

# CAN FDI FOSTER INCLUSIVE INNOVATION AND TECHNOLOGY DEVELOPMENT IN AFRICA?

By

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## Abstract

Does the presence of foreign owned firms assure the economy of new production techniques and greater investment in domestic innovation? With the use of innovation indicators for firms provided in the World Bank Enterprise Surveys, we examined the innovative activity of firms in the manufacturing sectors of Kenya and Nigeria. A binary logistic regression model was formulated to assess the likely influence of several firm-specific characteristics on firm's engagement in product and process innovation. The estimation results indicated that an improvement in domestic firm products and processes owing to the presence of foreign-owned or operated firms in the sector is not automatic. For both Kenya and Nigeria, process innovation is mostly influenced by the intensity of foreign competition, possession of internationally recognized quality certifications, ICT usage as well as the ownership status of the firm. We conclude that it is via the learning experiences provided by supply linkages and technology licensing that domestic firms take on advanced techniques and management practices employed by foreign-owned and foreign-operated firms.

Keywords: FDI, Product Innovation, Process innovation, Manufacturing

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## **Introduction**

Globally, foreign direct investment (FDI) is sought for the potentials it holds in facilitating technology transfers, increasing domestic production, providing employment opportunities and international market networks amongst other things. There has been a steady rise in FDI with increased integration across countries of the world in the last twenty years driven by the dynamic and speedy advances in technological change. According to the 2011 World Investment Report, global FDI flows have been rising even though not at the same rate as the pre-global crisis periods. Specifically, it rose to \$1.24 trillion in 2010 about 15 per cent below the pre-crisis average. On the other hand, global industrial output and trade has resumed to the pre-crisis levels. While FDI inflows to developed countries continue to nosedive phenomenally, developing and transition economies together attracted more than half of global FDI flows; with their outward FDI (mostly directed towards other countries in the south) also rising to heights. (Gachino, 2007; UNCTAD, 2011)

Some of the poorest regions of the world continued to experience declines in FDI flows. On the average, while flows to Africa, least developed countries, landlocked developing countries, Small Island developing States and South Asia fell, East Asia, South-East Asia and Latin America experienced strong growth in FDI inflows. The operations of MNCs worldwide generated value added of approximately \$16trillion in 2010; accounting for one-quarter of global GDP. The foreign affiliates of MNCs accounted for over 10 per cent of global GDP and one-third of global exports. FDI flows to *Africa* fell by 9 per cent in 2010. At \$55 billion, the share of Africa in total global FDI inflows was 4.4 per cent in 2010, down from 5.1 per cent in 2009. Notably however, FDI to the primary sector, especially in the oil industry, continues to dominate FDI flows to the continent. This accounted for the rise of Ghana as a major host country and for the declines of inflows to Angola and Nigeria. The political uprisings in northern Africa (Arab springs) and the uncertainties in Nigeria on the petroleum industry bill and political crisis in the Niger Delta served as inhibitions to foreign investors. On the relationship within countries in Africa, there is some evidence of how regional FDI is generating positive developments to the host countries. For instance, foreign investments in agriculture are serving to regenerate the state of agriculture in Zambia. Other countries provide incentives in order to attract such regional

foreign investment in agriculture, services, as well as the banking and finance industry. (UNCTAD, 2011)

Generally, the low technological capacity of most developing countries causes them to have a low potential for innovation and development compared to the rest of the world. Hence, since foreign owned firms are presumably the most equipped technologically, most studies are optimistic on the potential spillover effects associated with the presence of FDI in the long term and short term. With the increased globalization of trade and investment, FDI is believed to bring positive spillovers to domestic firms in the recipient country. The thinking back of this is that since most of these transnational corporations (TNCs) possess skills and knowhow and operate at the highest technological levels, their presence may facilitate the transmission of technological knowledge, managerial skills, competences and business know-how. Such transfer of technical knowledge and business skills may lead to ripples of productivity gains in the operations and output of domestic firms. (Marcin, 2008; Romer, 1993; Bloomstrom and Kokko, 1998; Jensen, 2004).

The crucial role of innovation in development is evident in the experiences of the South East Asian and emerging economies which demonstrate the advantage of combining small business growth with innovation in production systems; these present lessons for developing countries. In essence, the presence of foreign-owned firms (TNCs), which are sources of new technology and intangible assets (such as technological know-how, managerial and marketing skills, export contacts, long standing reputation), impacts domestic firms by causing a change in their productivity levels, leading to technology spillovers. For instance, during its early stages of industrial development, Singapore, following the transformation of industrial policies around 1985-1990, experienced significant increase in the TFP growth rates. The technology infrastructure which supports innovation and an institutional framework that encouraged cooperation among government, labour and business were employed as key strategies of growth in Singapore. Singapore also highly attracted foreign skills and promoted the internationalisation of her local companies through domestic and foreign investment. Consequently, the country as with other Asian Tigers laid the foundation for technological progress by using FDI to stimulate long term industrialization. (Akkemik, 2009; Marcin, 2008; Todaro and Smith, 2003)

According to Griffith, Waithe and Craigwell (2008) the endogenous growth model proposes the FDI-led growth situation; noting that within a conducive environment, FDI in conjunction with other factors such as human capital, exports, technology transfer and domestic capital can facilitate economic growth. The experiences of East Asian economies and emerging developing countries (BRICS) provide a strong indication that FDI is a crucial element for constricting narrowing resource gap and accelerating economic growth. This informs the growing scramble for pro-FDI policies across countries, including transition and developing countries.

The recently published <sup>3</sup>World Bank enterprise survey establishment-level data on countries in Africa has scarcely been used to empirically examine the industry-level effect of FDI in Africa. The World Bank enterprise surveys are comparable across world economies as they are conducted with the use of standardized survey instruments and a uniform sampling methodology and minimal measurement errors. The Enterprise surveys on other countries in Asia and Latin Americas have been used by researchers to study how changes in the business environment impacts on firm-level productivity. (Hale and Long, 2006; Sun, 2011 amongst others). In this present study we focus on examining whether the presence of foreign firms influences innovative activities in domestic firms.

Given theoretical models that describe the effect of FDI on the host economy, technology spillover to domestic firms is assumed to be automatic. Consequently, little attention is paid to the relationship that subsists potentially and actively between foreign direct investment entities and domestic ventures. On Africa, relatively little has been done on the impact of FDI on the local firms although several studies have examined the macroeconomic determinants of FDI and the potential effects to the economy. With the use of the World Bank Enterprise Survey Data on Nigeria and Kenya, this present study examines the impact of foreign firm presence on innovation of domestic firms. Our access to this firm-level data on non-oil sectors of the African countries enables us examine how the industry innovation in each country is affected by foreign presence. It is expected that the findings of the paper will provide direction for policy makers in the areas of investment, technology and innovation policy in Africa.

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<sup>3</sup> Available at [www.enterprisesurveys.org](http://www.enterprisesurveys.org)

This study aims to microeconomically examine the effects of FDI on the innovation activities of firms in the manufacturing sector, measured by the introduction of product innovation and process innovation. For this purpose, capacity and innovation variables and a host of other firm level characteristic data are extracted from the World Bank enterprise survey published in 2007 on Kenya and Nigeria. The rest of the paper is structured as follows. In section 2 a brief discussion of the FDI and innovation policy environments of Kenya and Nigeria is presented. Section 3 presents a brief review of existing empirical studies and future directions. In section 4 we discuss the data sources and measurements. The microeconomic model and estimation results are presented in section 5. Section 6 concludes the paper and provides some policy implications.

## **2. FDI and Innovation Policy in Kenya and Nigeria**

Most developing African countries are dependent on foreign direct investment as a source of foreign capital for development and employment. For an instance, the government of Kenya works hard to make the environment conducive for direct foreign investment by providing a growing infrastructural base, facilitating development of human capital, openness to trade and other forms of regional cooperation, providing a viable financial infrastructure and a liberalized economy without exchange or price controls. According to the 2007 ranking of competitiveness Kenya was placed 10<sup>th</sup> over 29 African countries. Even though the country is still characterised “as a factor-driven economy, with high dependence on commodity prices and world economic cycles it is fast being transformed into an innovation-driven economy. In Kenya, skilled labour is playing a greater role in the economy than in time past. The financial sector is also becoming more and more innovative. It is worthy of note that Kenya’s skill mix and human resource base makes Kenya a repository necessary for the achievement of its development agenda. Kenya’s private sector “has increased its ability to harness existing technologies required for its transition to being an innovation-driven economy. Business sophistication, increase goods and labour market efficiency which is Kenya’s experience is been driven by its increased financial sector sophistication. African Development Bank (2008)

Amongst the thrusts of Kenya’s vision 2030 is the macroeconomic stability continued governance reforms, enhanced equity and wealth creation, expansion of economic infrastructure,

science technology and innovation, land reforms and security and public sector reforms. “With over 20 public and private universities, offering both technical and professional education, Kenya has a *strong human resource base*. It also has a number of other institutions providing specialised training in management, science and technology. In combination with the large number of multinational companies and international banks basing their regional headquarters in Nairobi, this has led to the growth of a strong managerial cadre. Tapping the potential of this existing human capital to move the economy from factor driven to increasingly service driven (with greater efficiency and innovation) is an opportunity that needs to be exploited.” (African Development Bank, 2008: pp12)

In its Vision 2030 blueprint diversification of foreign direct investment of Kenya towards a globally competitive and prosperous Kenya is being considered. Recognizing the informal economy as a widespread source of income for the urban and rural, the government proposes to boost innovation in Kenya’s informal economy. On the science, technology and innovation platforms Kenya’s Vision 2030 recognized essence of science, technology and innovation to productivity and efficiency. In the broad framework it also clearly recognizes the critical role played by research and development in accelerating economic development in the emerging developing countries and takes a cue on this. The government of Kenya is thus geared towards engaging resources to promote activities and institutions that will promote scientific research and technical capabilities in the workplace among the working populations as well as among youths. More so Kenya’s goal for 2012 amongst other things centres on creating an interconnected, technologically advanced society with modern information and communication systems driving innovation, growth and social progress having recognized that innovation is the key to international competitiveness

Nigeria’s Vision 20:2020 documents the essence of raising the productivity of the manufacturing industry by encouraging increased involvement of foreign and domestic investment in the economy. “An analysis of the Nigerian manufacturing industry indicates that large firms are responsible for the bulk of non-oil, value added exports. However, small and medium firms make up the bulk of the manufacturing and processing firms. Most of these firms are so small that they are unable to significantly participate in foreign markets. Increasing the volume of

value-added exports can only be achieved by targeting investment in key sub-sectors and creating large firms focused solely on value-added exports. In the light of this, actions will be taken to increase the number of large manufacturing firms in the industry. This will be achieved by creating an enabling environment so that small/medium firms can grow and prosper through increasing direct investment – both domestic and FDI - in the manufacturing industry.”- (National Planning Commission, NPC, 2009)

The fundamental objectives of the Nigerian economic transformation agenda include the achievement of economic diversification, transformation of the structure of exports from primary commodities to processed and manufactured goods and the attainment of high levels of efficiency and productivity, in order to be globally competitive. Process innovation in the manufacturing industries may be labour-saving and job-displacing based on the complexity of the relationship. In a drive to build capacity and innovation, the Nigerian economic transformation blueprint recognizes that capacity building needs to be based on clear and dynamic strategies and policy measures that would foster innovation and entrepreneurship, facilitate the diffusion of Information and Communication Technology (ICT), foster the development of Research and Development and promote worker education and training inter alia. The promotion of business and technology innovation is being driven through the development of incubators. Also, effective linkages formed with local universities and research institutions is being forged to encourage innovation and promote indigenous research and development.

To ascertain a favourable policy environment the Nigerian Investment Promotion Commission (NIPC) serves in removing unnecessary controls and creating an atmosphere of trust and transparency to encourage innovation and entrepreneurship of our businessmen, industrialists and traders; all of which should facilitate the development of Nigeria as a global hub for manufacturing, trading and services. The Commission seeks out and nurture special focus areas which would generate additional employment opportunities. In addition, promoting sustainable development and application of acceptable and profitable technologies through strategic investments in biotechnology research and development to support innovation and economic development is one of the motivations of the NIPC.

In its incentive policy for investment, the NIPC<sup>4</sup> seek to promote MSMEs<sup>5</sup> utilization of modern and appropriate technology and innovations from research and development institutions. This would increase the capacity and diversity of the private sector by providing opportunities for international and local investors and contractors in public infrastructure, encouraging efficiency, innovation, and flexibility at minimum cost. An impact evaluation of such programmes engaged by the government to drive these policies will enable NIPC through investment promotion create more jobs in the economy. The timing of this study is thereby apt as it will in a substantial measure provide a basis for evaluating the performance of the existing policies on innovation in Kenya and Nigeria and the effectiveness of the frameworks for achieving their current national plans.

### 3. **Brief Literature Review**

Technology is transmitted across country borders through international trade, foreign private investments, research and development efforts and so forth. Foreign trade, for instance, has a potential to carry knowledge; in this case imports are crucial in the introduction of foreign technology to domestic production and could also spur on factor productivity. Hence, the degree of openness of a particular country will determine the benefits it can glean from foreign research and development. With the importation of technology, the human capital component aids the adoption of foreign technology and the creation of appropriate domestic technology. There are studies that show empirically that countries tend to record rapid total factor productivity growth the more they import from leading world technology countries. (Coe *et al*, 1997; Coe and Helpman, 1995; Keller, 1998)

The firm-specific advantages that may spur FDI as proposed by Hymer include: access to raw materials; economies of scale; intangible assets such as trade names, patents, superior management skills; reduced transaction costs when replacing an arm's length transaction (a transaction in which the buyers and sellers of a product act independently and have no relationship to each other; each party acts independently in their own self-interest with no pressure from the other party) in the market by an internal firm transaction. Firms will therefore

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<sup>4</sup> See NIPC (2012) for details on policy incentives for investment in Nigeria

<sup>5</sup> Micro, Small and Medium Scale Enterprises



only venture into FDI if the benefits of exploiting firm-specific advantages outweigh the relative costs of their operations abroad. In sum therefore venturing into FDI is a firm-level strategy decision rather than a capital-market financial decision. Dunning recognized the importance of the internalization theory in his eclectic paradigm but asserts that it only provides a partial explanation for FDI flows.

It is widely acknowledged that foreign direct investment (FDI) has played an important role in the economic development of host countries. FDI inflows contribute to physical capital accumulation, help to boost domestic employment, and may increase domestic competition, particularly in the short run. In addition, it is argued that FDI can positively affect domestic industries and firms, where positive spillovers can exist. Thus, testing the technology spillover of FDI empirically has attracted some attention. Foreign firms often have some advantages (usually technological superiority) to offset their disadvantages compared with local firms. These advantages inevitably benefit their local counterparts, either through backward and forward linkage, labour mobility, or a demonstration effect (Blomström and Kokko, 1998).

The empirical findings on the nature of spillovers from foreign direct investment are mixed with some studies noting negative spillovers while others find positive spillovers. Branstetter, 2005; Caves, 1974; Chuang and Lin, 1999; Globerman, 1979; Sinani and Meyer, 2004 find positive technology spillovers from FDI in Australia, Canada, Taiwan, Estonia, and the United States, respectively. Barrios and Strobl, 2002; Barrios, Dimelis, Louri, and Strobl, 2004; Dimelis and Louri, 2004 also found positive spillovers in Spain, Greece, and Ireland, with the scale of spillovers depending on firm-specific characteristics. In contrast, Aitken and Harrison (1999) and Sadik and Bolbol (2001) find negative spillovers from FDI in Venezuela and six Arab countries, respectively. Braconier, Ekholm, and Knarvik (2001) find no evidence of FDI-related research and development (R&D) spillovers in Sweden. Girma, Greenaway, and Wakelin (2001) find no aggregate intra-industry spillovers from FDI in the United Kingdom. In fact, the findings are so mixed that the study by Görg and Strobl (2001) focused on exploring reasons that can be adduced for the mixed results.

In examining the determinants of technology spillovers to host countries, most studies do not extensively examine other determinants of the magnitude of the spillovers such as host country innovation and imitation activities. However, Elmawazini (2010) conducted an investigation on host country innovation and imitation activities, measured by R&D spending as a percentage of GDP, as a main determinant of FDI technology spillovers using U.S. multinational enterprises (MNEs) data from the Bureau of Economic Analysis (BEA). The study thus extracts the technology diffusion effect from other productivity effects of FDI. The results of the panel data regressions indicate that host country spending on R&D has a positive and significant impact on the magnitude of technology spillovers from FDI in 38 developed and developing countries over the period 1966–2000. The study also indicates that government policies encouraging R&D activities may significantly increase the magnitude of technology spillovers from FDI.

Most countries in Europe and other developed countries develop community innovation surveys (CIS) which facilitate the analysis of innovation activities amongst firms. Using published CIS data Castellani and Zanfei (2003) showed for the Italian case that exist significant differences in the productivity and innovation behaviours of manufacturing firms, and noted the role affiliation to MNCs plays in the disparities that exist. Foreign affiliated domestic firms and fully owned foreign firms were more productive, seek technological linkages and collaborations and more likely to invest in product innovation and R&D than non-affiliated domestic counterparts. Even though most activities of affiliated firms relating the product innovation, R&D and technological collaborations are engineered mostly from their headquarter country base and diffused to the affiliates.

There are emerging studies of the empirics of FDI technology spillovers on India, Joseph (2007) and Sasidharan (2007) are two of such studies. Using panel data for the period 1989-2004 Joseph (2007) examined the effects of spillovers from FDI on the productivity performance of Indian manufacturing firms as well as the role of the absorptive capacity of domestic firms in utilizing such spillovers. The study results indicate the presence of positive spillover effects from foreign firms' market presence on increases the productivity of domestic firms. It was observed that there is both a competition effect from the presence of foreign firms and a complementary effect due to backward linkages between domestic firms and foreign firms, where local firms act as

suppliers of raw materials to the foreign firms. The observed vertical effects were the key facilitators of positive spillovers from FDI. The empirical analysis also suggests that greater productivity benefits from both horizontal and backward linkages are associated with high R&D intensity of domestic firms.

Managi and Bwalya (2010) analyzed the nature and occurrence of technology spillovers from foreign to local firms in the manufacturing sectors of Kenya, Tanzania and Zimbabwe. Using similar data based on the World Bank RPED surveys for the period 1993-1995, the authors examined horizontal, vertical and regional technology spillovers in these three countries. In the model developed three productivity spillover variables (horizontal spillover, vertical spillovers and agglomeration spillovers) were included in the conventional Cobb-Douglas production function to study their effects on productivity. A system generalized method of moments (GMM) was employed and the estimator was found to be consistent and efficient. The spillover effects were found to vary across the three countries; however, evidence of intra-industry and inter-industry productivity spillovers were established for Kenya and Zimbabwe. Only the regional spillover variable was found to be positive and significant for Tanzania.

Using a comprehensive firm-level panel data (containing firm-level and labour force information) from the manufacturing sector over the period 1992-1998, Waldkirch and Ofori (2010) examined the effect of foreign presence in manufacturing in Ghana on productivity and wages as well as possible occurrence of spillovers to domestic firms. Employing a recent methodology of the OLS and the system GMM, after controlling for observed and unobserved heterogeneity, the study results indicated that foreign firms in a given sector have a negative effect on the productivity of domestically owned firms, but a positive effect on most foreign-owned firms.

To our knowledge existing literature on the nature of FDI on the Nigerian economy focus mostly on the analysis of macroeconomic determinants of FDI as well as its impact on economic growth. Ayanwale (2009), Okodua (2009), Nwankwo (2006) and Ogunkola and Jerome (2006) are few examples of such studies. For an instance, Nwankwo (2006) carried out an analysis of data over the period 1962-2003 identified the main determinants of FDI inflows to Nigeria; the

study identified presence of natural resources as well as political and economic instability as major determinants of inward FDI to Nigeria. The study by Ogunkola and Jerome (2006) is a comprehensive review of the magnitude, direction and prospects of foreign direct investment in Nigeria.

A few conceptual and policy oriented studies could also be identified in the literature on the technology externalities of FDI for the Nigerian context. Uwaifo and Uddin (2009) merely examined the level of Nigeria's technology dependence, highlighting the causes of technological backwardness and presenting suggestions for developing technological productivity. A policy framework was put forward in Dutse, Okwoli and Kurfi (2011), based on the literature indication that significant technology spillover may occur amongst technologically active subsidiary firms and indigenous firms with high absorptive capabilities. The authors posited that policies in favour of improved technical education, promoting certain and institutional support for enhanced technological capable constitute a formidable and favourable environment for knowledge exchanges.

In an empirical study Yauri (2006) used data from World Bank Manufacturing Survey on Nigeria 2001, to investigate whether or not manufacturing firms benefit from FDI. Out of the total number of firms involved in the Survey, 232 manufacturing firms were covered. Due to nature of the data from the Survey a probit regression was employed. The probit regression model estimated consists of binary outcome variables that captured firm's use of technology, age, size and regional location. The analysis tested the hypothesis that FDI-invested firms do not employ more technology than non-FDI firms in the Survey. Findings revealed that FDI-invested firms employ more technology than non-FDI invested firms. The study however did not test for the presence of inter-industry spillovers of technology. The nature of the research instrument and data used for the investigation apparently placed a limit on the extent of analysis that could be carried out by the author. Similarly a survey sample of 200 small and medium food companies this was carried out in cities in south-western Nigeria to test the absorptive capacity hypothesis (Abereijo and Ilori, 2012). The study provides evidence that supports the notion that the presence of MNCs alone does not guarantee the occurrence of spillovers but more important was the level of absorptive capacity exercised by the domestic local firms.

Based on the foregoing, the importance of favourable institutional frameworks, industrial policy, technology policy and political will on the industrial development of a country has been highlighted from the experience of developed and emerging economies. Also, the role of human resource development in the making of a strong and highly competitive industrial sector is mirrored by the East Asian economic development experience. It is also recognized that there are advantages that accrue to latecomer countries in development and challenges to keep up with the trends of the global market (Oyelaran-Oyeyinka and Sampath, 2010). The emphasis of innovation in industrial development has not come at a better time than this for developing countries to study how to harness the forces of globalization to their advantage; noting that building a strong industrial economy is tantamount to remaining on the competitive edge of the industry. The literature is vast on the economies of South East Asia, new industrializing economies, the industrial countries of Europe and the Americas and relatively few emerging studies on Africa in the last decade. However, literature on the systematic study of the effect of FDI on innovation and technology development in the Nigerian economy has received least concentrated attention as this study proposes to highlight.

#### **4. Data**

Data used in the empirical analysis is the 2007 Productivity and Investment Climate Data (otherwise known as the World Bank Enterprise Survey) conducted by the World Bank. The survey consisted of a series of structured, face-to-face interviews with key senior managers/owners of a sample of establishments. The survey methodology followed a stratified random sampling. Based on the ISIC (revision 3.1) classification, the following industries were targeted: all manufacturing sectors, construction, retail and wholesale services, hotels and restaurants, transport, storage, and communications, and computer and related activities. The firms surveyed were categorized into private domestic and foreign firms, excluding the state-owned enterprises which were not covered in the survey. The survey instrument constitutes information on: sales and export, supplies and imports, capacity and innovation, investment climate constraints, infrastructure and services, conflict resolution and legal environment, business-government relations, labour relations, finance and productivity.

The cross-section data used is drawn from a survey of firms in the Kenyan and Nigerian economy. Four cities of Kenya were covered in the survey- Nairobi, Kisumu, Mombasa and Nakuru with a total of 435 manufacturing firms covered. A total of eleven (11) cities (Abeokuta, Abuja, Awka, Bauchi, Calabar, Enugu, Kaduna, Kano, Lagos, Sokoto and Umuahia), were covered in the survey of industries in Nigeria. For Nigeria a total of 1031 manufacturing establishments were surveyed. In the appendix we show the distribution of the firms by industry and city for both Kenya and Nigeria respectively. For this present study information on firms in the manufacturing sectors alone were extracted. Other information drawn from the survey questionnaires with respect to age, ownership structure, external trade relationships amongst other things were used to define the variables used in the analysis.

## 5. Empirical Model and Results Discussion

Based on existing literature on factors affecting innovation and information drawn from the World Bank Enterprise Survey (2007) we formulate hypotheses to test the interrelationship between innovation and firm-specific characteristics. The dependent variable captures the tendency of firms to engage in product innovation and process innovation, each of this is captured in the binary form (0, 1) where 1 represents engagement in product innovation (or process innovation) and zero otherwise. Amongst other things we test the hypothesis that FDI-invested firms engage in more product innovation or process innovation than non-FDI invested firms.

A logistic regression analysis was therefore expressed as:

$$INN_i = LN \frac{p_j}{1-p_j} = \delta_0 + \delta_1 X_{1j} + \delta_2 X_{2j} + \dots + \delta_n X_{nj} + \epsilon_j \quad (1)$$

where  $INN_i$  ( $i=1,2$ ) is the log of odds ratio of either engaging in product innovation ( $i=1$ ) or of engaging in process innovation ( $i=2$ ); while the  $X$ 's are the various explanatory variables.  $\delta_0$  is the intercept while other  $\delta$ s are the multiple regression coefficient (i.e., the expected change in  $INN$  per unit change in  $X$  assuming that all other  $X$ s are held constant. In this context, the logistic regression model,  $INN$  is the conditional probability of the form  $P \left\{ INN = \frac{p}{1-p} \right\}$  that shows the innovation activity as predicted by combinations of values of predictor variables. The analysis of

data was carried out with the Statistical Package for Social Sciences (SPSS) software. The hypothesis formulated tested the interrelationship between firm characteristics and the innovation activities engaged in. The dependent variable is measured as a dichotomous metric variable. In eliciting all these, questions related to innovation activities of firms were analysed. The predictors constitute selected control information and firm level characteristics.

Firm level control characteristics examined in the analysis include: age of firm, whether FDI-invested or not, technology level of the firm (low tech and high tech), supplies of intermediate product, ICT usage, engagement in training, firm's exporting activity, possession of internationally recognized quality certifications. Others include usage of technology licensed from a foreign company, location of firm, level of competition reported in the market and membership of a global production network. Based on the forgoing discussion, the following regression model is specified for the empirical analysis:

$$INN_i = \delta_0 + \delta_1 A_i + \delta_2 E_i + \delta_3 ICT_i + \delta_4 TL_i + \delta_5 L_i + \delta_6 SUB_i + \delta_7 HT_i + \delta_8 Q_i + \delta_9 PB_i + \delta_{10} FC_i + \mu_i \quad (2)$$

where  $INN$  constitutes  $PD$  (a dummy that measures whether the firm introduced new or significantly improved products in the last three years) and  $PC$  (a measure of whether the firm introduced new or significantly improved production processes within the last three years of operation).

$A$  is a numeric variable showing the age of the firm as at 2007.

$E$  is a binary variable (1, 0) measuring the direct exporting activity of the firm.

The binary  $ICT$  (1, 0) captures the usage of information communication technologies in the course of business operations.

$TL$  (1, 0) measures the possession of technology licensed from foreign company.

$L$  whether the firm is located in an industrial zone or export processing zone.

$SUB$  is a binary variable (1, 0) that describes whether the firms is part of a multinational firm; a subsidiary of a foreign company or a jointly-owned enterprise.

$HT$  (1, 0) measures whether the firm is in a high technology utilizing manufacturing sector or not

$Q$  measures (1, 0) whether or not firm possess of internationally recognized quality certification.

In order to capture learning via supply linkages  $PB$  (1, 0) indicates whether or not the firm's

principal customer is a foreign subsidiary related to the principal customer of the firm's goods is asked Principal buyer is a multinational firm.

*FC* (1, 0) measures whether firm's innovation activity is provoked by the intensity of foreign competition.

The descriptive statistics for the firm-specific variables used in the analysis is presented in the appendix. The impact of foreign competition and domestic competition on product or service innovation is also captured in the data. To capture learning via supply linkages questions related to the principal customer of the firm's goods is analysed. A firm whose principal buyer is a large multinational firm with more than 100 employees is more likely to seek improvement in product or service delivery than those with lower cadre of customers. Whether or not manufacturing firms are partly owned by foreigners is also captured in the analysis.

Table 1 shows the logistic regression result for the interrelationship between process innovation activity of Nigerian manufacturing firms and selected firm-level characteristics. The coefficient of each of the predictor variables shows the influence of each variable on the probability of engaging in process innovation (or product innovation). On the whole the model explained of the variance in the probability of engaging in innovation and correctly specified 62.6% of the cases.

Table 1: Logistic Regression Illustrating the Interrelationship between Process Innovation Activity and Selected Firm Characteristics

Firm characteristics	B	S.E.	Wald	df	Sig.	Exp(B)
Age	0.012	0.009	1.639	1	0.200	1.012
Foreign competition	0.601	0.214	7.868	1	0.005	1.825
Q, International Quality	-1.326	0.397	11.167	1	0.001	.266
TL, licensed	-0.312	0.302	1.066	1	0.302	.732
Exports	-0.460	0.630	0.535	1	0.465	.631
Hightech	0.210	0.334	0.396	1	0.529	1.234
L, location	-0.471	0.239	3.893	1	0.048	.624
ICT use	-0.452	0.175	6.670	1	0.010	.637
Subsidiary	-1.073	0.269	15.907	1	0.000	.342
Principal buyer	0.829	0.625	1.758	1	0.185	2.291
Constant	2.046	0.903	5.130	1	0.024	7.735

Overall percentage = 62.6%  
-2Log likelihood = 1331.571      Cox & Snell R Square = 0.089      Nagelkerke R Square = 0.118

The regression results show that age of the firm, intensity of foreign competition, firms in high technology manufacturing sectors, status of firm's principal buyer are positively related to the



occurrence of process innovation. When process innovation is observed the firm has introduced a new or significantly improved production process including methods of supplying services and ways of delivering products within the last years from the reference year. Possession of international quality standards, technology licensed from foreign firms, use of ICT are negatively related to occurrence of process innovations. Further, firms whose principal customers are large firms are 2.291 times more likely to engage in process innovations than firms serving lower cadre of customers. Firms in the high technology industries are 1.234 times more likely to engage in process innovations than other firms in low technology manufacturing sectors. The reality of foreign competition propels firms to improve their production processes hence the quality of their output. Possession of internationally recognized quality certifications, intensity of foreign competition, nature of the firm (whether it is a subsidiary of a multinational or not) are significant factors in determining the extent of process innovation among Nigerian manufacturing firms.

Table 2 shows the logistic regression result of the interrelationship between product innovation activity of Nigerian manufacturing firms and selected firm-level characteristics. Introduction of new or significantly improved products in Nigeria's manufacturing sector is positively related with the age of the firm, foreign competition, the status of the principal buyer of the firm's output, Export orientation of the firms, level of technology employed by firm. (see table 2)

Table 2: Logistic Regression Illustrating the Interrelationship between Product Innovation Activity and Selected Firm Characteristics

Firm characteristics	B	S.E.	Wald	df	Sig.	Exp(B)
Age	0.014	0.009	2.228	1	0.136	1.014
Foreign competition	0.411	0.214	3.697	1	0.055	1.508
Q, International Quality	-0.805	0.402	4.006	1	0.045	0.447
TL, licensed	-0.839	0.321	6.848	1	0.009	0.432
Exports	0.068	0.608	0.013	1	0.91	1.071
Hightech	0.008	0.348	0.000	1	0.983	1.008
L, location	-0.821	0.252	10.591	1	0.001	0.44
ICT use	-0.802	0.18	19.854	1	0.000	0.449
Subsidiary	-0.912	0.269	11.495	1	0.001	0.402
Principal buyer	0.986	0.62	2.533	1	0.111	2.681
Constant	2.2	0.891	6.103	1	0.013	9.027
Overall percentage = 64.2%						
-2Log likelihood = 1310.936		Cox & Snell R Square = 0.107		Nagelkerke R Square = 0.143		

Nigerian manufacturing firms whose principal buyer is a large firm are 2.681 times more likely to engage in product innovation. It would suffice to state here based on the logistic regression result in Table that firm's age, intensity of foreign competition, international quality certifications, export activity of firm, level of technology employed and the status of the principal customer of the firm are all positively related to the occurrence of product innovation of the firms in the manufacturing sector in the last three years. The more intense the foreign competition the more likely it will be for the Nigerian manufacturing firm to produce new and improved products.

Table 3 presents the logistic regression result of the interrelationship between process innovation activity of Kenyan manufacturing firms and selected firm-level characteristics. It is observed that possession of internationally recognized quality certifications, technology licensed from foreign company, export activity, technology level of the firm, location of the firm in an industrial zone, use of ICT and the status of the principal buyer of the company's product are positively linked with the occurrence of process innovation activity (see table 3). It is thus evident that firms with international quality certifications will be 7.338 times more likely to improve their production processes than other firms. In a similar vein, firms whose principal customers are large firms and who engage ICT are 2.124 and 4.047 times respectively more likely to process innovate than other firms. However, subsidiaries of foreign firms are less likely to introduce new or improved production processes than counterpart firms.

Table 3: Logistic Regression Illustrating the Interrelationship between Process Innovation Activity and Selected Firm Characteristics of Kenya Manufacturing

Firm characteristics	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-0.012	0.008	2.484	1	0.115	0.988
Q, International Quality	1.993	0.498	15.993	1	0.000	7.338
TL, licensed	0.217	0.388	0.312	1	0.576	1.242
Exports	0.079	0.275	0.083	1	0.774	1.082
Hightech	0.361	0.466	0.6	1	0.438	1.435
L, location	0.137	0.242	0.32	1	0.572	1.147
ICT use	1.398	0.257	29.61	1	0.000	4.047
Subsidiary	-0.221	0.348	0.404	1	0.525	0.802
Principal buyer	0.753	0.331	5.176	1	0.023	2.124
Constant	-0.72	0.206	12.169	1	0.000	0.487
Overall percentage = 71.7%						
-2Log likelihood = 511.350		Cox & Snell R Square = 0.21		Nagelkerke R Square = 0.282		

Table 4 presents the logistic regression result of the interrelationship between product innovation activity of Kenyan manufacturing firms and selected firm-level characteristics. The foreign competition indicator was excluded from the variables of interest in the Kenya analysis text above. Furthermore, Kenyan manufacturing firms with internationally recognized quality certifications are 4.294 times more likely to introduce new products (See table 4). Firms who make use of information communication technologies such as email and firm website can reach out to more customers for feedback and inputs into new customer requirements and therefore bring about innovations in products. In any case firms who use ICT and whose principal buyer is a large firm are 3.526 and 3.436 times respectively more likely to generate product innovations than other firms.

Table 4: Logistic Regression Illustrating the Interrelationship between Product Innovation Activity and Selected Firm Characteristics of Kenyan Manufacturing

Firm characteristics	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-0.012	0.008	2.633	1	0.105	0.988
Q, International Quality	1.457	0.443	10.803	1	0.001	4.294
TL, licensed	-0.243	0.379	0.41	1	0.522	0.784
Exports	0.272	0.281	0.938	1	0.333	1.312
Hightech	0.134	0.465	0.083	1	0.773	1.144
L, location	0.259	0.243	1.13	1	0.288	1.295
ICT use	1.26	0.255	24.465	1	0.000	3.526
Subsidiary	-0.478	0.347	1.899	1	0.168	0.62
Principal buyer	1.234	0.363	11.577	1	0.001	3.436
Constant	-0.494	0.201	6.017	1	0.014	0.61

Overall percentage = 70.2%  
-2Log likelihood = 512.658      Cox & Snell R Square = 0.188      Nagelkerke R Square = 0.255

Overall, the model summary indicates accuracy level of 70.2 percent. However, the association between the dependent variable and the predictor variables is indicated by Cox & Snell R Square of 0.188 and Nagelkerke R Square of 0.255. Additional information provided in the Kenyan survey indicate that being part of a global network of production, access to information on new technological improvements as well as acquisition of technology innovation are key determinants of process innovation and product innovation in Kenyan manufacturing firms.

## 7. Concluding Comments and Policy Implications

It is widely acknowledged based on the experience of developed and emerging developing countries that the extent of innovativeness could increase the productivity of domestic firms and lengthen their survival rate in the competitive business environment. Also, paradigm shifts from

producer innovation to inclusive innovation and user innovation, hold that in the ultimate development itself must become more inclusive. Actions have proceeded from developing countries in response to the dire inadequacies in the availability of infrastructure, knowledge skills and development resources. This is seen in the equivocations for foreign direct investment promotion policies in conjunction with other domestic resource mobilization efforts. How necessary is foreign direct investment in ensuring inclusive development which would involve inputs from domestic firms to generate more output solutions and technological development in the economy? With the use of innovation indicators for firms provided in the World Bank Enterprise Surveys, we examined the innovative activity of firms in the manufacturing sectors of Kenya and Nigeria.

This study examined the key firm level characteristics that influence innovative activities of manufacturing firms of Nigeria and Kenya. Concomitant to existing literature, firms who relate with multinationals and foreign-owned companies via supply linkages tend to enjoy some knowledge spillover effects. This is owing to the high quality requirements such multinational corporations place on supplier firms. This in turn could influence the firm's impetus to introduce new and improved means of production. With the widespread use of information and communication technologies, firms can also get feedback from their customers irrespective of their geographical location. An effective feedback system would engender more inclusive product innovations that will suit customer requirements and anticipated wants.

We conclude from our estimation results that subsidiaries of multinational firms more likely engage in product innovation in the Nigerian manufacturing sector. Also, engaging ICT (for example use of email and website) to either showcase products, services or to receive feedback from a wide range of customers is crucial for product innovation. Location of firms in industrial zones is also important for product innovation and this can be explained by the contagion effect of the industrial environment, economies of clustering and the infrastructural facilities that accrue to industrial residents of such zones. Technology licensing, a means of technology transfer, was also observed to be a crucial determinant of product innovation in manufacturing firms in the Nigerian cities covered in the survey. ICT usage, the status of the principal customer of the firm's output and possession of internationally recognized quality certifications were the

more crucial factors for product innovation in the Kenyan cities used for the survey. For both Kenya and Nigeria, process innovation is mostly influenced by the intensity of foreign competition, international quality certification, ICT usage as well as the ownership status of the firm (whether or not it is a part of a multinational firm).

The export behaviour of firms in both Kenya and Nigeria had no significant effects on their likelihood to engage in product or process innovation. This implies that most local manufacturing firms produce goods with a focus on meeting domestic market demands rather than seeking to expand export markets. However, studies such as Rettab, Rao and Charif (2009) recognized with substantive evidence that a firm's openness to the external economy does influence innovation intensity. This can be explained by the fact that expanding capacity to produce for the external context keeps the firm abreast of the latest developments, current production trends, greater capacity to meet growing customer requirements as well as maintaining the competitive edge in the sector.

As we approach the lapse period for the millennium development goals, the new focus is on innovation and inclusive development. Thus, only diagnostic and innovative thinking will be the key to driving development agenda in the world and especially for developing countries. The emerging performances recorded by emerging developing countries (EDCs) of which the BRICS presents lessons for other developing countries in Africa. Therefore, even though creating incentives to attraction of foreign direct investment to the continent is important. Greater emphasis should be placed on promoting firm level practices that will aid spillovers of knowledge, technology and managerial skills to local firms from the MNCs in the domestic economy. It is via such learning experiences that domestic firms can take on advanced techniques and management practices employed by foreign-owned and operated firms.

In conclusion, does the presence of foreign owned firms assure the economy of new production techniques, greater investment in domestic innovation, research and development activities; skills and training in entrepreneurship, management and marketing? The estimation results of this study indicated that an improvement in domestic firm product and processes owing to the presence of foreign firms in the sector within which it operates is not automatic. Thus, bringing

to fore the importance of the interactions with foreign firms in the form of supply linkages, use of ICT, adopting technology licensed from foreign companies which would attract opportunities for formal staff training in current technology trends. This is crucial as improved skills and competence building systems are of utmost relevance to ensuring a more inclusive global economy. To monitor the impact evaluation of such FDI promoting policies in the domestic economy, therefore, governments of developing countries are encouraged to engage in collecting periodical community innovation surveys (CIS). The availability of such community innovation surveys will provide the efficient evaluation of national systems of innovation and their attendant impact of firm-level productivity can be observed. CIS are already been utilized by developed countries as a veritable tool for policy analysis and formulation.

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## Appendix I

Table 1a: Distribution of Firms by City and Industry: Kenya

City	Type of industry					Total
	Manufacturing	Retail	IT	Construction and Transport	Hotel and other services	
Kisumu	56	26	3	4	17	106
Mombasa	55	26	4	4	18	107
Nairobi	297	78	15	11	65	466
Nakuru	45	31	3	5	18	102
<b>Total= 4</b>	<b>453</b>	<b>161</b>	<b>25</b>	<b>24</b>	<b>118</b>	<b>781</b>

**Source: World Bank Enterprise Surveys (2007)**

Table 1b: Distribution of Firms by City and Industry: Nigeria

Cities	Industry					Total
	Manufacturing	Retail	IT	Construction and Transport	Hotel and other services	
Abeokuta	121	74	6	0	56	257
Abuja	74	48	7	2	33	164
Awka	65	77	11	1	35	189
Bauchi	70	40	0	0	24	134
Calabar	82	65	15	8	50	220
Enugu	78	77	14	9	44	222
Kaduna	112	74	9	2	38	235
Kano	128	86	2	2	42	260
Lagos	182	116	11	19	75	403
Sokoto	57	32	0	2	15	106
Umuahia	62	74	14	9	38	197
<b>Total = 11</b>	<b>1031</b>	<b>763</b>	<b>89</b>	<b>54</b>	<b>450</b>	<b>2387</b>

**Source: World Bank Enterprise Surveys (2007)**

Table 2: Classification of Manufacturing Firms by Level of Technology Employed (Waheed, 2012)

High Technology Industries	Low Technology Industries
Chemicals	Food
Electronics	Garments
Machinery & equipment	Textiles
	non-metallic minerals
	Wood, wood products & furniture
	Metal and Metal Products
	Other Manufacturing

## Appendix II

### Descriptive Statistics on Variables: Nigeria

Variables	Minimum	Maximum	Mean	Std. Deviation
Process innovation PC	0	1	0.489	0.500
Produc Innovation PD	0	1	0.498	0.500
Firm's age in 2007, A	0	59	10.277	7.446
Subsidiary, SUB	0	1	0.093	0.291
Principal customer is large firm,PB	0	1	0.031	0.247
ict usage, ICT	0	1	0.210	0.407
Location in Izone, L	0	1	0.111	0.314
High tech, HT	0	1	0.053	0.225
Direct Exports E	0	1	0.019	0.138
Technology Licensed TL	0	1	0.087	0.282
Quality Certification Q	0	1	0.075	0.263
Foreign Competition FC	0	1	0.485	1.306

### Descriptive Statistics on Variables: Kenya

Variables	Minimum	Maximum	Mean	Std. Deviation
Process innovation PC	0	1	0.574	0.495
Produc Innovation PD	0	1	0.607	0.489
Firm's age in 2007, A	1	87	21.033	15.553
Subsidiary, SUB	0	1	0.139	0.346
Principal customer is large firm,PB	0	1	0.358	0.767
ict usage, ICT	0	1	0.631	0.483
Location in Izone, L	0	1	0.422	0.494
High tech, HT	0	1	0.082	0.274
Direct Exports E	0	1	0.322	0.468
Technology Licensed TL	0	1	0.126	0.332
Quality Certification Q	0	1	0.148	0.355