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The Emergence and Performance of New Technology-Based Firms in Nigeria

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Abstract: New Technology-Based Firms (NTBFs) are one of the key actors within the National System of Innovation. They are firms/businesses based on the exploitation of an invention and they play crucial roles in the processes of bringing new ideas or innovations to the market and by extension, contributing to economic growth. This paper provides empirical evidence on the emergence and performance of NTBFs in Nigeria. A survey design was used to collect data from NTBFs in the selected Technology Incubator Centres (TICs). Data were analysed using both descriptive statistics and the ordinary least square technique. The research results show that research and development (R&D) activities are vital for the growth and development of NTBFs, but this activity is still at a very minimal level. Product price, the number of employees, research and development, access to credit facilities, and the cost of raw materials are statistically significant in explaining the performance of NTBFs. The recommendations for ensuring the improved performance of NTBFs in Nigeria include the increased collaboration among NTBFs, universities, and research institutes, firms to spend at least 40 percent of their profit on research and development that relates to the improvement of their products, and the improvement in the level of the production process to enhance productivity and competitiveness.

Keywords: NTBFs, innovation, firm performance, research and development, Nigeria

1. Introduction

New Technology-Based Firms (NTBFs) are new firms and businesses based on the exploitation of an invention. They can be considered one of the key actors in the National System of Innovation. The key role they play is the bringing in of new ideas and innovation to the market and, by extension, contribution to economic growth. According to Simon (2003), the importance of NTBFs stems from their contribution to employment, technological innovation, and the diffusion of new technological knowledge. NTBFs employ a wide variety of creativity and innovation in their financial and production activities, as well as high efficiency of human resources (Bubou & Egai, 2012; Ismail & Ajagbe, 2013). Firms which are referred to as NTBFs or sometimes 'tech start-ups' can be characterised as located in the ICT sector or reliant on ICT services (ICT-enabled); the age of the firm is usually less than five years old and privately owned; not a subsidiary of another company; and the firm is often still searching for a reliable and sustainable

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revenue stream. In many countries, including Nigeria, the Technology Incubator Centre (TIC[1]) is one of the support programmes in place which links NTBFs with innovation (Egbetokun, Siyanbola, Olamade, Adeniyi, & Irefin, 2008). TICs in Nigeria provide tangible and intangible services to NTBFs (entrepreneurs, spin-offs of universities, and large firms) with the aim of helping them increase their chances of start-up, generating wealth, and remaining in business. Incubation assistance provided by TICs to NTBFs include hands-on management assistance, access to financing, business and technical support services, shared office space, and access to equipment. The key advantage expected from the assistance includes a reduction in the operating cost of an individual firm, thereby making them more competitive. Others include the advancement of the technology-base of the firm, assisting the firms in the identification of products/services worthy of entrepreneurial risk, as well as accelerating the technology acquisition/transfer from research institutes and tertiary institutions to entrepreneurs, among others. For instance, Ortega-Argilés & Voigt (2009), Audretsch (2004), and Dahlstrand (1994; 1999) show how start-up firms and university spin-offs produce major innovations.

McAdam & Marlow (2008) argue that the NTBF concept is a suitable policy tool for assisting the development and advancement of private venture enterprises, as several countries have used the incubator initiative as a strategy for job creation as well as wealth creation. Adelowo, Olaopa & Siyanbola (2012) also note that the basic objective of incubators is to bring forth successful businesses and to support entrepreneurs. Therefore, the integrated entrepreneurship development approach of technology incubation centers in Nigeria is one of the policy initiatives in place towards successful grooming, fostering, and nurturing of NTBFs as start-up firms, with a creative idea that can be nurtured to achieve firm performance and sustainable livelihood for entrepreneurs.

The theoretical perspective of this paper is undergirded by the theory of firm growth which is basically an examination of firm performance (Coad, 2009; Coad & Holzi, 2012; Farnoodi, Ghazinoory, Radfa, & Tabatabian, 2020; Kim & Castillejos-Petalcorin, 2020). Applying the theory of the firm in the context of this paper is with the assumption that NTBFs are expected to be innovative and efficient in sales, profits, and employment generation. Despite such strong assumptions, empirical evidence on whether NTBFs are efficient upon growth performances is somewhat controversial. This is because very few studies support innovation-led growth (Ndesaulwa & Kikula, 2016; Bhasin, 2012; Ojo et el., 2017; Jones & Vollrath, 2013; Segarra & Teruel, 2014), while others have contrary views (see Tetteh & Essegbey, 2014; Bergeaud, Cette & Lecat, 2014; Aghion et al., 2015; Nassar & Faloye, 2015). Abdu & Jibir (2018) posit that government efforts through TICs in Nigeria for speedy growth of NTBFs show that the investment in innovation is still relatively low compared to countries such as Indonesia, Malaysia, and Taiwan (Asian Development Bank (ADB), 2020; Khalid, Jabar, Kayani & Gilbert, 2017; Feigenbaum, 2020). Firms in these countries have developed rapidly and this is attributed majorly to private investment in innovation. Firm growth driven by investment in R&D activities is expected to trigger global competitiveness if well managed. The Asian Tigers, namely Hong Kong, Singapore, South Korea, and Taiwan have also embarked on an increased innovation expenditure which has led to their industrial growth and sustainable competitiveness (Hsieh & Klenow, 2012; ADB, 2020).

This paper provides the answers to the following research questions: (i) What are the types of NTBFs that have emerged in Nigeria? (ii) How have TICs affected the performance of NTBFs in Nigeria? and (iii) What are the challenges inhibiting the development of NTBFs in Nigeria?

2. Literature Review

Firm performance and its determinants have been examined extensively in the literature. For example, Ojo et al. (2017) reported a direct relationship between relationship innovation and the financial performance of the firm and concluded that the competitiveness of a business would be determined by the creativity and innovativeness of entrepreneurship. Egbetokun et al. (2008) explored the types and impact of innovation on different dimensions of firm performance in developing countries. The findings revealed that the focus of SMEs is either product or process innovations and concluded that the priorities of SMEs should be innovations that can be managed strategically given available resources.

Abdu & Jibir (2018), examining the major determinants of innovation at the firm level in Nigeria, find that investment in research and development (R&D), formal training, firm's size, exporting status, competitors, location, type and sector, or activity of a firm positively drive the propensity of a firm to innovate. However, the tendency of a firm's innovation is adversely affected by the age of the firm and the employee's education. Similarly, all the factors earlier mentioned are the significant determinants of product, process, organisational, and marketing innovation. Adeyeye, Jegede & Akinwale (2013), analysing the impact of technological innovation and R&D on firm performance in the Nigerian service sector, discover that technological acquisition, training, and in-house R&D positively influence technological innovation. However, government support is found insignificant owing to the lack of conducive business environment in the country, and this limit the firms' capacity to innovate. Also, the result shows that embodied

[1] Globally, the TIC is variously represented by entities such as Technopolis, Science Parks, Research Parks, Technology Parks, Technology and/or Business Incubators. These entities operate as separate organisations but are mostly integrated with other players in the innovation system.

knowledge from licensing and patents have an insignificant relationship with firm performance. To conclude, technology innovation and R&D activities are noted to have a direct impact on firm performance.

Nassar & Faloye (2015) conducted a firm-level cross-sectional study to explore the barriers to innovation in the Nigerian small and medium-scale firms (SMEs). The findings reveal that the major barriers to innovation in the Nigerian SMEs include inadequate financial means and venture capital companies to sponsor new innovations, inadequate government assistance, poor infrastructural facilities, the size of company and market, the lack of motivation for new innovations, inadequate research and development facilities within a firm, and the lack of opportunities for cooperation with other firms and research institutions. The authors conclude that Nigerian SMEs could only improve their performance and compete with other SMEs across the world if the barriers to innovation are reduced or eliminated. Tetteh & Essegbey (2014) employed a purposive sampling technique to assess the status of innovation among the 500 small, medium, and large firms in Ghana. The findings reveal that innovation in Ghana is more prevalent among small firms compared to medium and large firms. The study notes that most of the employees with university degrees are employed by large multinational and medium firms that are part of large groups. It also emerges that more than half (59 %) of the processed innovations are developed within the firms themselves and 21 percent of the innovative firms collaborate with other firms and institutions for their innovative activities. Azubuike (2013) adopts the Principal Component Analysis (PCA) approach, with Pearson's correlation analysis, to provide an understanding of the way technological innovation capabilities affect the efficiency and potential of firm performance in Nigeria. The author finds that innovation involves the process of commercialising or extracting values from ideas. Based on this perception, innovation is expected to be closely linked to firm performance or the development of a new product.

3. Theoretical Framework

The traditional explanation for the direct relationship between innovation development and firm performance rests on the work of Schumpeter (1934). In his argument, innovative new products, when first introduced to the market, face limited direct competition and consequently, enable firms to enjoy relatively high profits. Over time, these high profits are likely to erode due to imitation and competition, but firms that strictly continue introducing innovative new products may be more competitive and be able to achieve high profitability for a sustained period (Sharma & Lacey, 2004).

In another study, Varis & Littunen (2010) claim that the ultimate reason for firms to engage in innovation activities is to improve performance and be competitive. From the foregoing theoretical foundation, this study specifies a model to analyse the relationship between innovation development and the performance of NTBFs in Nigeria. In this study, turnover is used as a proxy for firm performance while R&D expenditure is used as proxies for innovation development. The model is specified as:

$$FP = f\left(ERD\right) \tag{1}$$

where *FP* represents firm performance and *ERD* denotes expenditure on research and development.

To incorporate other indicators of innovation development into the model, equation (1) is:

$$FP = f\left(ERD, J\right) \tag{2}$$

In equation (2), *J* is the vector of other measures of innovation development, such as product quality, the quality of raw material used, the age of the firm, the number of employees, provision for training for the employees, and the access to credit facilities. Following equation (2), the functional form of the equation for the dependent variable is stated as follows:

$$FP = f\left(ERD, PRQ, QMS, AGE, NOE, STP, ACF\right) \tag{3}$$

Explicitly, the empirical model to be estimated for this study can be fully specified as:

$$FP = \gamma_0 + \gamma_1 ERD + \gamma_2 PRP + \gamma_3 CRM + \gamma_4 AGE + \gamma_5 NOE + \gamma_6 STP + \gamma_7 ACF + \mu_i \tag{4}$$

where:
FP = firm performance
ERD = research and development expenditure
PRP = price of product produced
CRM = cost of raw materials used in the production

AGE = number of years in operation
NOE = number of employees used in the production process
STP = staff training/provision for staff training
ACF = access to credit facilities.

μ_i = error term

For $i = 1, \ldots, n$ n is the number of firms and for the parameters $\gamma_i's$ is the estimated regression coefficients. $\gamma_1, \gamma_4, \gamma_5, \gamma_6 and \gamma_7$ are expected to be positive while γ_2, γ_3 are expected to be negative.

3.1 Definitions and Measurement of Variables

- Firm performance can be proxied in four different dimensions, namely innovative performance, production performance, market performance, and financial performance (Yilmaz et al. 2005). In this study, firm performance is proxied as financial performance measured as turnover in sales.
- Research and development (R&D) is described as an activity or expense associated with the R&D of a company's goods or services. It refers to innovative activities undertaken in developing new services or products or improving existing services or products. It is also termed as the total expenditure incurred towards acquiring the needed capital input (such as equipment and machinery) and labour input (such as training employees to be more efficient). Following Wenzel, Khan & Evans (2009), R&D has been recognised as part of capital formation. In order to achieve this, several issues have to be addressed including deriving measures of R&D, price indices and service life. Presently, in Nigeria, R&D data are not well captured and the feasible means to capture this, particularly at firm level is to use expenditures on capital and labour inputs as the case may be.
- Product quality can be defined with respect to price, customer service, and product differentials. Suchánek, Richter & Králová (2014) argue that product quality can be constructed as the satisfaction of customers with a product and their willingness to repurchase the product.
- Age of firm refers to the number of years a firm has been in existence. It is indeed considered as one of several determinants of innovation that is common and vital to all firms (Abdu & Jibir, 2017).
- Quality of raw materials used in the production is a function of a production process which is expected to influence firm performance.
- Number of employees determines the size of a firm and is a vital determinant of firm performance (Abdu & Jibir, 2017).
- Staff training/provision for staff training enables the existing employees to acquire more knowledge and skills. According to Devanna, Formbrun & Tichy (1984) staff training and other HRM activities can increase individual performance, which is believed to lead to higher firm performance.
- Access to credit facilities is the access to finance which enables firms to expand their scale of operation, and consequently leads to higher performance.

Table 1 - Variables and their measurements

Variable name	Variable description	Measurement
FP	Firm's Performance	Sale values (Naira)
ERD	Research and Development expenditure	Expenditure on capital and labour inputs (Naira)
PRQ	Product Quality	Price of product (Naira)
QMS	Quality of raw materials used	Certification by regulatory agency Yes or No
NOE	Number of employees used in production	Units (number)
AGE	Age of firm	Number of years in operation
STP	Provision for staff training	Yes or No
ACF	Access to credit facilities	Yes or No

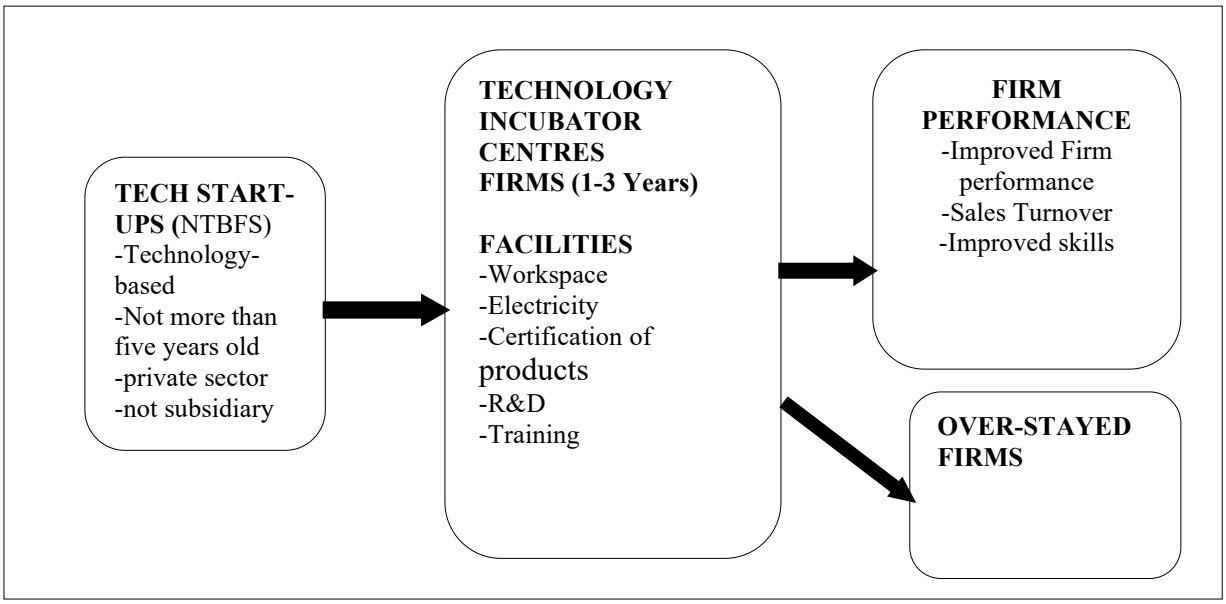

Fig. 1 - Link between NTBFs and TICs in Nigeria

4. Methodology

4.1 Research Design

A survey method was employed to generate primary data from the selected Technology Incubating Centres (TICs) and firms affiliated with them. All these firms were located within the TICs.

4.2 Sampling Procedure

A multi-stage sampling technique was adopted in this study. The Annual Report of the National Board for Technology Incubation (NBTI) provided a frame/list of all the TICs in Nigeria, showing a total of 24 TICs in the country (NBTI, 2017). The National Board for Technology Incubation (NBTI) is a government agency in charge with implementing the Technology Incubation Programme (TIP) in all 36 states of the federation.

The Technology Incubation programme is a one-of-a-kind and highly adaptable programme that includes a business development process, infrastructure, and people for the commercialisation of new technologies. NBTI is designed to nurture and grow new and small businesses, products, innovations, and entrepreneurs in their earliest stages of development. However, Technology Incubation Centres (TICs) are non-profit organisations that help entrepreneurs develop and structure by offering space, funding, networking, and mentoring. When these enterprises have been brought to the market and have demonstrated their ability to handle themselves, the incubation centers graduate them.

Following this, a purposive selection of two TICs in each geopolitical zones were selected, resulting in a total number of 12 sampled TICs. A random selection of ten firms located within each of the TICs or the number limited to firms located within the TICs, totaling 84 firms located within the 12 selected TICs. The choice of the purposive selection was guided by several considerations which include the age of the TICs, the number of functional incubation units in the TICs, and the number of firms and products in the TICs. The first TICs in Nigeria were established in Agege (1993), followed by Kano (1994) and Aba (1996), respectively. These first three TICs formed part of the sample in their respective geopolitical zone. The same justification of age of establishment and performance based on the number of firms located within the TICs was employed in other geopolitical zones to ensure the selection of either the oldest or the most active TIC in terms of number of firms and products. Table 2 presents information on the TICs in each of the six geopolitical zones in the country, as well as the selected TICs in this study.

Table 2 - Technology Incubation Centres (TICs) in Nigeria

TICs in each geopolitical zone	No. of Incubation Units	No. of Firms	No. of products	Selected TICS/firms for the study
SOUTH-WEST				
Lagos*	30	20	20	• Lagos (10) • Abeokuta (7)
Ile-Ife	10	0	0	
Abeokuta*	47	7	7	

Ekiti	8	0	0	
Akure	18	0	0	
Ibadan*	22	4	6	
SOUTH-EAST				
Aba*	19	18	18	• Aba (10)
Enugu	8	0	0	• Nnewi (10)
Anambra*	30	16	42	
Imo	9	0	0	
SOUTH-SOUTH				
Bayelsa	**4**	0	0	• Calabar (10)
Calabar*	**20**	10	17	• Uyo (6)
Benin*	**13**	8	15	
Akwa Ibom*	**10**	6	6	
Delta	**8**	8	11	
				• Jos (0)
NORTH-CENTRAL				• Minna (10)
Jos	**17**	0	0	
Minna	**22**	18	18	
NORTH-WEST				
Zamfara*	**8**	3	5	• Kano (10)
Kebbi*	**8**	5	9	• Kebbi (5)
Kano*	**24**	13	23	
Sokoto	**10**	5	5	
NORTH-EAST				
Taraba	8	0	0	• Yola (0)
Maiduguri*	8	6	6	• Maiduguri (6)
Yola	6	0	0	

***= TICs with functional incubation units**
Ibadan TIC was used as the pilot study
Source: Annual Report of NBTI, 2017

The selected TICs was used as the entry point to the selection of surveyed firms. The current study attempted a random selection of ten firms located within each of the TIC (where they exist), otherwise utilised the number of firms that existed within the TICs. A total of eighty-four (84) firms located within the twelve selected TICs were sampled.

4.3 Research Instruments

A structured questionnaire was used to collect data from sample firms in the selected TICs. The types of data collected were background information (age of the firm, location, types of products, or services), the nature and type of innovation, the investment on innovation (source of investment and available credit facilities), firm's growth (output, production, and turnover), labour characteristics (the nature and category of employees, level of education, and type of training), machinery and equipment (source, cost of acquisition, maintenance), market (targeted customers/ clients), income (sales target), production (the expected volume of output), the necessary types of machinery and equipment (type, source (s), cost), infrastructure requirements (type and source), and credit facilities (source (s), amount), as well as challenges in their operations.

4.4 Analytical Techniques

The current study applied quantitative methods to analyse data. Simple descriptive statistics such as the measure of central tendency (mean, percentages, charts, frequency distribution) and tabulation of data were employed. The ordinary least square (OLS) technique was used to analyse how TBIs affected the performance of NTBFs in Nigeria.

5. Results and Discussion

5.1 Types of Innovation in NTBFs in Nigeria

The types of innovation undertaken by the firms in the surveyed TICs are in terms of span product and process and marketing innovations in chemicals, engineering, food, leather, and information and communication technology (ICT).

All firms focused on more than one areas of innovation. Three areas of focus were identified as the most predominant among the TICs. These were chemicals, engineering, and food. Very few TICs' innovation focused on ICT and leather. The types of innovation predominant in each of the surveyed TICs are reflected in Table 3. Innovation in engineering, food processing, and chemicals are the most predominant innovations among the surveyed TICs. Innovations in engineering are predominant among the first generation of TICs, while innovations in food, chemical, and engineering are predominant among the second generation of TICs. Innovations in chemicals and food processing are also predominant in the younger TICs.

Table 3 - Types and focus of innovation in surveyed TICs

Name of TIC	Focus of Innovation
Technology Incubation Centre, Aba	Chemical and allied, agro processing, leather, ICT
Technology Incubation Centre Abeokuta	Food, chemical, engineering
Technology Incubation Centre, Calabar	Fabrication, chemical processing, food processing, electrical and electronics, leather works, paper
Technology Incubation Centre, Jalingo	Chemicals, food, engineering, leather works and ICT
Technological Incubation Centre, Jos	Food, herbal medicine/supplements, engineering
Technology Incubation Centre, Kano	Fabrication, agro-allied, mechanics, industrial equipment, electrical &electronics and software development
Technology Incubation Centre, Lagos	Food and engineering
Technological Incubation centre, Minna	Chemicals, food and engineering
Technology Incubation Centre, Nnewi	Engineering, chemical and food
Technology Incubation Centre, Uyo	Chemicals, food and engineering
Technology Incubation Centre, Yola	Chemicals and food
Technological Incubation Center, Zamfara	Food processing, engineering fabrication, chemical &allied

Source: Field Survey 2018

Research and Development (R&D) activities, including in-house R&D, external R&D, machinery/equipment acquisition, and training are vital for the growth and development of NTBFs. Figure 2 shows that about 70.7 percent of the surveyed firms had some form of research and development (R&D) in place. The firms reported embarking on R&D in product innovation, process innovation, marketing innovation, and quality product innovation.

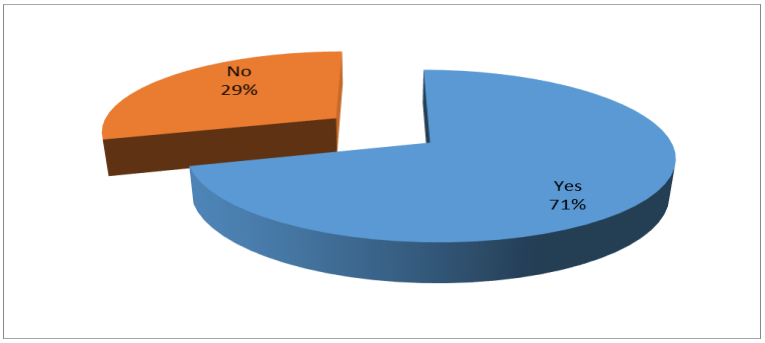

Fig. 2 - Firms' engagement in R&D activities

Source: Field Survey, 2018

Firms attested that they undertook various forms of R&D to enhance the market for their products. Figure 3 presents the forms of R&D activities. About 36 percent of the firms shuttled between new product development and improving product quality (product upgrade), 15 percent embarked on market research, 10 percent collaborated with university/research institutions, and only 7 percent conducted research and development in waste management.

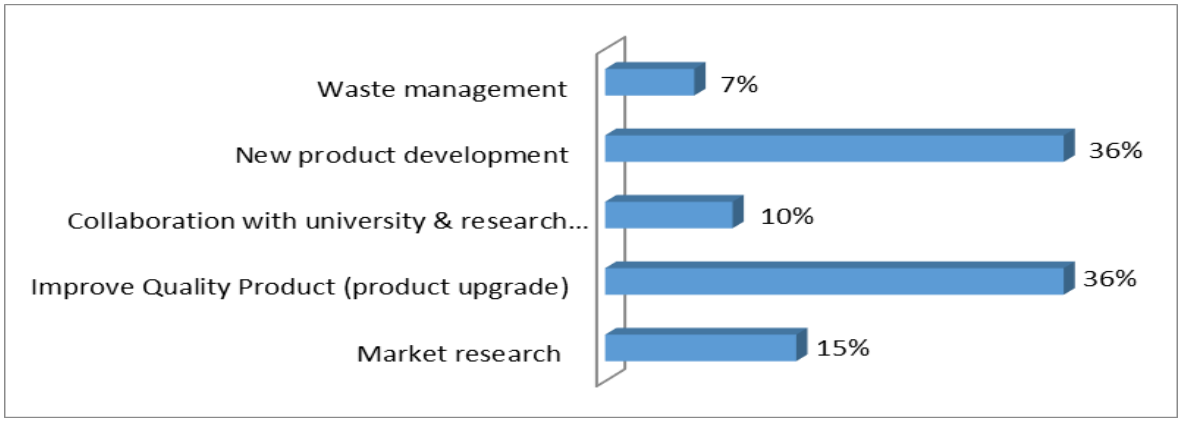

Fig. 3 - Forms of R&D activities

Source: Field Survey, 2018

5.2 Effect of TIC on the Performance of NTBFs in Nigeria

Table 4 summarises the results of the OLS regression analysis employed to show the effect of TICs on the performance of NTBFs in Nigeria. The estimated results revealed that the variables of product price, number of employees, research and development, access to credit facilities, and raw materials are statistically significant in explaining the performance of NTBFs. However, training facilities and age of the firm are not statistically significant.

Table 4 - The results of the regression analysis

Dependent Variable	Independent Variable/Constant	Coefficients	T-Values
Log(FP)	C	9.169	6.74
	Log(PRP)	0.201	3.30***
	AGE	0.038	0.51
	LNOE	0.345	2.03**
	STP	0.346	0.78
	ERD	0.499	1.75*
	ACF	-0.706	-2.44**
	LCRM	0.246	3.56***
	R^2	0.2686	
	Adjusted R^2	0.2323	
	F-statistic	7.40 (0.0000)	

Note: below indicates the significant level of t-value, while *, ** and *** represent 1 %, 5 % and 10 % significant levels.

The regression equation shows a positive intercept which implies that the performance of NTBFs largely depends on the level of innovation development being undertaken. The product price in the NTBFs shows a positive beta-coefficient which implies that the higher the unit price of their product, the higher the performance of the firms. This does not follow the a priori expectation because charging a higher price on any product is expected to reduce the volume of such products being sold and will invariably affect firm performance. However, products that are inelastic in nature command higher prices. This might be due to the low degree of substitutability and that consumers can rarely do without such products.

Regression results in the number of employees and firm performance of NTBFs to show a positive beta-coefficient. The translation of this result is that as the number of employees in the firm increases, there is the likelihood that the activities of the firm will expand. When more employees are engaged in a production process, the division of labour would be encouraged. The estimation results further suggest that a unit increase in the number of employees engaged in a production process could improve the performance of NTBFs by about 0.35 percent. A similar result is established by Abdu & Jibir (2018), who have found a significant positive impact of a firm's size, measured by the

number of employees on a firm's innovative tendency. They conclude that the tendency of a firm to innovate could be driven by investing in firm's size, research and development (R&D), and formal training, among others.

Research and development (R&D) is positive and statistically significant to explain the performance of NTBFs. This conforms to a priori expectation because the effort or ability of firms to undertake innovative activities, develop new services or products, or improve the existing services or products could bring about improved performance of the NTBFs. For instance, a one percent increase in the expenses incurred on innovative activities could result to an increase in the performance of NTBFs. The result agrees with theory and is consistent with the findings of Adeyeye, Jegede & Akinwale (2013), as well as Nassar & Faloye (2015). These authors submit that inadequate research and development facilities within a firm is a part of the major barriers to innovation in the Nigerian SMEs and this could adversely affect firm performance.

The significant negative coefficient of access to credit facilities does not follow the hypothesised sign as the performance of the NTBFs could be improved, even though there is no access to credit facilities. This is counterintuitive because the success of firms can only be guaranteed if they have access to credit facilities. This result does not conform to the theory and the study of Ojo et al. (2017) who found the existence of a direct relationship between relationship innovation and the financial performance of a company.

Lastly, the positive coefficient of the cost of raw material used in the production does not conform to the hypothesised sign. The cost of raw material is expected to negatively affect the performance of NTBFs because the nature of produced products determines the type of raw material required, the associated costs, and the source. The estimated result showing significant positive coefficient on the cost of raw materials implies that the performance of NTBFs could be enhanced even though there is an increase in the cost of raw materials required to produce both intermediate and finished goods. This is likely to happen if firms use imported raw materials of high quality. There is also a possibility that firms' turnover will increase tremendously despite the increase in the cost of raw materials. The result suggests that the performance of NTBFs could be improved by 0.25 percent if the cost of raw materials used increases by 1 percent.

The F-statistic value (7.40) shows that the overall model is statistically significant at one percent level of significance. This means that all the explanatory variables simultaneously explain the variations in the performance of NTBFs. Also, the variables were statistically significant at 99 percent confidence interval, with exception of LNOE and CRED that were significant at 95 percent, while ERD was significant at 90 percent confidence intervals, respectively. Being a survey study, the coefficient of determination (R^2) is not expected to be high as the estimated result only reveals about 27 percent changes that could be explained by the explanatory variables in the model.

5.3 Challenges Inhibiting the Growth of NTBFs in Nigeria

As shown in Figure 4, inadequate finance is considered the most severe challenge with 42 percent of the surveyed firms attesting to this. This challenge prevents firms from working at optimum capacity. Next is the challenge of infrastructure which was reported by 37 percent of the surveyed firms. Identified infrastructure challenges include lack of electricity, epileptic power supply, lack of utility vehicles, and inadequate water supply. Training was also considered inadequate by 13 percent of the surveyed firms. Inadequate training manifests in low skills and knowledge acquisition by the staff of a firm. The poor working environment within the TIC is also considered a challenge by eight percent of the surveyed firms. Most of the TICs where the NTBFs were accommodated had dilapidated building, inadequate space, and poor infrastructure (particularly roads, water, and electricity).

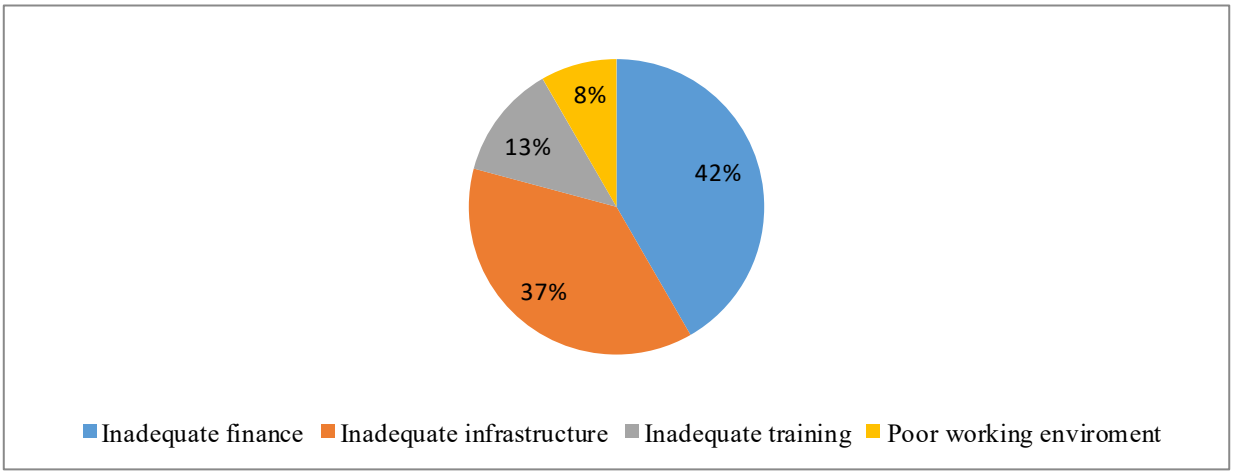

Fig. 4 - Challenges faced by NTBFs

Source: Field Survey, 2018

5. Conclusion and Policy Recommendations

This study concludes that the purpose of NTBFs and their location within TICs in Nigeria is essential, hence must not be undermined to achieve innovation development and economic growth in Nigeria. The performance of these firms has important roles to play in employment generation, poverty reduction, and growth of the Nigerian economy. It is in this regard that we propose several policy recommendations.

Firstly, allocations given to the TICs should be increased to enable them to achieve the mandate of nurturing NTBFs. In addition, state governments and NGOs in each of the states where the TICs are located should also play the role. The National Board for Technology Innovation (NBTI) should also liaise with the governments of each state of the federation to raise funds for the TICs. This enables the TICs to have enough space or buildings to nurture more innovators, repair dilapidated buildings, install and maintain infrastructures (water, electricity, and equipment), and provide staff trainings among other things. Secondly, increased collaboration between NTBFs, universities, and research institutes should be encouraged. Accordingly, there will be opportunities to harness R&D outputs of tertiary institutions and research institutes for industry use to achieve the desired linkages for technical progress and capacity build-up. Thirdly, firms are encouraged to spend at least 40 percent of their profit on research and development that relates to the improvement of their products, as well as improve the level of production process to enhance their productivity and competitiveness. Lastly, the activities of firms in TICs should be regularly publicised through electronic and print media. The National Board for Technology Innovation (NBTI) should initiate and produce jingles, handbills, and billboards to promote the activities of the TICs. Firms should also participate in various trade fares organised by their localities to showcase their products and activities. This will enable more start-up firms' innovative ideas to locate the TICs and nurture their ideas into successful businesses.

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