources, capabilities or assets which are necessary to make an innovation successful	Teece (1986), Buckley (2017), Rugman, Verbeke and Nguyen (2011), Hennart (2009)	Hillemann and Gestrin (2016) propose to include complementary assets in the definition of CSAs. Wei and Nguyen (2020) clarify that complementary assets can be generated by an array of actors including suppliers, research

			institutions, and universities among others.

Figure 1: NLB and LB- FSAs by types of firms

Types of firms	Sources of Technology				
	HOMEDEV	*LICENSE*	*ACQUISITION*	*OTHERFIRM*	*INSTITUTION*
DOMESTIC*	LB-FSA	NLB-FSA	LB-FSA *Access to Complementary Assets*	LB-FSA *Access to Complementary Assets*	LB-FSA *Access to Complementary Assets*
FOREIGN*	NLB-FSA	NLB-FSA	LNB-FSA	LB-FSA *Access to Complementary Assets*	LB-FSA *Access to Complementary Assets*

Home-country grown FSAs (domestic)

MNE-grown FSAs (foreign)

Host-country grown FSAs (domestic)

* **Domestic: Ghanaian firms**

**** Foreign: Foreign MNE subsidiaries**

Table 2. Sample profile (N=247)

Descriptors	Percentage of sample respondents
Firm age (years)	
Less than 10	37.1
10-19	27.8
20-29	12.2
30-59	19.2
60 or above	4.7
Firm Size	
Small (Less than 50 employees)	42.9
Medium (51-249)	22.3
Large (more than 250 employees)	24.8
Industrial sector	
Manufacturing/agriculture/construction	17.9
Banking/Financial services	31.9
Education/health/IT services (Other services)	18.3
Trade/wholesale/retail	15.8
Government agency and related services	16.1
Country of origin of firm	
Ghana	86.2
Foreign	13.8

Source: Survey data, authors' calculations

Table 3: Estimation Results of the Regression Analysis (N=247)

	Model 3.1	Model 3.2	Model 3.3	Model 3.4	Model 3.5
	HOMEDEV	LICENSED	ACQUISITION	OTHERFIRM	INSTITUTION
Intercept	1.471***	.693**	.064	.574*	.667**
	(.342)	(.336)	(.320)	(.320)	(.288)
PROSPECTOR	.233**	.060	.158*	-.022	.004
	(.097)	(.096)	(.091)	(.091)	(.0082)
ANALYSER	-.032	.107	.128	.099	.166**
	(.096)	(.094)	(.064)	(.089)	(.081)
DEFENDER	-.060	-.035	-.003	-.032	-.135*
	(.089)	(.087)	(.083)	(.083)	(.075)
REACTOR	.198**	-.146*	-.072	.147**	.057
	(.062)	(.076)	(.083)	(.073)	(.065)
AFRICA	.381***	-.088	.308***	.007	.110
	(.116)	(.114)	(.109)	(.109)	(.098)
NONAFRICA	-.202	.386*	.330*	.541***	.411**
	(.200)	(.172)	(.187)	(.187)	(.168)
FOREIGN	-.169	.499	.461	-.057	-.321
	(.683)	(.671)	(.640)	(.638)	(.575)
FIRM_AGE	.000	.002	.001	.005*	.003
	(.003)	(.003)	(.003)	(.003)	(.002)
FIRM_SIZE	-.076*	.066	.075*	-.021	.011
	(.041)	(.040)	(.039)	(.039)	(.035)
MANUFACTURING	-.064	-.092	-.099	-.157	-.042
	(.211)	(.207)	(.197)	(.197)	(.177)
FINANCE	.175	.429**	-.058	-.013	-.084
	(.106)	(.190)	(.181))	(.181)	(.163)
OTHER SERVICES	-.360*	.261	-.143	.297	.019
	(.211)	(.059)	(.198)	(.197)	(.177)
TRADE	-.225	.059	.085	-.198	.052
	(.219)	(.215)	(.205)	(.205)	(.184)
R^2	.157	.133	.203	.131	.121
Adj. R^2	.110	.085	.159	.083	.072
F	3.343	2.750	4.578	2.707	2.478
df1,df2	13, 233	13, 233	13, 233	13, 233	13, 233
P	.000	.003	.000	.001	.004

Note: Standard errors in parentheses: *** significant at p<.01; ** significant at p<.05; * significant at p<.10

Table 4: Estimation Results of the Regression Analysis-Domestic Firms Only (N=205)

	Model 4.1	Model 4.2	Model 4.3	Model 4.4	Model 4.5
	HOMEDEV	LICENSED	ACQUISITION	OTHERFIRM	INSTITUTION
Intercept	1.575***	.811**	.369	.639*	.613*
	(.398)	(.375)	(.350)	(.358)	(.327)
PROSPECTOR	.194*	.098	.154	-.065	-.015
	(.109)	(.102)	(.096)	(.098)	(.089)
ANALYSER	.032	.108	.198**	.120	.166*
	(.108)	(.102)	(.092)	(.097)	(.089)
DEFENDER	-.105	-.067	-.054	.032	-.112
	(.105)	(.099)	(.079)	(.094)	(.086)
REACTOR	.221**	.142*	-.043	.134*	.079
	(.089)	(.084)	(.133)	(.080)	(.073)
AFRICA	.324**	.041	.163	.086*	.146
	(.151)	(.142)	(.221)	(.136)	(.124)
NONAFRICA	-.069	.205	.508**	.440	.391*
	(.251)	(.237)	(.003)	(.226)	(.206)
FIRM_AGE	-.001	.002	.000	.002	.002
	(.004)	(.003)	(.001)	(.003)	(.003)
FIRM_SIZE	-.098**	.038	-.005	.033	.014
	(.046)	(.044)	(.041)	(.042)	(.038)
MANUFACTURING	-.164	-.116	-.335	-.283	-.099
	(.244)	(.230)	(.215)	(.219)	(.200)
FINANCE	.166	.481**	-.127	.001	-.068
	(.216)	(.203)	(.190)	(.194)	(.177)
OTHER SERVICES	-.357	.199	-.194	.202	.001
	(.233)	(.219)	(.205)	(.209)	(.191)
TRADE	-.292	.086	-.132	-.189	.008
	(.251)	(.236)	(.221)	(.226)	(.206)
R^2	.150	.138	.183	.124	.120
Adj. R^2	.010	.085	.132	.069	.065
F	2.873	2.587	3.591	2.274	2.193
df1,df2	12, 193	12, 193	12, 193	12, 193	12, 193
P	.001	.003	<.001	.010	.013

Note: Standard errors in parentheses: *** significant at p<.01; ** significant at p<.05; * significant at p<.10

Table 5: Estimation Results of the Regression Analysis-Domestic SMEs Only (N=169)

	Model 5.1	Model 5.2	Model 5.3	Model 5.4	Model 5.5
	HOMEDEV	LICENSED	ACQUISITION	OTHERFIRM	INSTITUTION
Intercept	1.580***	.512	.297	.503	.639*
	(.464)	(.436)	(.410)	(.408)	(.383)
PROSPECTOR	.231*	.048	.130	-.095	-.025
	(.122)	(.114)	(.108)	(.107)	(.100)
ANALYSER	.004	.098	.191*	.119	.184*
	(.121)	(.113)	(.107)	(.106)	(.099)
DEFENDER	-.152	-.091	-.079	-.009	-.151
	(.116)	(.109)	(.103)	(.102)	(.096)
REACTOR	.247**	.180*	-.036	.181**	.116
	(.102)	(.096)	(.090)	(.090)	(.084)
AFRICA	.323*	-.028	.090	-.027	.078
	(.169)	(.159)	(.149)	(.149)	(.140)
NONAFRICA	-.044	.329	.650**	.625**	.455*
	(.280)	(.263)	(.248)	(.246)	(.231)
FIRM_AGE	-.001	.002	-.002	.000	.002
	(.004)	(.004)	(.004)	(.004)	(.004)
FIRM_SIZE	-.095	.158**	.025	.096	.034
	(.072)	(.067)	(.063)	(.063)	(.059)
MANUFACTURING	-.110	-.123	-.251	-.260	-.123
	(.284)	(.266)	(.250)	(.249)	(.234)
FINANCE	.197	.459*	-.041	.043	-.075
	(.257)	(.241)	(.227)	(.225)	(.212)
OTHER SERVICES	-.406	.286	-.156	.137	-.198
	(.277)	(.261)	(.245)	(.244)	(.229)
TRADE	-.278	.093	-.058	-.173	-.040
	(.279)	(.262)	(.246)	(.245)	(.230)
R^2	.160	.153	.174	.134	.128
Adj. R^2	.096	.088	.110	.068	.061
F	2.480	2.344	2.737	2.019	1.909
df1,df2	12, 156	12, 156	12, 156	12, 156	12, 156
P	.005	.009	.002	.026	.037

Note: Standard errors in parentheses: *** significant at p<.01; ** significant at p<.05; * significant at p<.10

Table 6: Estimation Results of the Regression Analysis-Service sector (N=165)

	Model 6.1	Model 6.2	Model 6.3	Model 6.4	Model 6.5
	HOMEDEV	LICENSED	ACQUISITION	OTHERFIRM	INSTITUTION
Intercept	1.434***	.804*	.157	.510	.569
	(.460)	(.446)	(.418)	(.410)	(.361)
PROSPECTOR	.314**	.054	.238**	-.033	-.048
	(.123)	(.119)	(.112)	(.110)	(.097)
ANALYSER	.039	.152	.123	.130	.232**
	(.121)	(.118)	(.110)	(.108)	(.095)
DEFENDER	-.132	-.046	.047	.009	-.020
	(.119)	(.115)	(.108)	(.106)	(.093)
REACTOR	.135	.172*	-.151*	.074	-.040
	(.009)	(.096)	(.089)	(.088)	(.077)
AFRICA	.385**	-.146	.061	.049	.105
	(.167)	(.162)	(.151)	(.149)	(.131)
NONAFRICA	-.182	.591**	.655***	.629***	.471**
	(.253)	(.245)	(.230)	(.225)	(.198)
FOREIGN	-.144	-.030	.589***	-.171	-.220
	(.243)	(.236)	(.221)	(.216)	(.191)
FIRM_AGE	-.006	-.001	-.002	.002	.000
	(.004)	(.004)	(.004)	(.004)	(.003)
FIRM_SIZE	-.068	.057	-.013	.045	-.003
	(.050)	(.049)	(.046)	(.045)	(.040)
R^2	.121	.097	.242	.131	.143
Adj. R^2	.069	.044	.198	.080	.093
F	2.361	1.848	5.502	2.585	2.875
df1,df2	9, 155	9, 155	9, 155	9, 155	9, 155
P	.016	.064	<.001	.008	.004

Note: Standard errors in parentheses: *** significant at p<.01; ** significant at p<.05; * significant at p<.10

Table 7: Estimation Results of the Regression Analysis-Finance sector Only (N=81)

	Model 7.1	Model 7.2	Model 7.3	Model 7.4	Model 7.5
	HOMEDEV	LICENSED	ACQUISITION	OTHERFIRM	INSTITUTION
Intercept	2.232***	.923	-.160	1.252**	.601
	(.611)	(.655)	(.612)	(.589)	(.509)
PROSPECTOR	.095	.184	.250	-.208	-.111
	(.190)	(.203)	(.190)	(.183)	(.158)
ANALYSER	.108	.047	.194	.080	-.012
	(.179)	(.192)	(.179)	(.173)	(.149)
DEFENDER	.054	.069	.143	.121	.358**
	(.195)	(.208)	(.195)	(.187)	(.162)
REACTOR	.077	.091	-.177	.096	-.085
	(.126)	(.135)	(.126)	(.121)	(.105)
AFRICA	.660***	-.244	.189	.127	.242
	(.207)	(.222)	(.207)	(.200)	(.172)
NONAFRICA	-.609	.549*	.470	.403	.370
	(.297)	(.319)	(.297)	(.286)	(.247)
FOREIGN	-.141	-.135	.385	-.120	-.233
	(.302)	(.324)	(.303)	(.291)	(.252)
FIRM_AGE	-.003	.005	.004	.006	.002
	(.007)	(.007)	(.007)	(.006)	(.006)
FIRM_SIZE	-.168**	.028	-.043	-.047	-.068
	(-.168)	(.070)	(.065)	(.063)	(.054)
R^2	.220	.105	.301	.138	.251
Adj. R^2	.121	-.008	.212	.029	.156
F	2.222	.929	3.394	1.268	2.639
df1,df2	9, 71	9, 71	9, 71	9, 71	9, 71
P	.030	.506	.002	.270	.011

Note: Standard errors in parentheses: *** significant at p<.01; ** significant at p<.05; * significant at p<.10

APPENDIX A

Survey question (Q.25) for technology sources:

Please grade each of the following sources of technology of your business (at the local level) ability to be competitive currently where 1= not at all, 4=only source.

1. Technology developed by your company using exclusively your resources accessed in the home country of your firm
2. Technology licensed by another firm
3. Technology acquired from another part of your firm
4. Technology developed in collaboration with other firms
5. Technology developed in collaboration with scientific institutions (e.g., universities)

Clarifying note: In Table 3 we present results for the whole sample that includes both domestic firms and subsidiaries of foreign MNEs in Ghana. Thus, source 1 and 3 in Q.25 in the case of foreign subsidiaries is associated with the home country of the subsidiary and the MNE network of the subsidiary. To this end, the inclusion of dummy FOREIGN clearly distinguishes between foreign and domestic ownership.

Table A.1. Descriptive statistics and bivariate correlations for all variables (N=247)

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. HOMEDEV	2.19	.98													
2. LICENSED	2.13	.94	.04												
3.ACQUISITION	1.75	.92	.27**	.19**											
4. OTHERFIRM	1.89	.89	.24**	.27**	.44**										
5.INSTITUTION	1.56	.79	.29**	.22**	.44**	.55**									
6. AFRICA	1.50	.65	.20**	.05	.35**	.17**	.24**								
7.NONAFRICA	1.21	.39	.08	.12	.29**	.24**	.25**	.59**							
8.PROSPECTOR	2.54	.77	.22**	.18**	.20**	.07	0.05	.19**	.11						
9. ANALYSER	2.30	.79	.14*	.21**	.17**	.13*	.15*	.13*	.10	.54**					
10. DEFENDER	2.61	.78	.01	.10	.08	0.02	-.06	.08	.11	.44**	.41**				
11. REACTOR	2.04	.80	.20**	.16**	.02	.15*	.09	.04	.01	.20**	.33**	.20**			
12. FOREIGN	0.01	.09	.03	.03	.07	.01	.05	.09	.07	.05	-.09	-.01	.05		
13. FIRM_AGE	21.47	21.86	-.01	.07	.08	.14*	.15*	.02	.01	-.04	.12	-.13*	.06	-.03	
14. FIRM_SIZE	244.23	468.34	-.02	.06	.17**	.13*	.14*	.18**	.27**	-.06	-.03	-.14*	.00	-.03	.29**

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).