Enterprise Innovation in Nigeria: Do Geographic Locationand Enterprise Size really matter?

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Abstract
The aim of this study is to investigate the relevant determinants of firm-level innovation across the Nigerian enterprises and questions whether geographic location, enterprise, and other enterprise attributes do matter have any significant impacts on three streams of innovation measures, product, process and all-inclusive innovation in Nigeria. Using the 2014 Enterprise Survey (ES) conducted by the World Bank and probit econometric model, results obtained indeed depicts that firm's size – whether micro, small, medium or large and firm's location whether located in the North-central, North-west, North-East, South-west, South-east and South-south do matter in determining the product, process, and all-inclusive innovation in Nigeria. Based on the econometric evidences, we affirms that (i.) there are relationship between size of business and level of innovation (ii) there is a relationship between location of business and level of innovation (iii) there are relationship between owners and business characteristics and level of innovation.
Keywords: *Innovation, Product and Process, Probit, Size, Location, Nigeria.*

I. Introduction

The 9th Goal within the Sustainable Development Goals (SDGs) framework is built on promoting industrialization and fostering innovation for development. The relevant role of innovation in shaping the dynamics of business and socioeconomic development is notdebatable (Edwards-Schechter 2018). According to Oslo Manual (OECD/Eurostat, 2005), the concept of innovation relates to the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. It relates to the various input, output and processes used in production process. This implies that the principal factor that can differentiate small and medium enterprises (SMEs) from other enterprise performance levels is innovation (Chen and Lau 1993; Plotnikova et al 2016). Despite this apparent definition, there are still significant research gaps on the determinants of innovation amongst enterprises, and as a result leading to paucity of relevant strategy related to Small and Medium Enterprises (SMEs) on effective and efficient means of promoting innovative ideas (Hall and Rosenberg 2010; Aksoy 2017). Theconsensus as to why enterprises choose to innovate is still very limited especially in developing countries (Aksoy 2017).This paper sheds some light on innovation amongst enterprises in Nigeria and the significant roles of organizational characteristics and macroeconomic geographic location have on innovative behavior.

The aim of this study is to investigate the relevant determinants of firm-level innovation across the Nigerian enterprises and questions whether geographic location, enterprise, and other enterprise attributes do matter have any significant impacts on three streams of innovation measures, product, process and all-inclusive innovation in Nigeria. Nigeria is rated as the most populous country in Africa (World Bank 2017) and incidentally the world's poorest (World Data Lab 2018). Nigeria has been characterized as being heterogeneous in nature (Guven-Lisaniler et al 2018) with diverse solid and minerals resources from different regions contributing to the growth of any businesses. Within the Schumpeterian innovation ideology (Schumpeter 1934), the history of innovation in Nigeria can be traced production efficiency in Coco plantation (Berry 1974).The 2017 – 2018 Global Competitiveness Report (World Economic Forum Report 2018 reports that Nigeria – despite having a large market size when compared to others sub-Saharan African countries is relatively deficient in infrastructural and institutional base for growth. Even though the Nigerian economy as a whole has largely benefitted from business activities across the regions, the relevance of business attributes on innovation is still limited. Most of these limitations are credited to narrow measurement of innovation such as

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patent rights, finance in research and development or computer aided production systems. However, studies have shown that innovation involves several dimensions such as imitation of an existing product, and an improvement of production and marketing processes are also to be considered as innovation measures (Acemoglu et al 2006; Aksoy 2017; Ayyagari et al 2011). This implies that a further enquiry on the determinants of product and process innovation amongst the Nigerian enterprises is imminent.

The paper is organized as follows. Section 2 presents the conceptual framework and literature reviews related to regional and firms size effects on innovation. Data and research methodology are presented in section 3. Sections 4 and 5 provide the descriptive/econometricevidences and summary of findings respectively.

2.1 Conceptual Framework

Defining innovation have been inconclusive in the literature and proven indecisive as scholars have not been able to reach a specific definition to innovation concept (D'Wan, 2005). According to Organization for Economic and Community Development (OECD), the concept of innovation is perceived as the application of production and distribution process coupled with most recent revamped marketing features (Oslo Manual, 2003). This definition was further broaden as presented in the third edition of Oslo Manual incorporating advanced organizational technique in running business or outer affairs related to the organization (OECD, 2005). Perceiving innovation as the transformation, OECD's definition also include renovation and design technique needed to satisfy consumer and producer's utility (Doc, 2008).

Argument related to the perspective to which innovation is been perceived by various discipline arose among scholars. In the construction industry, Yusof et al. (2010) conceded construction firms' innovation to be proposed so as to handle rising obstacle with regards variation in clients demand, maintenance of serene environmental act and improved principle, technological advancement, rising competition among other threat the industry encounter. Thornhill (2006) and Craighead, Holt & ketchen (2009) viewed innovation idea as an essential action undertaken that mostly yield more valuable and reasonable execution of activities. In the same vein, Hilmi and Ramaya (2008) were able to deduce that improving an organization achievement and obtaining a reasonable edge over other organization can be obtained through proper administration of firms assets coupled with enhancing the level of innovative execution. Complementing the active debates on innovation concept, a firm can achieve a height of reasonable outcome in her activities through her innovation strength (Calanstone, Cavusgil & Zaho, 2002). In other words, innovation create avenue for firms to earn an advantage over others in their dealings relevant to the firms prolonged existence and expansion (Roxas et al, 2013; Hult et al, 2004; Salavou, 2004; Knight and Cavusail, 2004; Desphande et al, 1993; and Damanpour, 1999).

2.2. Influence of process and Product Innovation on firms

Firms need to develop new products, at least on occasion, to gain competitive advantage. The rate at which they are capable to develop these new products has been linked to performance and long-term survival (e.g., Soni et al., 1993; Banbury and Mitchell, 1995). This is also true for small firms as it is for large ones (De Jong, Vermeulen and O'Shaughnessy, 2004). Chris Freeman, one of the authorities in innovation research, even states that 'not to innovate is to die' (Freeman and Soete, 1997). A wide variety of scholars has studied and extensively documented the success factors of product innovation in small firms, resulting in a plethora of literature suggesting product, firm, market and innovation process characteristics as determinants of product innovation (e.g., Acs and Audretsch, 1988, 1990; Hyvärinen, 1990; Kim et al., 1993; Brouwer and Kleinknecht, 1996; Hadjimanolis, 2000; Freel, 2003; Rogers, 2004).

Process Innovation as reviewed by Tirone (1988) opined the activity to be related to action taken aimed at cutting down the average cost of production incurred for a prevailing product. For example, the innovation technique adopted by the ford company (automobile specialty) in assembly lines can be pointed as classical example for a process innovation, likewise a managerial changes that requires employees or workers suggestion for cost-cutting technique can also be classified under the process innovation action. Following the above perception process innovation can be commonly associated and will decline cost of production.

A different view from Cohen & Klepper (1996) have been able to report the replacement factor that exist between exist between existing and new product with the help of the product Innovation technique. An existing enterprise will establish a room for thriving competition for her product in a situation where a new or more advanced product is been discovered. Studies like Arrow (1962) Tirole (1988) among others have been able to identify the replacement factor between existing and new product to result in "Innovative damage". From recent happenings, it can be noted that there are many product upgraded version that have been invented to serve as close substitute to prevailing brand (product) with common reference to digital, cameras, detergent, beverages among others. There is opportunity for a firm to expand her variety standard popularly referred to as new brand (Product) to still gain their customer loyalty and to match the existing product concurrently in order to model her price-quality merger as a way of classifying customers based on their different preference of demand related with the quality variety. Hence can avenue for the firm to relatively act bias and earn more

profit (Musa & Rosen, 1978).

2.3. The Location of a Firm and Innovation

The location of a firm or the region in which it operates is advantageous but this is subjected to the size of the firm and the form of business engaged in (Adeleke et al., 2017). Borje, Johansseon and Hansloof (2008) using information collected from two thousand and ninety four (2094) firms and the application of the novel dataset to check for the impact of location against variables of firm attributes found out that when factors such as the intensity of physical capital, the industry, market extension, the size of the firm and composition of skill are controlled, the intensity of research and development and the number of interactions in both the vertical and horizontal systems of innovation are not affected by the location of the firm.

An advantage attached to the clustering of firms is the capacity of firms in such environment to be able to achieve greater innovations and also make use of the innovations to achieve economic growth (Porter 2000). According to the theory of the Evolutionists (the theory of innovation systems on which the regional systems of innovation base itself), the economic performance of a firm is not only subjected to its own individual efforts but also, to external factors that give rise to an environment that is prone to innovation and economic growth (Dossi, 1988). The ability of a territory to innovate is dependent on variables such as the inter-organization network, education and training systems, the structure of governance, policies pertaining to innovation, institutions(legal and financial) and so on (Lmmarino,2005). The ability of a firm therefore to be able to innovate and also grow is seen to be very much dependent on the availability of the local or regional innovation systems.

Borje Johansson and Hans Loof (2006) reveal that a firm's location should be of great importance due to the reason been that the resource availability in terms of knowledge and flow of knowledge differs from one region to another. The conglomeration of firms that belong to a firm and the economies of localization of an innovative environment are seen to be one of the two views regarding how the functional region impacts the options available to firms within the region in terms of innovation. The view stated above is also termed as the Marshall-Arrow-Romer externality which places emphasis on the flow of knowledge within an industry (Glaeser et al, 1992). The Jacob externality which is the second view is of the assumption that innovation activities are basically determined by different knowledge flows between industries and this takes into cognition spillovers (Jacob, 1984). The Jacob's view references the urbanization economies which imply that activities of innovation are triggered most especially by the environment and the systems of innovation that exists in the metropolitan regions. A regions which encloses different industry clusters that would lead to urban regions been of greater advantage is termed Metropolitan region (Capello, 2002).

2.4 Innovation and the Size of a Firm

According to Roxas et al. (2013), the size of an organization is described as the staff strength which is the number of workers in an organization in total. Musa Abdu &Adamu J. (2017) looking into factors that determine the innovation of firms considering Nigeria as a country with analytical employment of the probit and tobit models of regression using data sourced from the World Bank(Enterprise Survey Data), the findings of the study reveals that investment in the size of a firm, training of workers formally, research and development, the location of the firm, type and sector of the firm, competitors and the exporting status of the firm all have positive influences on the inclination of a firm towards innovation. However, factors such as the age of the firm and the education of workers according to the study findings affect negatively the innovative chances of the firm. More specifically, a firm's investment in research and development, the size of the firm, formal training, sector and type among other factors were found to determine the product, marketing, organizational and process innovation of such firms significantly. Therefore, the study suggests that these factors (R&D, the firm's size, formal training, type and sector) should be the main focus of the firms relating to innovation.

The firm's size has been proven to be one of the factors that also influence the innovative actions of a firm. For firms in Poland, studies such as Belsowics and Jacubiak (2009) reveal that the innovative activities of firms are not significantly influenced by their size, sector and structure. Also, capital intensity and the concentration of the market were found to affect significantly the capacity of firms to innovate. In line with this, using data extracted from business longitudinal survey done on the economy of Australia, factors such as the intensity of Research and Development, the structure of the market, shares of trade and size were to technological firms favorable.

Mohammed, A. Y. et al. (2014) in their research work to determine the influence factors such as the firm size, the age of the firm and sector have on the firm's behavior as pertain to innovation studying Consultancy Services Organization in developing countries with the use of multiple regression analysis run from the primary data collected from Nigerian Construction Consultancy firms, is of the conclusion that only the firm size has a positive and significant influence on the innovative activities of consultancy firms in Nigeria while the age of the firm and the sector to which the firm belongs have insignificantly negative impact on the

innovation practices of the consultancy firms in Nigeria.

However, empirical inconsistency as to the impact a firm's size has on its innovative capacity and activities abound. While Frambbach and Schilleweart (2002) states that the size of a firm influences its tendency to embrace innovation as revealed in large firms where strong structures, workers of high quality and their investment in research and development are regarded as factors that importantly control the readiness of a firm to adopt innovation, Yusuf et al. (2011) however opines that for small firms, the flexibility of their structure, specialization and ties that are strong with their customers are factors that influence their innovation. The non-unified empirical findings stem from not only the different innovation measurements applied as seen in Gunner et al. (1997) and Le Bars et al. (1998) but also, the different sampling methods employed (Clarysseet, 1998 and Inndvall, 1992). This is said to be as a result of the fact that researchers source data across industries with the aim of reaching a generalized conclusion other than taking a look at patterns of innovation that are specific to industries. Due to this and in order to avoid skepticism, the firm size distribution are not included in the analyses (Inndvall,1992 and Clarysset,1998) or are seen as control variables as used in the research work of Becheikh et al(2006).

III. Empirical Analysis

3.1 The Data

The primary focus of this research is on the Nigerian enterprises and their antecedents related to innovativeness. We make use of the 2014 Enterprise Survey (ES) conducted by the World Bank. The ES is a rich collection of comprehensive firm-level data in across the developing and emerging economies. The survey's data collection was carried out with an aim to of obtaining feedbacks on nature of private enterprises including factors affecting the business environment over time. The Enterprise Surveys gather a wide range of subjective and quantitative data across firms including gender, finance, business infrastructure, corruption, innovation, firm performance ratings and formality. In this research, we use the Nigerian equivalent of the survey based on its rich and streamlined data collection methodologies and ample information related to innovations. The sample collection was random sampling where three dimensions of stratification were utilized by industry, region and size. Industrial stratifications classified across firm types which are manufacturing or service oriented segments (retail and other services). The manufacturing stratification including firms producing goods such as beverage and food, clothing, metal works non-metallic mineral items, furniture, distributing, and other manufacturing. The data was captured across 19 states out of the 36 states in Nigeria. Such states cut across all the 6 Six geo-political zones of Nigeria: Abia, Abuja, Anambra, Cross River, Enugu, Gombe, Jigawa, Kaduna, Kano, Katsina, Kebbi, Kwara, Lagos, Nasarawa, Niger, Ogun, Oyo, Sokoto, Zamfara. Since, the study captured different states; we have categorized these states according the Nigerian geopolitical zonal classifications such North-Central, North-East, North-West, South-East, South-South and South-West. However, in the North-East, only Gombe State was surveyed, this indeed is a limitation of the study as mentioned earlier. These zones are known for their commercial, financial and industrial attributes including their business oriented prospects. For instance, Lagos in the South-West is highly commercialized with several formal and informal business operations as documented by (Guven-Lisaniler et al 2018). Also, other regions have their unique features that indeed attract businesses. The sample structure for the Nigeria Enterprise Survey was created with the point of acquiring interviews at 2,674 firms across all zones in Nigeria.

Dependent Variables

Following the World Bank Enterprise Survey (2014), our dependent variable is selected based on the survey questions related to innovation across several enterprise types which very much complies with other studies Abdu, M., &Jibir, A. (2018).To this effect, the following questions are used to capture if a given firm within the last three years innovated or not:

• QH. 1 "During the last three years, has this establishment introduced new orsignificantly improved product or service?"

• QH. 3 "During the last three years has this establishment introduced any new orsignificantly improved methods of manufacturing product or offering services"

• All inclusive innovation implying if the establishment introduced each of QH 1 andQH 3,

From the forgoing, an establishment's affirmative response to any of the three questions as stated above implies they innovated. It should be mentioned that the fourth measure of innovation called the "All Inclusive Innovation" implies that the given establishment adopted all innovation methods over the three years period. Thus, this research uses dummy variables to capture each of these methods as follows: as

• Inno_prod = 1 if affirmative to QH1 and 0 otherwise.

• Inno_proc= 1 if affirmative to QH3 and 0 otherwise

• Inno_prod, + Inno_proc + Inno_mrkt is all innovated = 1 if affirmative to QH1, QH3, and 0 otherwise

In order to carry out the quantitative analysis of which this study aims at achieving, we will adopt the binary probit regression model that will be formulated in the proceeding sections. A brief summary of all variables are outlined under the Appendixsection – see Table A1. Also the descriptive statistics of key variables are provided under Table A2. Thus, it is observed that the proportion of firms that adopted both process and product innovation are similar. Firms' adopting all inclusive innovation is about 33%.

Independent Variables
1.   Demographic Characteristics
        The demographic variable used in this study comprises the (six) 6 geopolitical zones covering the following regions: North-Central, North-East, North-West, South-East, South-South and South-West. The relevance of the zone is relevant in the context of Nigeria's regional diversity and heterogeneity across employment types. The most recent labour market study for Nigeria opines that the Nigerian business environment and labour is heterogeneous across regions (Guven-Lisaniler et al 2018), thus, it is expected that regions with high population intensity such as Lagos in the South-West or regions with economic opportunities such as oil dominance in the some parts of Abia or Cross-River States commands opportunities for business operations which inherently can spur innovations across business in such locations across the country.
        Also the demographic analysis viewed the size characteristics which have micro, small, medium and large which different characteristics. To determine the firm's size, we categorize firms according to the number of employees in each establishment. Thus we firm's size has been classified into Micro (less than 5 employees), Small (5 to 19 employees), Medium (20 to 99 employees) and Large (99 workers and above). Size generally influences the ability in which firms can be productive; for instance, large firms may find it easy to run R&D programs which may cut across any of the innovation module to achieve the end goals of the business, Belenzon, & Patacconi, (2008).

Business Characteristics
        The Business Characteristics as applied in this research include a categorical variable of firm's size, trainings for employees, firm's annual sales (in Naira), the presence of security network or not, the types of firms. Abdu and Jibir (2018) pointed out the relevance of these variables in explaining innovations. Additional well-functioning infrastructure such as the availability of electricity and generator can drive innovative tendencies across firms (Ozaki 2011). It is therefore expected that these business infrastructural facilities can drive innovative behaviors positively.

2.   Personal Characteristics
        Personal characteristics used in this study is influenced by different sources such as attributes, education and business experience of business owners as factor driving innovation.(Gray 2006, Romijn&Albaladejo 2002). For instance Gray 2006) attributes education as an absorptive capability of a business owner that very much improve the productivity, growth and innovation amongst the small and medium enterprises (see Thomson and Gray, 1999). Personal capabilities are essential for innovation activities which are showed in this study in the areas of manager's educational level and experience including owner's gender (Sanni2018). Compared to male business owners, it's been established in the literature that females are relatively more innovative in terms of ideas and sophistication in the production process (Dohse et al 2017).

3.   Research Characteristics
        We further include some research oriented variables that shows how transformative ideas across firms. From the studies, research variable such as research and development (R&D) are necessary for innovation. Thus we include enterprise internal R&D such as transformative activities within the establishment and external R&D such as activities outside the business environment. According to Abdu, M., &Jibir, A. (2018), internal and external characteristics in research and development (R&D) drives the propensity of a firm to innovate.

3.2   Methodology
        To realize the aims of this study, the methodology used is drawn from several other studies on determinants of innovation across firms (Abdu &Jibir. 2018; Abazi-Alili et al 2016; Boermans&Roelfsema 2016). Particularly, Abdu and Jabir (2018) draw their analysis from the World Bank Enterprise survey (WBES, 2015) which very much tallies with this study. Following these studies the model adopted in this work is obtained from Long and Freez (2001) formulation, this model is very much similar to Abdu &Jibir (2018). Thus assuming an unobserved innovation variable $y*$such that:

$$y_i^* = \alpha + \beta X_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where y_i^* is the innovation variable in each firm i. Since we have measures of innovation; the equation is remodel thus:

$$prod\_Inno_i^* = \alpha + \beta X_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots .2a$$
$$proc\_Inno_i^* = \alpha + \beta X_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots .2b$$
$$All\_Inno_i^* = \alpha + \beta X_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots .2c$$

Where X_i describes a vector of demographic, personal, business and research characteristics as explained in TableA1, while β is a vector of parameters to be estimated. ε is the stochastic error term and α is the constant term.

The binary probit model formulation aims to explain the link between observed y (Innovation variable) and the unobserved y^* using the equation below:

$$y_i = \begin{cases} 1 \; if y_i^* (Inno^*) > 0 \; ie \; "YES" \\ 0 \; if y_i^* (Inno^*) = 0 \; ie \; "NO" \end{cases} \ldots\ldots\ldots .(3)$$

This means that in cases where y_i^* is observed; $y = 1$ and y_i^*=0 when; and y values are observed when = 0. As explained the case corresponding to $y = 1$ represents the "YES" response to QH1, QH3, and the "all inclusive classification as mentioned earlier. In direct application to this study, our binary probit model is appropriate to estimate product, process, marketing, and all inclusive innovations given that the variables are binary dummies specified as follows:

$$Pr(Inno = 1/X) = \theta(\beta_0 + \beta_1 Demogr_i + \beta_2 Persnl_i + \beta_3 Busins_i + \beta_4 Res_i + \varepsilon_i)$$
$$\ldots\ldots .(4)$$

Where equation 4 represents the probit model for each innovation types and $Demogr_i$; $Persnl_i$; $Busins_i$; Res_i are the independent variables representing the demographic, personal, business and research characteristics as earlier defined under Table A1.

IV. Results

4.1.   Descriptive EvidenceTable 1: Here

What is the comparative nature of businesses competitiveness and innovation amongst three largest economies in Africa such as Nigeria, South-Africa and Egypt? We challenge this question using the 2017-2018 Global Competitiveness Report as published by the World Economic Forum. As reported under Table 1, compared to South-Africa and Egypt, Nigeria's performance in different components of the report is quite minimal. Particularly, in terms of business sophistication and innovation, Nigeria is ranked 112th which is almost three times lower than that of South-Africa. Nigeria, like in many other sub-Saharan African countries has little access to funds, which hampers their emergence and eventual growth. Such disparities in competiveness and innovation across countries may be due to within country regional heterogeneity or differences in firm's sizes that inhibit growth. We present descriptive patterns of innovation by the Nigerian region and sizes in Tables 2A to 4B.

Table 2A – 4B: Here

Tables 2A, 3A and 4A show regional differences in product, process innovation and all- inclusive innovation. Businesses located in the North-Central and South-Southern region are the most innovative product and process innovative. These are due to the social and economic regional attribute derivable from such geographic regions. The spillover effects of socio- economic opportunities in the North-Central region due such as the federal capital Abuja or economic opportunities such as oil in the South-South may be good indicators of business concentration and innovation. The patterns of innovation may also vary by firm's size. Abdu &Jobr(2018) holds that firm's size has positive impact on the firms and Innovation. As reported under Tables 2B, 3B and 4B also indicates that innovation (product, process and all- inclusive) increases as firms become larger.

4.2. Econometric Evidence

The estimates pertaining to the determinants of product innovation are presented under Table 5, that of process and all-inclusive innovation in Tables 6 and 7 respectively. First, we include the main independent variables in line with the research topic. This means we include the size and regional variables alternatively in the equation before incorporating other covariates. This allows us to observe independent effects of regional and size variables on innovative outcomes. As observed under each Table Column 1 is the estimate with the size variables only. In column 2, also include the regional variables only. Columns 3 and 4 reports estimate for size and regional variables and other covariates alternatively.

Table 5: Here

Ably observed under column 1 (Table 5), all the size variables are highly significant at 99% level. This means that sizes (alone) do matter in determining product innovation where the probability of carrying product innovation is more pronounced amongst small, medium and large firms (relative to not innovating) when compared to smaller firms with less 5 workers. In column 2, most of the regional variables are highly significant, except South-South. Particularly, zones North-West, South-East and South-West are relatively less innovative than firms located in the North-Central. Interestingly, firms in the North-Eastern region are more product innovative than those in the North-Central. Fritsch, & Meschede (2001) support this view that size of firms have significant value on product innovation. This is indeed a puzzle owing to the prevalence of Boko-Haram incidences in that region. Combining both size and region in Column 3, the results do not change much as found in Columns 1 and 2. However, including other covariates such as the personal, research and business characteristics, the effects of region and size on product innovation diminished slightly. This implies that size variables lose significance (but marginally for large firms) and North-West region also fails to be significant. In terms of other covariates, education (postgraduate), gender-owner, employee training are significant that determine product innovation. But, there appears to be a negative relationship between employee training and firms' product innovation where trainings is associated with about 0.349 points decrease in product innovation. Accordingly, this can mean that such trainings might not be innovation oriented, rather normal routine training based on improving self-efficiency which will not lead to product innovation. In particular, firms adopting internal research and development tend to be positive oriented toward product innovation this can be through workers brainstorming to achieve a set departmental goals. This study is in accordance with Acs, &Audretsch, (1987) that size of firm's has an advantage on product innovation which also create positive advantage of market structure.Compared to manufacturing sector, innovation probabilities are lower amongst service firms (retail and none-retail oriented types)

Table 6: Here

Similar to Table 5, column 1 in (Table 6) also shows that firm's sizes do matter in determining innovation which is highly significant. This shows that sizes (alone) are necessary in determining process innovation whereby probability of carrying process innovation is highly noticeable and positive amongst Small, Medium and Large firms in comparison to the base group (firms with less than 5 workers). Following the Column 2, most regional variables are significant in process innovation, except in South-South region. Thus, the probability of firm level process innovation is lower amongst firms located in the North-West, South-East, South-West region when compared to those in the North-Central. Even after including other, covariates such as the personal, research and business characteristics, there still remained a significant relationship between region and size on process innovation. This implies that size variables maintain high significance (but have less impact large firms). Consideringother covariates, education (except graduate education), gender-owner, employee training are do not determine process innovation. Compared to manufacturing firms, retail or non-retail oriented firms are relative less process innovative. This also means that manufacturing processes require a significant production technique which again necessitates a process of innovation.Firms that adopted internal research and development are more process innovative than those with none. This implies that internal transformative goals facilitates firm's propensity to improved production processes withinthe firm.

Table 7: Here

Table 7 also reports the all-inclusive such that a typical firm adopted both product and process innovation. The result of Table 7 is no different from that reported under Table 6. Therefore the study can generally conclude that firm size (irrespective of either small, medium or large) posit a significant relationship in determining innovation in Nigeria. Also regional attributes do matter in determining product and process innovation.

V. Summary of Findings

Using data obtained from the World Bank Enterprise Survey 2014, this study investigated, if firm's size and regions matter in determining innovation across the business enterprise in Nigeria. To do this, the study adopted three streams of innovation such as product, process, and an all-inclusive innovation using a binary probit econometric model. Thus, we raised the following questions such as: (i) What are the determinants of innovation in Small and Medium Scale Enterprises?; (ii) What is the relationship between the size of a business and the level of innovation?; (iii) What is the relationship between the location of a small business and the level of innovation?

The results obtained indeed depicts that firm's size – whether micro, small, medium or large and firm's location whether located in the North-central, North-west, North-East, South-west, South-east and South-south do matter in determining the product, process, and all-inclusive innovation in Nigeria. Based on the econometric evidences, we affirms that (i.) there are relationship between size of business and level of innovation (ii) there is a relationship between location of business and level of innovation (iii) there are relationship between owners and business characteristics and level of innovation. It shows positive significant relationship between the firm size and location (region) of which businesses operate, and varies around small, medium and large enterprise. Interestingly, firm's size value tends to show positive responds between small and medium but a slightly diminishes on large firms in determining innovation in Nigeria respectively. Following the Schumpeterian view (2002), which supports a positive relationship between size and innovation, the research proofs that region has a significant influences on innovation as it affect the business enterprise. It is recommended that any firm that wishes to be innovative in using any of the different types of innovation (Product, Process and All-Inclusive) must pay attention to firms internal and external environment such as Internal R&D, Firm's Sizes and regions. Furthermore, policies that will help in encouraging micro firms innovative behavior should be put in motion and redirect attention towards microenterprise this will have a positive impact on their activities.

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Table 1: Global Competitiveness Report Analysis for three largest economies in Africa

	Nigeria		SouthAfrica		Egypt	
	Rank/137	Score(1-7)	Rank/ 137	Score(1-7)	Rank/137	Score(1-7)
IndexComponent						
GlobalCompetitivenessIndex	125	3.3	61st	4.3	100th	3.9

Basic Requirement Institutions	136	2.9	92	4.3	106	4.0
Infrastructure	125	3.2	76	3.8	64	3.9
Macroeconomic Environment	132	2.0	61	4.3	71	7.1
Efficiency/Enhancers	122	3.5	82	4.5	132	2.6
Higher Education/Training Labour	86	3.9	52	4.4	87	3.9
Market Efficiency	116	3.1	85	4.1	100	3.6
Financial Market Development	32	4.6	93	4.0	134	3.2
	91	3.7	44	4.4	77	3.9
Market Size **Innovation/Sophistications factor** Business	26	5.0	30	4.9	25	5.1
Sophistications&Innovation	108	3.3	39	4.1	101	3.4
	94	3.7	37	4.5	84	3.8
	112	2.8	39	3.8	109	2.9

*Source***:** The Global Competitiveness Report 2017-2018.

Table 2A: Product Innovation Patterns by Nigerian Regions (2014)

	Product Innovation				Total	
Zones	YES		NO			
	Number	**%**	**Number**	**%**	**Number**	**%**
North-Central	291	55.11	237	44.89	528	100
Gombe–(NE)	91	72.22	35	27.78	126	100
North-West	440	46.03	516	53.97	956	100
South–East	142	35.50	258	64.50	400	100
South–South	79	59.09	57	41.91	136	100
South–West	258	48.68	272	51.31	530	100
Total	1,301	48.62	1,375	51.38	2,676	100

Source: Author's computation from World Bank Enterprise Survey 2014
Table

Table 2B: Product Innovation Patterns by Enterprise Sizes (2014)

	Product Innovation				Total	Total
Sampling Size		YES		NO		
	Number	**%**	**Number**	**%**	**Number**	**%**
Micro<5	121	38.29	195	61.71	316	100
Small>5to<19	680	48.75	715	51.25	1,395	100
Medium>20to<99	383	51.76	357	48.24	740	100
Large100above	117	52.00	108	48.00	225	100
Total	**1,301**	**48.62**	**1,375**	**51.38**	**2,676**	**100**

Source: Author's computation from World Bank Enterprise Survey 2014

Table 3A: Process Innovation Patterns by Nigerian Regions (2014)

	Process Innovation				Total	
Zones	YES		NO			
	Number	**% Number**		**%**	**Number**	**%**
North-Central	314	59.92 210		40.08	524	100
Gombe – (NE)	90	28.00 35		44.96	125	100
North -West	424	44.96 519		55.04	943	100
South – East	130	32.66 268		67.34	398	100
South – South	82	61.19 52		38.81	134	100
South – West	259	49.05 269		50.95	528	100

Total	1299	48.98 1,353		50.02	2652	100

*Source:*Author's computation from World Bank Enterprise Survey 2014

Table 3B: Process Innovation Patterns by Enterprise Sizes (2014)

SamplingSize	ProcessInnovation				Total	
	YES		NO			
	Number	**%**	**Number**	**%**	**Number**	**%**
Micro<5	106	33.54	210	66.46	316	100
Small>5to<19	674	48.42	718	51.58	1,392	100
Medium>20to<99	395	54.26	333	45.74	728	100
Large100above	124	42.59	92	57.41	216	100
Total	**1,299**	**51.02**	**1,353**	**48.98**	**2,652**	**100**

*Source:*Author's computation from World Bank Enterprise Survey 2014

Table 4A: All-Inclusive Innovation Patterns by Nigerian Regions (2014)

Zones	ProductandProcessInnovation				Total	Total	
	YES		NO				
	Number	**%**	**Number**		**%**	**Number**	**%**
North-Central	210	39.77	318		60.23	528	100
Gombe–(NE)	80	63.49	46		36.51	126	100
North-West	274	28.66	682		71.34	956	100
South–East	91	22.75	309		77.25	400	100
South–South	57	41.91	79		58.09	136	100
South–West	171	32.26	359		67.74	530	100
Total	**883**	**33.00**	**1,793**		**67.00**	**2,676**	**100**

*Source:*Author's computation from World Bank Enterprise Survey 2014

Table 4B: All-Inclusive Innovation Patterns by Enterprise Sizes (2014)

SamplingSize	ProductandProcessInnovation				Total	Total	
	YES		NO				
	Number	**%**	**Number**	**%**	**Number**	**%**	
Micro<5	63	19.94	253	80.06	316	100	
Small>5to<19	468	33.55	927	66.45	1,395	100	
Medium>20to<99	269	36.35	471	63.65	740	100	
Large100above	83	36.89	142	63.11	225	100	
Total	**883**	**33.00**	**1,793**	**67.00**	**2,656**	**100**	

*Source:*Author's computation from World Bank Enterprise Survey 2014

Table 5: Probit Estimates for the Determinants of Product Innovation in Nigeria.

	(1)		(2)		(3)		(4)	
	With Firm'sSize		WithRegion		SizeandRegion		All Covariates	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Size (Base:<5employees)	.							
Small	0.266***	(0.079)			0.215***	(0.080)	-0.000	(0.106)
Medium	0.342***	(0.085)			0.290***	(0.087)	-0.027	(0.124)

	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Large	0.348***	(0.110)			0.320***	(0.114)	-0.378*	(0.195)
Region (Base:North-Central)								
North-East			0.461***	(0.131)	0.452***	(0.131)	0.464***	(0.144)
North-West			-0.228***	(0.068)	-0.227***	(0.068)	-0.123	(0.082)
South-East			-0.500***	(0.084)	-0.474***	(0.085)	-0.568***	(0.104)
South-South			0.076	(0.121)	0.086	(0.121)	0.059	(0.142)
South-West			-0.162**	(0.077)	-0.197**	(0.079)	-0.318***	(0.105)
Education (Base:Primary& Secondary)								
Voc.Edu							-0.047	(0.078)
BachelorEdu							0.030	(0.077)
Post-graduateEdu							0.489***	(0.148)
Femaleowner							0.223***	(0.080)
Experience(log)							0.032	(0.038)
Employeesize(log)							0.026	(0.041)
Employeetraining(vsnone)							-0.349***	(0.065)
Annualsales(log)							0.019	(0.014)
Security(VsNone)							0.367***	(0.066)
Electric(VsNone)							0.058	(0.076)
Generator(VsNone)							0.225***	(0.080)
FirmType (Base:Manufacturing)								
Retail							-0.203**	(0.084)
Non-retail							-0.151**	(0.068)
InternalR&D(VsNone)							0.434***	(0.155)
ExternalR&D(VsNone)							0.203	(0.302)
Int_email(VsNone)							0.113	(0.117)
Constant	-0.298***	(0.072)	0.129**	(0.055)	-0.089	(0.088)	-0.041	(0.297)
Observations	**2,676**		**2,676**		**2,676**		**1,914**	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Probit Estimates for the Determinants of Process Innovation in Nigeria.

	(1) WithFirm's Size		(2) With Region		(3) Sizeand Region		(4) All Covariates	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
proc_inno Size	.	(.)	.	(.)	.	(.)	.	(.)
Small	0.385***	(0.080)			0.335***	(0.082)	0.277***	(0.105)
Medium	0.532***	(0.086)			0.484***	(0.089)	0.320***	(0.123)
Large	0.612***	(0.113)			0.598***	(0.117)	0.346*	(0.195)
Region BaseNorth-Central								
North-East			0.331**	(0.132)	0.318**	(0.133)	0.336**	(0.145)
North-West			-0.378***	(0.069)	-0.379***	(0.069)	-0.305***	(0.082)
South-East			-0.701***	(0.086)	-0.660***	(0.086)	-0.844***	(0.104)
South-South			0.033	(0.123)	0.054	(0.124)	0.109	(0.149)
South-West			-0.275***	(0.078)	-0.349***	(0.080)	-0.440***	(0.106)
Education Base: Primary&Secondary)								

Voc.Edu	-0.025	(0.079)
BachelorEdu	0.105	(0.077)
Post-graduateEdu	0.268*	(0.142)
Gender_owner	0.117	(0.081)
Experience(log)	0.086**	(0.038)
Employeesize(log)	-0.070*	(0.041)
Employeetraining	-0.301***	(0.066)
Annualsales(log)	0.017	(0.014)
Security(VsNone)	0.423***	(0.066)
Electric(VsNone)	0.071	(0.077)
Generator(VsNone)	0.089	(0.081)
FirmType		
Retail	-0.370***	(0.084)
Non-retail	-0.219***	(0.069)
InternalR&D(VsNone)	0.360**	(0.155)
ExternalR&D(VsNone)	0.008	(0.297)
Int_email(VsNone)	0.161	(0.118)

Constant	-0.425***	(0.073)	0.251***	(0.055)	-0.099	(0.089)	0.011	(0.296)
Observations	**2,652**		**2,652**		**2,652**		**1,914**	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Probit Estimates for the Determinants of All Inclusive Innovation in Nigeria.

	(1)		(2)		(3)		(4)	
	With Firm'sSize		**WithRegion**		**SizeandRegion**		**All Covariates**	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Inno_all	.	(.)	.	(.)	.	(.)	.	(.)
Size								
Small	0.419***	(0.088)			0.369***	(0.089)	0.270**	(0.112)
Medium	0.495***	(0.093)			0.454***	(0.095)	0.196	(0.129)
Large	0.509***	(0.117)			0.514***	(0.121)	-0.006	(0.201)
Region								
North-Central								
North-East			0.604***	(0.127)	0.591***	(0.128)	0.634***	(0.142)
North-West			-0.304***	(0.070)	-0.302***	(0.070)	-0.215***	(0.082)
South-East			-0.488***	(0.089)	-0.451***	(0.089)	-0.646***	(0.107)
South-South			0.055	(0.122)	0.069	(0.123)	0.115	(0.144)
South-West			-0.201**	(0.079)	-0.253***	(0.081)	-0.393***	(0.108)
Education								
Base:Pri.&Sec.)								
Voc.Edu							-0.018	(0.081)
BachelorEdu							0.089	(0.080)
Post-graduateEdu							0.410***	(0.138)
Gender_owner							0.212***	(0.081)
Experience(log)							0.064*	(0.038)
Employeesize(log)							-0.005	(0.042)
Employeetraining							-0.328***	(0.064)
Annualsales(log)							0.015	(0.014)
Security(VsNone)							0.413***	(0.069)
Electric(VsNone)							0.064	(0.079)
Generator(VsNone)							0.117	(0.083)

FirmType								
Retail							-0.280***	(0.087)
Non-Retail							-0.241***	(0.070)
InternalR&D							0.511***	(0.148)
ExternalR&D							0.123	(0.302)
Int_email							0.211*	(0.119)
Constant	-0.844***	(0.080)	-0.259***	(0.055)	-0.622***	(0.095)	-0.560*	(0.297)
Observations	**2,676**		**2,676**		**2,676**		**1,914**	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix

Table A1: Definition of Variable

Variable	Definition
Prod_Inno	Dummyvariable=1ifproductinnovatedand=0otherwise
Proc_Inno	Dummyvariable=1ifnonproductinno=0andotherwise
All_Inno	Dummyvariableifallinnovated=1nonallinnovated=0andotherwise
Demographic Characteristics	
Size	Categoricalvariablescapturingfirm'ssizes
Micro	Categoricalvariableforfirmsemployinglessthan5employees(Basecategory)
Small	=1iffirmsemploy5to19workers.
Medium	=1iffirmsemploy20to99workers.
Large	=1iffirmsemploymorethan100workers
Region(Geopolitical Zones)	ThiscoversthedifferentzonesinNigeria
North-West	=1iffirmislocatedintheNorth-WestregionofNigeria
North-Central	FirmslocatedintheNCregionservesasthebasecategory
North-East(Gombe)	DummytoanyfirmthatissituatedinGombeStateNigeria
South-West	DummytoanyfirmthatissituatedinSouth-WestNigeria
South-East	DummytoanyfirmthatissituatedinSouth-EastNigeria
South-South	DummytoanyfirmthatissituatedinSouth-SouthNigeria
PersonalCharacteristics	
Education	Levelsofowner'seducationalachievement.
Prim_SecSchool	Baseoutcomecapturingifownercompletedthebasicprimaryorsecondarylevelof education.
VocationalEducation	=1 if owner completed a vocational training outside the normal primary and secondarylevels.
BachelorEducation	PercentageofemployeswhofinishedBachelor'seducation
Post-graduateEducation	PercentageofemployeeswhofinishedPost-graduateeducation
Exper_owners	Yearsofownerslevelofexperienceinthebusiness(inlogs).
Gender_owner	Femaleowner=1versusMaleowner=0
BusinessCharacteristics	
EmployeeTraining	Dummyvariable=1iffirmhademployeetrainedand=0otherwise
Sales	Firm'sannualsalesinNaira.
Security	**Levelofsecurityinthefirm**
Genr	**Basedonpowerthroughgenerator**
Electricity	**Basedonpowersupply**
FirmTypes	**Differentlogoffirms**
Manufact	Baseoutcomeifthefirmisinthemanufacturingsector
Retail	=1ifbusinessisretailoriented

Non-retail	=1ifbusinessisnon-retailorientedsuchasotherservices
ResearchCharacteristics	
R&D_Internal	Dummy=1 if firms engaged in any form of within firm research and development and 0 otherwise
R&D_External	Dummy=1 if firms engaged in any form of external research and development and
	0otherwise
Int_email	Dummy=1 if availability of internet for firm's operation and 0 otherwise

Generated using WBES 2014 dataset

Table A2: Descriptive Statistics of all variables using the probit regressions.

	(2)	(3)	(4)	(5)
Variables	Mean	SD	Min	Max
Prod_inno	0.486	0.500	0	1
Proc_inno	0.490	0.500	0	1
AllInno	0.330	0.470	0	1
Micro	0.118	0.323	0	1
Small	0.521	0.500	0	1
Medium	0.277	0.447	0	1
Large	0.0841	0.278	0	1
North-Central	0.197	0.398	0	1
North-East	0.0471	0.212	0	1
North-West	0.357	0.479	0	1
South-East	0.149	0.357	0	1
South-South	0.0508	0.220	0	1
South-West	0.198	0.399	0	1
Prim.Sec.School	0.381	0.486	0	1
VocationalEducation	0.254	0.436	0	1
BachelorEducation	0.284	0.451	0	1
Post-graduateEducation	0.0801	0.271	0	1
Exper-owners	2.251	0.850	0	4.277
Gender-owner	0.181	0.385	0	1
Employee	2.627	1.092	0	8.517
EmployeeTraining	1.656	0.534	0	2
Sales_annual	14.83	2.484	9.616	27.63
Security	0.619	0.486	0	1
Genr	0.782	0.413	0	1
Electricity	0.764	0.424	0	1
Manufact	0.429	0.495	0	1
Retail	0.205	0.404	0	1
Non-retail	0.366	0.482	0	1
R_D_internal	0.0534	0.225	0	1
R_D_external	0.0131	0.114	0	1
Int_email	0.0852	0.279	0	1
NoofObs.	**2,676**			

Note: SD= Standard Deviations