

Innovation Types and Firm Performance in Nigeria

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Abstract: The study investigated the existence of innovation types and examined their effects on firm performance in Nigeria's manufacturing industry. Using logistic regression analysis, data were sourced from forty-eight (48) non-quoted manufacturing firms (consisting of food, beverages and tobacco; textile, apparel and footwear; non-metallic, pharmaceuticals and cement) to examine the effect of innovation types on firms' performance. The results confirmed the existence of product, process, marketing and organisational innovations and also identified recruitment modelling and talent management as other organisational innovation techniques employed in Nigeria's manufacturing industry. In addition, the study showed that product innovation ($t = 0.67$; $p < 0.05$) and patent rights ($t = 2.13$; $p < 0.05$) had positive and significant effects on firm performance. The findings of this study recommend that firms should focus on improving the combined effects of product, marketing, process and organisational innovations. In addition, organisational policies should be geared towards human capital development to achieve greater manufacturing performance required for industrial growth and economic development.

Keywords: Innovation, Patent Rights, Recruitment Modelling, Talent Management, Firm Performance

1. INTRODUCTION

There is no doubt that the world is already in its fourth industrial revolution (4IR) characterised by different combinations of digitally powered technologies (robotics, data analytics, artificial intelligence and machine learning, internet of things) and their interactions with humans and machines in workplaces. Many countries of the world have fostered industrialisation by organising

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factor inputs to create new values through technological innovations for profit making. Innovation, defined as the implementation of a new or significantly improved product, process; marketing method; or organizational method in business practices; workplace organization or external relations (Organisation for Economic Co-operation and Development, 2005), is not an end in itself but has been viewed as a means to greater firm productivity and profitability (Fagerberg *et al.*, 2010).

Newly industrialised countries such as Singapore, Hong Kong and Malaysia have attained economic development with high global innovation index rankings (7th, 14th and 36th respectively) among 132 countries in 2022 and are said to have large manufacturing bases which is one of the determinants of long-run sustainable growth of an economy (World Intellectual Property Organisation, 2022). According to the United Nations Conference on Trade and Development (UNCTAD, 2017), innovation is required for the realisation of sustainable development. However, it is disheartening to know that despite the national Science and Technology (S&T) policy implemented in 1986 and the Nigerian Industrial Revolution Plan (NIRP) launched in 2014 to link innovation to the industry, the Nigerian economy is yet to be transformed from being a primary sector-oriented economy to an industrialised one, thus, the country continues to remain in the category of lower-middle-income countries of the world. Consequently, Nigeria ranked 114th among 132 countries in innovation in 2022 as its share of medium and high-tech sectors in manufacturing value added and exports continue to decline (World Intellectual Property Organisation, 2022).

Given that contemporary developed and emerging countries of the world have attained economic growth and development through the industrial sector, there is a need to improve manufacturing value-addition through industrial innovativeness if the Nigerian economy must catch up with the advanced economies because the technologically improved industrial output is essential for its relevance in the international markets. Moreover, industrial innovation has a lot of implications for firm performance. Firm performance is described as the sum of all values created through firm activities for stakeholders over some time (Freeman, 1984, Freeman *et al.*, 2010). Thus, firms embark on different innovative strategies/activities to increase performance in terms of outputs, market share, growth, profitability and so on (Selvam *et al.*, 2016).

Controversies exist in the literature on the relationship between innovation and firm performance. Studies by Griffith *et al.* (2006); Cassiman *et al.* (2010); Hall, (2011); Crespi and Zuniga (2012); Peters *et al.* (2013); Krusinskas *et*

al. (2015); Mazlina and Normaz, (2015); Karabulut (2015); Carvalho and Avellar, (2017); Fu, *et al.* (2018) showed that innovation exerts positive effects on firm performance, although, this is subject to controversy depending on different types of innovation. Conversely, Goedhuys *et al.* (2008) showed that innovation types have no impact on firm performance whereas other studies by Griffith *et al.* (2006); Ding *et al.* (2006); and Hall (2011) revealed mixed effects of innovation types on firm performance.

Innovation involves labour and capital inputs as well as entrepreneurial skills in conducting business in the organisation (Hashi and Stojcic, 2010). Therefore, innovation should not only be construed as the introduction of sophisticated, high-tech or complex activities alone (Munemo and Nyantakyi, 2014; Gottinger, 2016), rather, it should be viewed to include changes to existing products, processes, marketing and ways of conducting business in the organisation even when they seem negligible to the technology frontier (Fagerberg *et al.*, 2010). A new or improved product/service does not only result from the introduction of technologies but a combination of many innovative strategies embarked on in the organisation to achieve optimum production levels at the minimum cost possible for profit maximisation.

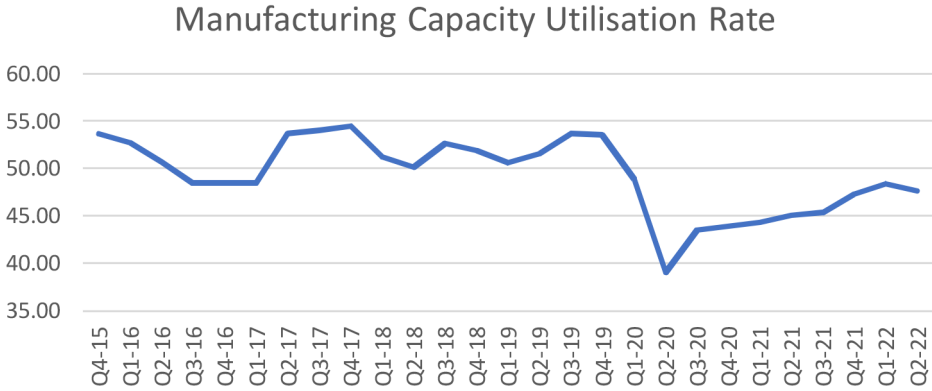
Given conflicting results of the effects of innovation types on firm performance in the literature and the fact that innovation has been viewed as a critical factor in the industrial sector (Mytelka, 1999) to achieve economic growth and overall development (Adeoti and Olubamiwa, 2009), most of the studies in Nigeria have examined the relationship between innovation and firm performance in the service sector (Dauda and Akingbade, 2011; Bello and Isola, 2014) with a few on manufacturing sector (Adeyeye *et al.*, 2016; Oluwadare *et al.*, 2016). Besides, the manufacturing capacity utilisation rate has dwindled below average in recent times in Nigeria (National Bureau of Statistics, 2022). Hence, this study seeks to identify different types of innovation employed by manufacturing firms and examine their effects on firm performance in Nigeria's manufacturing industry.

2. LITERATURE REVIEW

This section explains different types of innovation and discusses relevant literature on innovation-firm performance relationships.

2.1. Types of Innovation

Innovation has four basic types which are product (goods or services); process (production or delivery of products); marketing (market development); and

Figure 1: Manufacturing Capacity Utilisation Rate in Nigeria (2015 – 2022)

Source: Author's computation, 2022.

organisational (use of business practices) innovations. However, the definition given by the Oslo Manual has restricted its application to business enterprises neglecting public sector firms of the economy. Innovation should be largely applicable to all sectors by emphasizing the availability of innovation to potential users. In a generalised definition of innovation, a new or significantly improved product (good or service) occurred when it is available/accessible to potential users. Similarly, a new or significantly improved process (comprises of production, marketing and organisational methods) occurred when brought into use by the organisation in the firm's operations (Gault, 2016).

2.1.1. Product Innovation

Product innovation comprises products and service innovation. It is described as the introduction of entirely new products and services or major improvements to existing ones. Hassan *et al.* (2013) reported that product innovation could be viewed in terms of new products in the firm; new products to customers; and improvements on the existing products of the firm to meet customers' needs. The new or improved products must be significantly different from existing products in terms of their features, intended uses, components, materials and software. Generally, product innovation is a new or significantly improved product given its peculiar features and intended uses.

2.1.2. Process Innovation

Process innovation is described as new or significantly improved production techniques or delivery methods (OECD, 2005). It is implemented through

significant changes in equipment, techniques and software of production or product delivery methods. These new productions or delivery methods can be developed either by the organisation itself or with the assistance of external bodies and the methods must be entirely new such that the organisation has not implemented them before (Polder *et al.*, 2010). This type of innovation also includes significant improvements in supportive activities like accounting, purchases and maintenance. Generally, an organisation adopts a new process to minimise the cost of production or delivery to compete effectively with rival firms and ensure customer satisfaction (Hassan *et al.*, 2013).

2.1.3. Marketing Innovation

Marketing innovation is the implementation of new or significantly improved methods in product packaging or design, pricing, product promotion or placement (OECD, 2005) which is usually required for the implementation of product and process innovations. This aims at opening new or developing existing market areas to increase sales and market share. Therefore, marketing innovation could be categorised as a non-technological innovation because it promotes the product, process and corporate image by implementing new or improved marketing methods (product design, placement, promotion and packaging) that the firm has never implemented before.

2.1.4. Organizational Innovation

Organisational innovation is viewed as the implementation of new methods in business practices, workplace organisation or external relations (OECD, 2005). It introduces entirely new ways of conducting business in an organisation. It involves innovative ways of conducting day-to-day activities, organising methods, decision-making systems and external relationship management which must be new to the organisation either developed by the firm or outsourced to external bodies (Polder *et al.*, 2010). Innovation in organisational methods should bring changes in the set-up of the organisation to compete effectively with rival firms and satisfy customers' needs.

Besides these four basic types of innovation discussed above, the literature has also presented other kinds of innovation which include; incremental and radical innovations (OECD, 2005). The implementation of these and many other classifications of innovation is a strategy required for the growth and development of a firm. Therefore, innovation strategy involves all efforts, methods and ways by which a firm employs innovation to achieve its business

objectives and improve its performance (Lendel and Varmus, 2011). As a result, firms should conduct different types of innovative activities which should be coordinated and implemented as an integrated whole.

2.2. Empirical Literature

2.2.1. Innovation and Firm Performance

Cassiman *et al.* (2010) studied the relationship between innovation, productivity and the level of exports among Spanish manufacturing firms. The study used panel data comprised of both small and medium enterprises in cross-sectional data analysis for the period between 1990 and 1998 across 1,256 companies from 20 different industries. The study showed that product innovations affected labour productivity positively and motivated non-exporting firms to become exporters. The study concluded that process innovation exerts a positive and significant effect on productivity.

In addition, Hall (2011) analysed the relationship between innovation measures and firm-level productivity among 18 manufacturing sectors in Europe. Using the CDM structural model approach on innovation indicators such as patents, the results of the panel data analysis showed the existence of a positive relationship between product innovation and productivity but process innovation exerted an uncertain impact on productivity.

In a cross-country European study, Griffith *et al.* (2006) examined the role of innovation in a study that comprised ten (10) industries in four (4) European countries namely; France, the UK, Germany and Spain. Using the structural model (CDM) approach by Crepon *et al.* (1998) to analyse the manufacturing data set of community innovation surveys (CIS), the study found that interactions between expenditure on R&D and productivity of labour varied across the selected countries. The study found that product innovation enhanced productivity in the UK, France and Spain except in Germany.

In examining the innovation-productivity relationship, Fu *et al.* (2018) adopted the CDM approach among 501 Ghanaian manufacturing firms. A revised CDM structural model approach was employed to analyse a data set of 501 manufacturing firms, the study reported that innovation had positive effects on firms' labour productivity and that non-technological related innovations significantly influenced productivity when compared with technological-related innovations. The effect of innovation was significantly

greater on productivity for informal firms compared with formal firms.

Similarly, Carvalho and Avellar (2017) explored the interaction between innovation and the performance of 2,846 businesses in Brazil. The performance was measured by the productivity of workers and TFP-total factor productivity. Using a cross-sectional model and panel analysis using the fixed-effect model, the study found that the relationship between innovation and productivity was positively significant. The results suggested that productivity is influenced by the procurement of plants and equipment for innovation. They concluded that innovation enhanced the emergent impact on the productivity of the Brazilian manufacturing industry.

In addition, Krusinskas *et al.* (2015) analysed the intensity of R&D investments, innovations and firm performance of 8,000 firms in Lithuanian industrial sectors between 2005 and 2012. Using panel data analyses, the study showed that medium-low-tech enterprises were the leading investors in fixed and tangible assets before 2010. However, they were replaced by the high-tech industry in 2010. The study showed that through innovation high-tech firms exhibited a high level of productivity.

Furthermore, Karabulut (2015) studied the impact of various innovation types on the performance of 197 firms in the Turkish manufacturing industry. Using the regression model, the study showed that products, processes and organizational innovations exerted positive impacts on firm performance. Other performance indicators like customer service, internal control performance, learning curve and growth performance were also influenced by innovative activities. Innovations in marketing were shown to exert a positive impact on firm performance, customer services, and internal control performance.

Mazlina and Normaz (2015) investigated the effects of innovation on firm productivity in the Malaysian manufacturing industry. Using cross-sectional data, a total of 7,222 firms from 36 sectors were observed in 2008 in Malaysia. The connection between R&D expenditure, innovative activities and firm productivity (measured by fixed assets per employee) was examined through a structural model. The study showed that export-inclined firms are more innovative to enhance the competitiveness of their products internationally. The study concluded that the support of quality labour and technology will assist firms to achieve higher productivity.

In a related vein, Lee (2011) studied trade, innovation and productivity among Malaysian firms. Using innovation survey data from 1997 to 2004, the results of the study revealed that an insignificant positive relationship exists

between product innovation and firm productivity measured by employees' value added. The study showed that export-oriented firms are usually more innovative than other firms whose products cannot compete internationally. Thus, a positive relationship exists between export orientation and R&D expenditures.

Conversely, Goedhuys *et al.* (2008) studied the effects of innovation types on productivity among 187 firms in the Tanzanian manufacturing industry. The study also evaluated technological progress and the relative importance of the business environment to firm productivity. Using firm-level panel data analysis, the study found that research and development, product and process innovative activities do not have an impact on firm productivity however the business environment exerted a positive impact on productivity.

Dauda and Akingbade (2011) studied the effect of technological innovation on bank performance in Nigeria. Using the Pearson correlation technique to analyse the primary data collected from fifteen (15) banks, the study showed that innovation enhances employees' productivity and performance, customers' services and the profitability of banks.

Similarly, Bello and Isola (2014) investigated the structure-conduct-performance hypothesis in the banking industry in Nigeria. Using a panel regression model to analyse a data set of 12 banks from 2004 to 2013, the study evaluated the Nigerian banking industry using both structure and efficient hypotheses. The study found that the structure-performance hypothesis exists among Nigerian banks; however, bank efficiency (proxied by operating efficiency) showed a negative effect on bank performance thereby refuting the efficient-performance hypothesis in the Nigerian banking industry.

Adeyeye *et al.* (2016) examined innovation and its determinants among 1,000 manufacturing enterprises in Nigeria. The study employed binary logistic regression in investigating the interaction between the innovative activities and other independent variables employed in the study. Expenditure on R&D; investment in plant and machinery positively influences innovative activities.

3. METHODOLOGY OF THE STUDY

Schumpeterian growth theory provides the framework that puts innovation at the centre of economic growth (Schumpeter, 1942). According to Aghion and Akcigit (2015), the innovation-based theory posits that long-run growth depends on various types of innovation intending to replace old innovations with new ones (creative destruction). This theory begins with an industrial-level production function for the present period specified in equation (1) as;

$$Y_{i,t} = A_{i,t}^{1-\alpha} K_{i,t}^\alpha \quad 0 < \alpha < 1 \tag{1}$$

Where $Y_{i,t}$ represents the aggregate output, $A_{i,t}$ is the parameter of the firm's recent technology, $K_{i,t}$ represents capital stock and α represents the elasticity of output to the input.

Therefore, the Schumpeterian growth theory implies that innovation-led growth is directly synonymous with innovation-driven profitability (Schumpeter, 1942). To obtain the growth model, the previous period production function and present period production function will be compared. The output model for the previous period production function (t-1) is stated as;

$$Y_{i,t-1} = A_{i,t-1}^{1-\alpha} K_{i,t-1}^\alpha \tag{2}$$

Hence, subtracting equation (2) from equation (1) after introducing the natural log produces the growth in output which is specified as;

$$y_t = (1 - \alpha) a_t + \alpha k_t \tag{3}$$

Where y_t is the output growth, a_t is the growth in technology (innovation) and k_t is the growth in capital stock.

Following the study by Aghion and Akcigit (2015), one of the implications of Schumpeterian growth theory is that a faster output/productivity growth rate implies higher firm performance, as such;

$$yi,t \approx PEFi,t \tag{4}$$

Hence, since creative destruction suggests a situation where successful innovations displace old innovations, firm performance could be said to be a function of $a_{i,t}$ the - technology (innovation) parameter. According to Schumpeterian growth theory, therefore, performance/profitability is a function of innovation (INN), thus, equation (4) becomes;

$$PEF_{i,t} = \beta INN_{i,t} \tag{5}$$

The stochastic form of equation (5) is expressed as;

$$PEF_{i,t} = \beta INN_{i,t} + \epsilon_{i,t} \text{ Where } \epsilon_{i,t} \text{ is the error term.} \tag{6}$$

As its estimation techniques, this study employed a logistic regression model to investigate the effects of innovation on firm performance. A multistage sampling technique was employed and data were sourced from forty-eight (48) non-quoted manufacturing firms operating in food, beverages and tobacco;

textile, apparel and footwear; non-metallic, pharmaceuticals and cement sectors through a self-administered questionnaire and interviews. According to Park (2013), logistic regression assumes a non-linear relationship between the dependent variable and explanatory variables. Unlike the linear regression model, the model does not follow the linearity assumption of the ordinary least square method but requires the dependent variable to be distinct, each observation must be independent and that data should be fitted directly into a logistic curve. The model is explained in terms of the odds of an event which is the ratio of the probability of an event occurring (p) to the probability of an event not occurring ($1-p$). Therefore, extending the logistic regression model to the relationship between firm performance and innovation, the model can be specified as follows;

$$PEF = \frac{e^{\alpha + \beta_i INN}}{1 + e^{\alpha + \beta_i INN}} + \epsilon_i \quad (7)$$

4. RESULTS AND INTERPRETATION

4.1. Innovation Types

This study investigated the existence of innovation types in Nigeria's manufacturing industry and subsequently examined their effects on firm performance. Table 1 revealed the existence of the four basic innovation types which are product, process, marketing and organisational innovations. Out of 48 respondents, 28 respondents confirmed the existence of product innovation through the introduction of new products to the market within the last five (5) years. On process innovation, 27 respondents, 29 respondents, 17 respondents and 24 respondents confirmed the existence of process innovation in production techniques, equipment, software and product delivery respectively. In addition, 30 respondents confirmed the existence of product design, 23 respondents established that product placement exists, 24 respondents recognised the availability of product promotion and 27 respondents confirmed after-sale services as marketing methods. Lastly, 26 respondents agreed that organisational innovation exists through new organisational methods employed by manufacturing firms in the last five years.

4.2. Innovation Types and Firm Performance

This study investigated the effects of innovation types on firm performance in Nigeria's manufacturing industry. The effects of the product, marketing, process and organizational innovations on manufacturing firm performance

Table 1: Types of Innovation

| <i>INNOVATION TYPES</i> | <i>Yes</i> | <i>No</i> | <i>Missing</i> | <i>Total</i> |
|----------------------------------|------------|-----------|----------------|--------------|
| PRODUCT INNOVATION | | | | |
| Introduction to New Products | 28 | 8 | 12 | 48 |
| PROCESS INNOVATION | | | | |
| Production Techniques | 27 | 9 | 12 | 48 |
| Equipment | 29 | 10 | 9 | 48 |
| Software | 17 | 13 | 18 | 48 |
| Delivery | 24 | 10 | 14 | 48 |
| MARKETING INNOVATION | | | | |
| Product Design | 30 | 12 | 6 | 48 |
| Product Placement | 23 | 10 | 15 | 48 |
| Product Promotion | 24 | 11 | 13 | 48 |
| After Sales Service | 27 | 11 | 10 | 48 |
| ORGANISATIONAL INNOVATION | | | | |
| New Organizational Methods | 26 | 10 | 12 | 48 |

were investigated using the ordinal logistic regression model. Table 2 shows a significant positive effect of product innovation on firm performance at a 5% level of significance. By implication, new or significantly improved products results in high firm performance. Also, the study revealed that patent rights have positive effects on firm performance at a 5% significance level. This suggests that patent rights significantly improve the performance of Nigeria’s manufacturing firms.

Table 2: Logical Regression Results

| <i>Variable</i> | <i>Coefficient</i> | <i>Std. Error</i> | <i>t-statistic</i> | <i>Prob.</i> |
|-------------------------|--------------------|-------------------|--------------------|--------------|
| PIN | 1.296966 | 1.938524 | 0.67 | 0.050** |
| MIN | -0.000612 | 0.022751 | -0.03 | 0.979 |
| PRN | 0.003344 | 0.025082 | 0.13 | 0.894 |
| OIN | 0.965029 | 1.59066 | 0.61 | 0.054* |
| PTR | 2.844519 | 1.336574 | 2.13 | 0.033** |
| Intercept 1 | 2.127171 | 2.201799 | | |
| Intercept 2 | 6.138383 | 2.661349 | | |
| No of Obs. | 48 | | Log Likelihood | -14.0833 |
| LR Chi ² (5) | 10.82 | | Pseudo R2 | 0.2775 |
| Prob. | 0.0551 | | | |

Note: PIN, MIN, PRN, OIN and PTR represent Product Innovation, Marketing Innovation, Process Innovation, Organisational Innovation and Patent Rights respectively

Notes: **, * significance at 5% and 10% respectively.

The study found that the recruitment process, talent management and integrated workflow are some of the innovative ways through which firm performance can be greatly improved in Nigeria's manufacturing industry. The recruitment process is crucial in any organisation given the role of employees in the organisation through the application of knowledge and skills on tasks assigned to them. The recruitment process comprises sequential steps to be followed in ensuring that applicants with relevant knowledge, skills and capabilities are selected. These steps include but are not limited to the job description, specification and profile; strategy development (advertisement); shortlisting of qualified applicants; screening/interview; and recruitment evaluation and control of applicants (Thebe and Waldt, 2015). Thus, this study identified a sound recruitment process as an organisational innovation method that significantly improves firm performance.

In addition, talent management was identified as an organisational innovation technique in Nigeria's manufacturing industry. Talent management can be referred to as an offshoot of a well-designed recruitment process and it includes activities that attract, identifies, develops, engages, retain and deploy valuable employees within an organisation (Baquatayan, 2014). Thus, it is not just enough to employ the right set of people in the organisation, it is equally important to design effective staff development programmes to discover, unlock and maximise potential talents in employees. Hence, an effective recruitment process and well-designed talent management have been identified as some of the organisational innovation methods to be implemented to increase employees' productivity and firm performance in Nigeria's manufacturing industry.

5. CONCLUSIONS

Innovation types were investigated and their effects on firm performance were equally examined. The study confirmed the existence of innovation types (product, process, marketing and organisational innovations) in Nigeria's manufacturing industry and identified recruitment modelling and talent management as other organisational innovation techniques employed among firms. A good innovation-performance-relationship is best described as one in which various innovation types employed exert significant positive effects. However, out of all innovation types examined only product innovation and patent rights have significant positive effects on firm performance, consequently, the study concluded that the overall innovation performance in Nigeria's manufacturing industry is poor.

The study recommends that firms should focus on improving the combined effects of product, marketing, process and organisational innovations because these innovation types complement one another. Thus, the effect of one cannot be separated from others in as much as the implementation of one should not be isolated from the implementation of others. In addition, organisational policies should be geared towards human capital development to achieve greater manufacturing performance required for industrial growth and economic development.

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