Technopreneurship as a Pathway to Sustainable Business Performance: Empirical Evidence from SMES in Nigeria

Ola Olusegun Oyedele[1], Paul, I. Ojeaga[2], Idris Olayiwola Ganiyu[3], Evelyn Derera[4], Mutiu Adeleke Oyero[5]

Abstract: The overall objective of the study was to examine empirical evidences on how technopreneurship impacts business sustainability carried out in some selected areas in Abeokuta, Nigeria. A sample of 126 respondents were selected using Yaro Yamane random sampling method. A primary method of data collection was used, a well-structured questionnaire was administered, and responses were analysed using linear regression. The frequency of responses to each of the explanatory variables in the questionnaire are shown using frequency tables. The study findings which were based on the test of two (2) hypotheses in the study, show that intellectual property rights have significant impact (R2 = 0.294 and P = 0.000) on business profitability, research and development and innovation (R&D&I) has a direct positive (R2 = 0.292 and P = 0.000) effect on business earned revenue. The study recommends that businesses should possess or sell and commercialise intellectual property rights (IPRs) and engage in research, development and innovation as this boosts business turnover or sales revenue earned. Finally, technopreneurship should be a central concern for government and policymakers.

Keywords: intellectual property; research; development; innovation; business performance

JEL Classifications: M12; I31

1. Introduction

Emerging economies have come to realise the prospects of technopreneurship (a blend of innovation, technology and entrepreneurship) in stimulating economic prosperity in today's globalised and knowledge-driven world. More emphasis and attention from researchers/academia, policy makers, think tanks and the government, is given to technological innovation as a key driver of sustainable business performance, sustained long-run competitive advantage and national competitiveness. In this part of the world there exists an acute insufficiency of science and technology, most especially high-tech entrepreneurial competence needed to propel technology entrepreneurship. This situation has led to the near non-existent productive capacity of the continent, with quite minimal potentials for innovation (Bubou & Siyanbola, 2010).

[1] Federal University of Agriculture, University of Agriculture, Nigeria, Address: Makurdi, P.M.B 2373, Makurdi, Benue State, Nigeria, Corresponding author: oyedeleoo@funaab.edu.ng.
[2] Federal University of Agriculture, Nigeria, Address: University Of Agriculture Road Makurdi Benue North Bank, Nigeria, E-mail: drpaulojeaga@gmail.com.
[3] University of KwaZulu-Natal Durban, South Africa, Address: 238 Mazisi Kunene Rd, Glenwood, Durban, 4041, South Africa, E-mail: ganiyui@ukzn.ac.za.
[4] University of KwaZulu-Natal Durban, South Africa, Address: 238 Mazisi Kunene Rd, Glenwood, Durban, 4041, South Africa, E-mail: dererae@ukzn.ac.za.
[5] College of Management Sciences, University of Agriculture, Nigeria Address: Makurdi, P.M.B 2373, Makurdi, Benue State, Nigeria, E-mail: oyeromutiu@gmail.com.

Technopreneurship is an emerging concept that is placed at the core of many fundamental subjects and concepts. It is a relatively new term and is receiving increasing recognition from the scholars of various areas of business, science and technology disciplines, as well as from players in the business world. It stresses integration of technology with entrepreneurship. According to Wood (2011), technopreneurship is a logical or gradual process which progress in four phases - innovation disclosure and intellectual property protection, awareness and securing industry collaboration, commercialisation mechanism selection, and commercialisation. It is important to note that discoveries in the form of technological innovations and/or results of R&D&I remain in crude form unless they are commercialised. In a research conducted by Matejun (2016), he posits that the scope of operations that constitute part of technology entrepreneurship needs simultaneous and cooperative involvement of the enterprise in four basic areas which include:

- Internal company entrepreneurship - involving identifying market opportunities and commercialising ideas to create value;
- Individual or firm's technology and innovation potential - involving identifying and developing competencies, knowledge, skills and engaging in research and development;
- Integration of business and science - cooperation with research institutes, building a network of connections and gaining access to external knowledge;
- Market distribution of technological and innovation effects - identifying market demands, implementing technologies and gaining feedback from customers.

Nonetheless, few extant studies examined technopreneurship in developing economies. Views of SMEs on technological entrepreneurship development programmes/practices with impact on business performance and the challenges in the Nigerian context have not been adequately explored (Aribaba et al., 2011; Bubou and Okrigwe, 2011). The basis for the development of technopreneurship is formed, therefore, through interactions between science, technology and business (Poznańska, 2010). All the activities of this phenomenon relate to "the identification of potential entrepreneurial opportunities arising from technological developments, and the exploitation of these opportunities through the successful commercialization of innovative products" (Petti, 2012). Aderemi et al. (2008) positioned technological entrepreneurship as being needed to make optimum use of the available knowledge of science and technology in response to market needs, thereby making the economy in question more productive and more internationally competitive.

How technopreneurship sustains business performance and the relationship between them is premised upon availability of capital, advanced technology transfer, role played by universities and research institutions through linkage/partnerships with private sector to efficiently harness knowledge, support in terms of policies and infrastructure, intellectual property, entrepreneurial culture, among other constructs (Aderemi et al., 2011; Akande & Oladejo, 2013; Fowosire, Idris & Opoola, 2017; Abbas, 2018).

2. Literature Review

Technology is the application of scientific research in the industries (an enterprise) where innovations are nurtured till new products reach the hands of the end users. Technopreneurship results in commercialisation of such innovative ideas. If such ideas or intellectual property assets are left unprotected, a good invention or creation may be lost to larger competitors/counterfeits that are in a

better position to commercialise the product or service at a more affordable price, leaving the original inventor or creator without any financial benefit or reward (Sukarmijan & De Vega Sapong, 2014). As a matter of fact, economy, markets and businesses grow better with innovation performance as it ultimately results in better economic (profits, costs, outputs etc.) performance with rapid progress in various sectors, such as agriculture, manufacturing and service. However, how such performance levels could be achieved depends on how creative the products are, of what valuable standard the product is and how that standard is protected and secured through property protections (Fowosire, Idris & Opoola, 2017). Entrepreneurs and innovators alike consider property rights a major problem in the commercialisation of their products and processes: "89% had not explored the use of the patent law, even though the law had been enforced since 1970 and 6 644 patents have been registered with only 177 owned by Nigerians" (Aderemi et al., 2011).

Furthermore, creating links between knowledge generation and commercial/market opportunities remains one of the notable challenges faced by African countries generally (Juma, 2006). For instance, in our own economy, it has really been difficult to commercialise knowledge and ideas that emanate from researches in universities and other research institutes, turning them into value added innovative products, processes and services. Distinctively, the availability of innovation subsidies, linkages with knowledge centres, firm-level investments in research and development (R&D) and the firm's internal processes of skills, competence and capacity building in tech-research are identified as crucial for successful innovation (Akande & Oladejo, 2013). A particular knowledge gap identified in the review of previous literature shows that most of those studies are unavoidably context-specific, making the knowledge on innovation in SMEs still limited. Thus, the knowledge about what types of innovation SMEs undertake, how they actually do this and the impact of their innovation efforts on different dimensions of firm performance remains limited (Oke et al., 2004; Akande & Oladejo, 2013) especially in the developing countries (Bala- Subrahmanya, 2005). Firms that are able to use innovation to differentiate their products and services outperform their competitors, whether the measure of performance is in terms of market share, operational efficiency, profitability, growth, or market capitalisation and so on (Okorie et al., 2014; Selvarani & Kanagaraj, 2015).

A careful look at the factors influencing technology entrepreneurship is of particular importance to emerging/rapidly growing economies because to transcend from the factor/efficiency-driven stage to the innovation-driven stage of economic development, they must compete by ability to produce new and different goods using the most sophisticated production processes and through innovation (Wennekers, Wennekers, Thurik & Reynolds, 2005; Pathak, Xavier-Oliveira & Laplume, 2013). Review of extant literature shows that a number of factors influence technopreneurship either by stimulating or inhibiting a firm's attitude towards innovation, evident in its innovative activities or behaviours. They include government supported developments, financial resources, academia-industry collaborations, and market dynamics, all of which are externally driven factors. A number of internally driven elements for the firm include management orientation, organisational culture, technology orientation, alliance and cooperation, and market orientation. The external environment may potentially determine the development of technological innovations. Both endogenous factors and external environment undoubtedly play an important role in the process of technopreneurship linked with the basic pillars of knowledge economy (Avlonitis & Gounaris, 1999; Al Ansari, 2014; Matejun, 2016).

2.1. Theories

The review of the relevant business management and entrepreneurship literature revealed theories like the firm's theory and resource-based theory, both of which are relevant to the topic of research "technopreneurship as a pathway to sustainable business performance". This study is however anchored on resource-based theory. Technopreneurship and the resource-based view are interdependent because they are both concerned with how to create and capture value through resources that embody technology and scientific advances. While technology entrepreneurship applies to any firm that relies on and is affected by advances of science and technology, the resource-based theory applies to those few firms that are continuously successful (Bailetti, 2012).

2.1.1. Resource-Based Theory

According to resource-based theory, sustainable business performance results from resources that are inimitable, not substitutable, tacit in nature, and synergistic (Rylander, 2001; Barney, 1991; Al Ansari, 2014). It aspires to explain the internal sources of a firm's sustained competitive advantage; as such managers need to be able to identify the key resources that drive performance (Kraaijenbrink, Spender & Groen, 2010). Based on this theory the intellectual capital is a main resource to improve enterprise growth. It can be human (characteristics, knowledge, skills, and capabilities), organisational (technology, processes, patents, and networks), and social (links with customers, suppliers, and partners), all of which are important strategic resources/assets which the firm needs to propel its innovation efforts alongside increasing and sustaining competences and capabilities (Dorf & Byers, 2008; Martinez-Roman, Gamero & Tamayo, 2011). Moreover, intellectual capital has been studied by many past researchers who investigated the influence of intellectual capital on business performance (Ngugi, Mcorege & Muiru, 2013).

Also, through continued use, these "capabilities", defined as the capacity for a set of resources to interactively perform a stretch task or an activity, become stronger and more difficult for competitors to understand and imitate - which usually result from R&D and can be used to augment future production possibilities (John, Maurice & Joseph, 2013). Teece (2010) exposits that "the resource-based view suggests that the firm, when operating in changing business and market environments, is required to encompass resources (i.e. capabilities and competencies) and perform tasks efficiently and expeditiously to capture new opportunities and threats and to meet customer needs by either morphing existing, or creating new ventures". The theory however failed at explaining the innovation process issues, to deal adequately with the issue of complementarities of resources, to explain dynamic capabilities, to acknowledge the role of human involvement (mental processes and judgements) in assessing and creating value, and to explain how to manage resources in ways that sustain business performance (Wiengarten et al., 2013).

2.1.2. The Theory of the Firm

The technopreneurship domain and the theory of the firm are also interdependent; the firm constitutes the specialised individuals and heterogeneous assets committed to a project or goal for the purpose of creating and retaining value for the firm. The theory of the firm aims to explain why firms exist, what determines their boundaries, what determines their structure, and what drives their different actions and performances (Bailetti, 2012). According to Teece (2010), the theory of the firm has not done much in explaining the process of innovation in creating new products and services and their profitable commercialisations. This assertion birthed "the innovative firm" rather than the adaptive/optimising firm that utilises strategies and mechanisms like creating new organisational

capabilities and values to innovate and improve business performances through providing the framework that permits managers to assemble particular complementary and co-specialised assets and identify opportunities for producing values of innovative products and services to customers and delivering those values at higher profits in the marketplace (Normann & Ramirez, 1993; Teece, 2010, Al Ansari, 2014). The framework in Figure 1 underlies the subsequent conceptual review of literature.

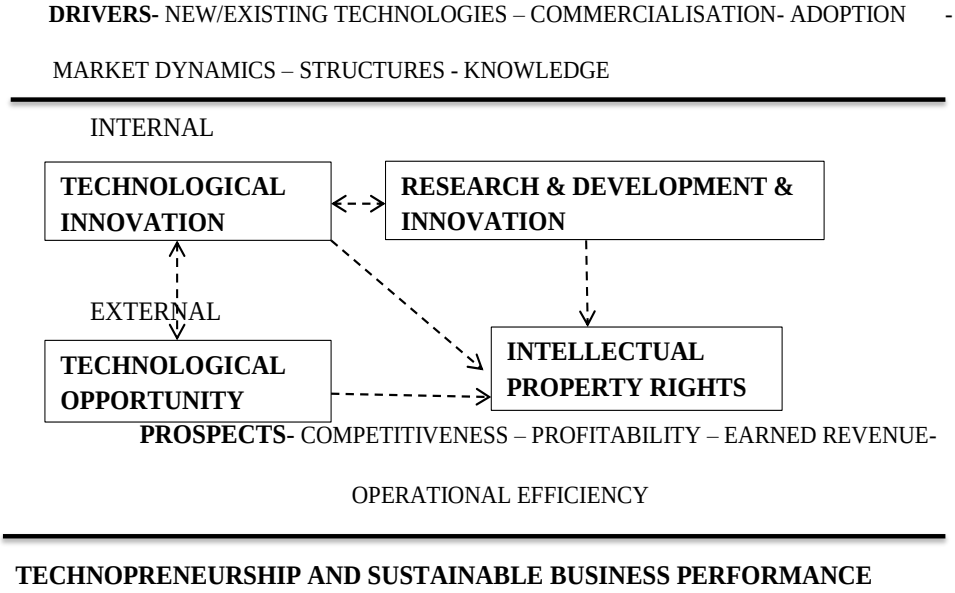

Figure 1. Conceptual Framework

2.2. IPR and Profitability

Intellectual property rights (IPRs) is a bundle of legally recognised rights that includes intangible creations of the human intellect, and primarily encompasses copyrights, patents, trademarks, trade secrets, geographical indication, publicity rights, moral rights, rights against unfair competition, and artistic works like music and literature, as well as some discoveries, inventions, words, phrases, symbols, and designs, through which ideas or inventions are protected (Mohd Noo, 2011; Sullivan, 2016). Technological innovation gears and contributes to the technological progress of countries; such development depends on the extent of protection granted to innovators (Goldstein & Reese, 2008). Profitability is the primary goal of all business ventures and without it the business will not survive in the long run - and is not sustainable. Profitability is measured through income and expenses. Income is money generated from the activities of the business, while expenses are the cost of resources used up or consumed by the activities of the business (Hofstrand, 2009).

According to Fowosire, Idris and Opoola (2017), better performance results in different industries and sectors of the economy can be achieved through innovations, quality of innovations, and patenting culture. Patenting culture explains the importance of IPRs in ensuring performance of Small and Medium-Sized Enterprises (SMEs). Intellectual property (IP) can become a valuable business asset if it is legally protected and there is a demand for the IP-related products or services in the marketplace. IP may generate income for the SME through licensing, sale or commercialisation of the IP products or services that may significantly improve the SME's market share or raise its profit margin (Idris, 2003). A direct link exists between the result of R&D and business performance based on the number of property rights or income of technical fee. Patent among direct performance is a means for

effectively protecting competitive assets including products of enterprise, process and service, stimulating research and development, and ultimately for measuring the ability of technology innovation and the effect of technical competitiveness of the industry. Studies from which this evidence was adapted have been deeply conducted and seem to depict positive effects on performance (Allred & Park, 2007; Artz et al., 2010; Pathak, Xavier-Oliveira & Laplume, 2013; Minseo, Ji-eung, Yeong-wha & Kwang-sun, 2018).

However, not all intellectual property may be relevant or applicable to agro-based product or service that relates well with the study (MohdNoo, 2011). Trademark is quite relevant - an IPR granted to firms on brands as consumers tend to be more influenced by brand rather than product or service. Another IP is geographical indication – which provides legal protection to products of natural resources based on their geographical origin. In general, geographical indication is a sign used on goods which have a specific geographical origin and possess particular qualities or a reputation due to that place of origin (MohdNoo, 2011). The role of IPRs like patents, protected designs and copyright, have been extensively discussed in literature; however for SMEs there is no strong evidence to support its importance as well they may be disadvantaged due to the costs of IP registration and protection (Blackburn, 2003; Love & Roper, 2013). Therefore, the following hypothesis will be tested:

HO_1: How does an intellectual property right influence businesses profitability?

2.3. R & D & I and Earned Revenue

Research and development (R&D) refer to innovative activities undertaken in developing new services or products, or improvement in existing services or products. It is presumed that the outcome of a R&D activity/process is innovation; hence innovation stays on as a crucial part of primary/normal business activities to earn revenues (also known as sales, turnover or net sales) usually from the sale of goods and services to customers. Revenue is also referred to as sales or turnover. In addition, some studies proved that R&D has no direct relation with innovativeness (Kwon & Lee, 2004); so far other studies in UK firms suggest that R&D and innovation are mutually reinforcing (Harris & Moffatt, 2011; Love & Roper, 2013). This therefore influenced the fusion of research and development and innovation (R&D&I) as a construct for this study. The R&D&I view of technopreneurship can be explained in two ways: corporate technopreneurship (in-house R&D) and corporate and institutional partnerships or collaborations.

Corporate technopreneurship process is a system of internal entrepreneurial processes mainly related to technological innovation and strategic capabilities, where technology may be utilised as a system of theoretical and operational knowledge and skills by enterprises to exploit opportunities that emanate like products and services as well as innovative business models; all of which are embodied in its personnel, materials, facilities, equipment, and physical procedures and processes (Petti & Zhang, 2011; Dolatabadi & Mohammad, 2013). “In-house research and development (R&D) play a crucial role in firms’ ability to generate new knowledge which may provide the basis for proprietary intellectual property and innovation” (Love et al., 2009). Furthermore, innovation in smaller firms is less dependent on internal R&D than in larger firms and more dependent on external knowledge obtained either through partnerships or spillovers, particularly for SMEs where formal R&D measures noticeably under-report their research activity and degree of innovativeness. Nonetheless, innovative enterprises tend to perform better than others, as reflected in their sales turnover and profit (Piergiovanni, Santarelli, & Vivarelli, 1997; Ganotakis & Love, 2011; Adegbite, 2012).

Corporate and institutional partnerships or collaborations focuses on efforts to connect the scientific potential of universities and research and development centres with capital market institutions and business activities (Flaszewska & Lachiewicz, 2013). The bright future of technopreneurship in emerging economies is grounded upon central roles for universities, research institutions, incubators and innovation centres to contribute to, by establishing alliances/integration with universities and superior technology companies and introducing them into the country with sustained financial support from stakeholders. Such alliances foster competition - the primary motivation of continuous learning and development (Abass, 2018). Figure 2 showcases the effective factors of the corporate technopreneurship process.

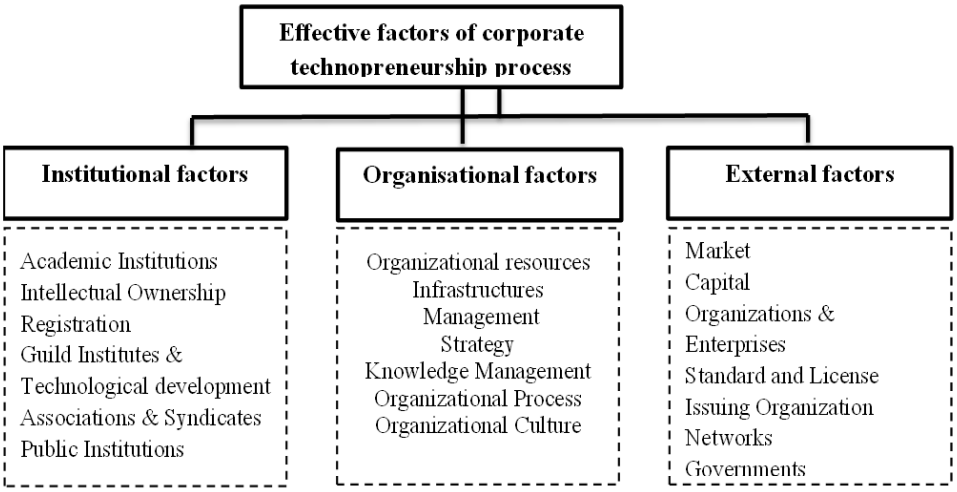

Figure 2. Research Models of Effective Factors on Corporate Technopreneurship

Source: Petti and Zhang (2011). Factors Influencing Technological Entrepreneurship

Figure 2 shows collaborations with institutions like public and private universities, science and technological centres, and academic research centres for innovation. Sourcing and providing a capital and financial support fund for researchers and supporting fund for investment are some other activities. Consequently, it entails integration of science and business, where focus is placed on creating a cooperation with research and academic institutions, thereby enhancing enterprises' learning ability, promoting rapid tech/knowledge transfer, accelerating the flow of information to enable enterprises to timely access to technological innovation, reducing the innovative resources shared and the risk of investment in research and development, as well as building profound networks for the exchange of knowledge (Daqi, 2013; Matejun, 2016). Distinctively, the role of government and public sector institutions in supporting technopreneurship cannot be overemphasised; they come in various forms either directly or indirectly, more importantly through regulations and public policies for creating and reinforcing a stable ecosystem for technopreneurship and boosting the national innovation system (Venkataraman, 2004, Adegbite, 2012).

Empirical evidences from literature revealed that involvement in developing technology entrepreneurship may be a source of numerous benefits to SMEs, some of which include sustainable competitive advantage and operational efficiency (Motyka, 2015). Foray Hall and Mairesse (2007) argue that R&D&I expenditures are positively correlated with sales growth while Del Monte and Papagni (2003) show that R&D&I has a positive impact on firm growth, but this is more pronounced in traditional industries than in the most 'high-tech' ones. Lin (2007) evidenced that the tendency of

owners to engage in new ideas, novelty, experimentation and creative processes results in new products, services or technological processes, which has great influence on the performance of SMEs. Innovations caused increased firm sales in Taiwan while another study by Ngungi (2013) found that innovation has a weak link with performance (in terms of sales) in Kenya. Also, empirical evidence from literature suggests that there exists a statistically significant positive degree of association between innovations, sales and sales growth (Ayandibu, Ngobese, Ganiyu, & Kaseeeram, 2019; Lin, 2007). A significant majority of the innovative SMEs could convert their innovative efforts into earned sales, though in varying proportions in total sales - a vast majority of them to achieve sales growth more than others. Similarly, they distinctively attain higher growth compared to non-innovative SMEs in sales turnover in all the three sectors covered by the study (auto components, electronics, and machine tool sectors of Bangalore in India) (Subrahmanya, Mathirajan & Krishnaswamy, 2008).

Furthermore, there exists a positive impact of technology entrepreneurship development programmes on the performance of the participating small businesses. The level of participation among those who were aware was high and regular with reasons including learning new technique, improved productivity, increased turnover, and improved product quality (Akande & Oladejo, 2013).

HO_2: Research and development and innovation have no direct effect on business earned revenue performance.

3. Research Methodology

The research adopted a survey research design. It was carried out as an empirical study that assesses the impact of technopreneurship on sustainable business performance. The respondents were purposively randomly selected. They are all owners of agro businesses within farm settlements in the study area which includes Ibara Orile (Ponkuku Village), Idi-Aba (Mile 6), Alabata, and Owowo in Abeokuta, Ogun State, Nigeria. Businesses situated in these areas include poultry farms, pig farms, fish farms, Cassava processing, fruit and crop production, among others. Primary method of data collection was used to collect necessary data that was used for the analysis of this study with the aid of purposive, well-structured questionnaires as well as through an in-depth personal interview guided by the questions raised in the questionnaire. This proved to be most effective due to the fact that most respondents could not fill in their responses and due to time constraints. A sample of 126 respondents was identified from a population of 183 agro businesses within the study area using the random sampling method of Yamane (1967) and the Rao soft sample estimation method based on reports of the number of agro businesses in the study area. Response rate was 74% - the number of questionnaires administered that were returned. The questionnaire instrument was designed using a six (6) point Likert scale – 1 Strongly Disagree (SD), 2 Disagree (D), 3 Fairly Disagree (FD), 4 Fairly Agree (FA), 5 Agree (A) and 6 Strongly Agree (SA). Each of the dependent and independent variables of the research construct were measured by four (4) items each validated by different authors found in extant literature. Pre-test was also conducted through a pilot study which was carried out to ascertain the research instrument's validity to gain insight into the language or causality or structural problems in the questionnaire and necessary modifications were made. Cronbach and split half method of reliability test results - Cronbach $\boldsymbol{\alpha}$ - 0.773, split halves 0.590 and 0.690 respectively - show that the research instrument is reliable (Kumar, 2010). The independent variable of the study is

technopreneurship and this was measured by R&D&I and IPRs, while the dependent variable sustainable business performance was measured through competitiveness and earned revenue.

The model is shown mathematically as follows: $Y=\alpha+\beta X$ where 'y' is profitability and earned revenue performance, 'x' is IPRs and R&D&I, 'α' is a constant factor and 'β' is the value of coefficient.

4. Analysis and Results

Table 1. Reliability Statistics

Reliability Tests

Cronbach's Alpha	N of Items
.773	16

Reliability Statistics

Cronbach's Alpha	Part 1	Value	**.647**
		N of Items	8[a]
	Part 2	Value	**.700**
		N of Items	8[b]
	Total N of Items		16

Profile of Respondents

A total number of 126 questionnaires were administered among the respondents, out of which ninety-three (93) were filled and returned. From the demographic of respondents analysed 69.9% were males while 30.1% of the respondents were females. Most of them are experienced and have been in the business between six and nine years. Furthermore, they were engaged in Crop production (28%), Animal Husbandry/Production (5.4%), Aquaculture (2.2%) and Poultry farming (26.9%); most of the respondents engaged belonged to others category - Cassava processing, Piggery, Orchard farming etc. (37.6%). Moreover, 16.1% were startups, 51.6% were small scale, 23.7% were medium sized businesses and 8.6% were large businesses.

Descriptive Statistics (Construct items)

Table 2. Descriptive Statistics

Constructs	N	Minimum	Maximum	Mean	Std. Deviation
Intellectual Property Rights (IPRs)	93	3.50	6.00	4.7419	.49240
Profitability	93	3.00	5.75	4.6290	.45685
Research and Development and Innovation (R&D&I)	93	2.50	6.00	4.7473	.60959
Earned Revenue Performance	93	3.25	6.00	5.0753	.50377
Valid N (listwise)	93				

Table 3. Regression Analysis (Hypothesis Testing)

Model (Linearity)	5.645		1	5.645	
37.90 .000					
Deviation from linearity	1.008		8	.126	
.833 .576					
(Combined)		6.653		9	.739
4.890 .000					
Within Groups		12.548		83	.151
Total	19.202		92		
Model (Profitability)		**Coefficient**	**Std. Error**	**t**	
P>|t|					
(Constant)		2.243	.390	5.759	
.000					
Intellectual Property Rights (IPRs)		.503	.082	6.156	
.000					
Number of obs = 93, R Squared = 0.2940					
Root MSE = .38597, Adjusted R Squared = 0.2862					
The t-values were significant at p < 0.05					

Source: Output of STATA 10 and SPSS 20 Statistics – Researchers Computation (2019)

The result from Table 3 revealed that the extent to which the variance, profitability, can be explained by IPRs is 29.4% (R Square = 0.294). It shows the result of the linearity assumption of linear regression test. Also, the value of significance for Deviation from Linearity of 0.576> 0.05, implies that there is a linear relationship between the variables of profitability and intellectual property rights. Furthermore, a unit (or 100%) change in IPRs will lead to 0.503 (50.3%) change in profitability and P value (0.000) is less than 0.05. Thus, the decision would be to reject null hypothesis (HO_1) and accept alternative hypothesis (HA1), i.e. IPRs has significant impact on profitability among agro businesses in Abeokuta, Ogun State.

Table 4. Regression Model

Model (Linearity)	6.819		1	6.819	
37.55 .000					
Deviation from linearity	2.873		11	.261	
1.530 .137					
Combined		9.692		12	.808
4.732 .000					
Within Groups	13.656		80	.171	
Total	23.348		92		
Model (Earned Revenue)	**Coefficient**		**Std. Error**	**t**	**P>|t|**
(Constant)	2.955		.349	8.471	
.000					
Research and Development and Innovation (R&D&I)	.447		.073	6.127	.000
Number of obs = 93, R Squared = 0.2921					
Root MSE = .42618, Adjusted R Squared = 0.2843					
The t-values were significant at p < 0.05					

Source: Output of STATA 10 and SPSS 20 Statistics – Researchers Computation (2019)

The result from Table 4 revealed that the extent to which the variance, earned revenue performance can be explained by R&D&I is 29.2% (R Square = 0.292). Also, the result of the linearity assumption of linear regression test from the value of significance for Deviation from Linearity of 0.137> 0.05, implies that there is a linear relationship between the variables of earned revenue performance and R&D&I. Furthermore, a unit (or 100%) changes in R&D&I will lead to 0.447 (44.7%) change in earned revenue performance and the P value (0.000) is less than 0.05. Thus, the decision would be to

reject null hypothesis (HO1) and accept alternative hypothesis (HA1), i.e. R&D&I have direct effect on earned revenue performance among agro businesses in Abeokuta, Ogun State.

4.1. Discussion

The study findings based on the result from test of hypothesis one (1) revealed that there is a significant, strong, positive and linear relationship between IPRs and profitability among agro businesses in Ogun State (β= 0.503, R^2=0.294, P=0.000<0.05 and deviation from linearity 0.576>0.05). The outcome of the study is consistent with previous studies by Idris (2003), Gee (2007) and Mohd Noo (2011) on the grounds that IPRs such as industrial designs, patents, trademarks, geographical indication, and trade secrets related to agro products are important business assets as they attract a relatively high demand in the market place. Also, IPRs provided business owners with incentives to create invention and engage in agriculture-innovative activities which ultimately stimulate increase in investment with returns and commercial activities of the firm to a certain extent. It further reveals that licensing, commercialisation or sales of IPRs - IP-related agro products most importantly, trademarks - and geographical indication due to attractiveness, qualities or reputations, generates more income and raises a firm's profit margin.

The study outcome also revealed that R&D&I play a crucial role in business performance of firms. The outcome of the study from test of hypothesis three (3) shows that there is a positive, linear and significant relationship between R&D&I and earned revenue performance of businesses (β=0.447, R^2=0.292, P=0.000<0.05 and Deviation from Linearity 0.137>0.05). This outcome is consistent with the findings of previous studies, which revealed that innovations such as crop improvement, science and technological efforts in agrobusinesses enhance and create values for firms (Foray et al., 2007; Matejun, 2017; Petti & Zhang, 2011). Also, there exists integration between science and business particularly through collaborations/alliances with research and academic institutions; this accounted for the largest percentage of R&D&I in the firms under study compared to corporate technopreneurship activities within businesses. More importantly, application/commercialisation of research results to some extent raises the revenue earned by agro businesses on business activities.

4.2. Limitation and Suggestion for Further Studies

The study recommendations that are deduced from the findings as well as limitations to the study suggest more avenues for future research. The study mainly focused on agro businesses, and future researches could investigate large firms and manufacturing industry firms for generalisability. Future research studies on technopreneurship should investigate the endogenous and exogenous factors that directly affect firms' attitude toward technopreneurship, either by stimulating or inhibiting its innovative activities.

5. Conclusion

This study examines the impact, role, relationship and influence of technopreneurship on performance of agro businesses in Abeokuta, Ogun State.

The concept of technopreneurship constitutes an interesting proposition for businesses that are willing to increase their level of innovativeness through a use of interactions between the internal innovation

capabilities, competencies, and resources, as well as favourable external factors, represented by research and development, IPRs and technological opportunities. This study has significant implications for both policymakers and business owners as it provides an approach to guide the implementation of technopreneurship practices for businesses and insight into how a number of interconnected practices contribute to sustainable performance of businesses.

The results revealed that IP and R&D&I significantly affect profitability and earned revenue performance respectively. Finally, it is credited that this study has broadened previous knowledge as well as provided empirical backing for some latent conceptions or suggestions proposed in academic literature; likewise providing some new and worthy insights into the extant literature of entrepreneurship, innovation, and technology management literature.

6. Managerial Implication

The managerial implication of this study is derived from the outcome of the statistical analysis. Businesses could develop indigenous technology and commercialise the technological innovation. Appropriate legal right which may enhance the commercialisation of the indigenous technological innovation by entrepreneurs should be obtained from the government authority saddled with such responsibility. The role of government here cannot be overemphasised. The government must actively get involved in the administration of IPRs and provide the necessary infrastructure regulation of IPRs whereby critical measures are taken to fight piracy and counterfeiting to raise the level of IP practice through law enforcement.

Academic/research institutions-industry collaborations/interactions can enable firms to access talent, science and technology as a system of their operational knowledge and skills, commercialisation of research results leading to innovative activities like design of new products or services or improving products or services. Most importantly, it will aid SMEs carry out research and development activities that are usually embedded in most large firms. This study also encourages the government, academic and research institutions to take a leading role in providing legal, financial and institutional support for SMEs, to support the commercialisation of research results and transfer of knowledge and technology from academic/research institutions to firms and vice versa. Finally, technopreneurship should be a central concern for policymakers; technopreneurial development programmes need be launched and preserved to drive and facilitate business and economic growth.

References

Abass, A. (2018). The bright future of Technopreneurship. *International Journal of Scientific & Engineering Research*, Volume 9, Issue 1.

Adegbite, S. A. (2012). An Evaluation of Technology Innovation on the Performance of Indigenous Textile Weaving Firms in Southwestern Nigeria. *Journal of Business & Management*, Volume 1, Issue 1, pp. 1-14.

Aderemi, H. O.; Ilori, M. O.; Siyanbola, W. O.; Adegbite, S. A. & Abereijo, I.O. (2008). An Assessment of the Choice and Performance of Women Entrepreneurs in Technological and Non-Technological Enterprise in Southwestern Nigeria. *African Journal of Business Management*, 2(10), pp. 165-176.

Aderemi, H. O.; Siyanbola, W. O.; Egbetokun, A. A. & Sanni, S. (2011). Framework for Technological Entrepreneurship Development: Key Issues and Policy Directions. *American Journal of Industrial and Business Management*, 1, pp. 10-19. doi:10.4236/ajibm.2011.11002 published on (http://www.SciRP.org/journal/ajibm).

Akande, O. O. & Oladejo M O (2013). An appraisal of technological entrepreneurship development programmes on the performance of selected SMES in Lagos- Nigeria. *Issues in Business Management and Economics* 1(8), pp. 208-217.

Al-Ansari, Y (2014*). Innovation practices as a path to business growth performance: a study of small and medium sized firms in the emerging UAE market'. PhD thesis.* Southern Cross University, Lismore, NSW.

Aribaba, F. O.; Asaolu, T. O. & Olaopa, O. R. (2011). An evaluation of the impact of technological innovative entrepreneurial development programmes on the performance of small scale business in Nigeria. *Global Journal Business Management* 1(1), pp. 1-9.

Artz, K. E.; Norman, P. M.; Hatfield, D. E. & Cardinal, L. B. (2010). A loungitudinal study of the impact of R&D, patents, and product innovation on firm performance. *Journal of Product Innovation Management*, Vol. 27, pp. 725-740.

Avlonitis, G. & Gounaris, S. (1999). Marketing orientation and its determinants: An empirical analysis. *European Journal of Marketing*, Vol.33, No.11/12, pp. 1003-1037.

Ayandibu, A. O.; Ngobese, S., Ganiyu, I. O., & Kaseeeram, I. (2019). Constraints that Hinder the Sustainability of Small Businesses in Durban, South Africa. *Journal of Reviews on Global Economics*, *8*, pp. 1402-1408.

Baileti, T. (2012). Technology Entrepreneurship: Overview, Definition, and Distinctive Aspects. *Technology Innovation Management Review*, Vol. 8, No. 1, pp. 5-12; 77-94.

Blackburn, R. A. (2003). *Intellectual Property and Innovation Management in Small Firms*. London: Ed. Routledge.

Bubou, G. M. & Okrigwe, F. N. (2011). Fostering Technological Entrepreneurship for Socioeconomic Development: A Case for Technology Incubation in Bayelsa State, Nigeria. *Journal Sustainable Development*, 4(6), pp. 138 – 149.

Bubou, G. M. & Siyanbola, W. O (2010). Science and Technology Entrepreneurship for Socio-Economic Development in Africa (SEEDA). *In proceedings of the Third Annual International Conference on Entrepreneurship organised by WITS Business School*. University of Witwatersrand, Johannesburg, South Africa, October 20 – 21.

Daqi, X. U. (2013). Research on Improving the Technological Innovation Capability of SMEs by University-Industry Collaboration. *Journal of Engineering Science and Technology Review* 6 (2), pp. 100-104.

Del Monte, A. & Papagni, E. (2003). R & D and the Growth of Firms: Empirical Analysis of a Panel of Italian Firms. *Research Policy*, Vol. 32, pp. 1003-1014.

Dorf, R.C. & Byers, T. H. (2005). Technology ventures: From idea to enterprise. New York: McGraw-Hill.

Foray, D.; Hall, B. H. & Mairesse, J. (2007*). Pitfalls in Estimating the Returns to Corporate R&D Using Accounting Data*. Paper presented at the First European Conference on Knowledge for Growth.

Fowosire, R. A; Idris, O. Y & Opoola, E. (2017). Technopreneurship: A view of technology, innovations and entrepreneurship. *Global Journal of Researches in Engineering: Electrical and Electronics Engineering*, 17(7), pp. 41-46.

Ganotakis, P. & Love, J. H. (2011). R&D, product innovation, and exporting: evidence from UK new technology based firms. *Oxford Economic Papers*, 63(2), pp. 279-306.

Griffith, R., et al. (2003). R & D and Absorptive Capacity: Theory and Empirical Evidence'. *Scandinavian Journal of Economics*, 105(1), pp. 99-118.

Harris, R. & Moffatt, J. (2011). R & D, Innovation and Exporting', SERC Discussion Paper 73. *Spatial Economics Research Centre*.

Hofstrand, Don (2009). Understanding Profitability. IOWA State University Outreach. *Ag Decision Maker A Business Newsletter for Agriculture*.

John, K. N.; Maurice, O. M. & Joseph, M. M. (2013). The Influence of Innovativeness on the Growth of SMEs in Kenya. *International Journal of Business and Social Research (IJBSR)*, 3(1), pp. 25-31.

Juma, C. (2006). Reinventing growth: science, technology and innovation in Africa. *International Journal of Technology Globalisation*. 2 (3-4), pp. 323-339.

Kraaijenbrink, J.; Spender, J. C. & Groen, A. J. (2010). The resource-based view: a review and assessment of its critiques. *Journal of management*, 36(1), pp. 349-372.

Kwon, H. J. & Lee, H. C. (2004). An empirical study of the venture business' R&D expenditure on the enterprise value-compare high-technology firms to low-technology firms. *Journal of Korea Tax Accounting Research*, 15(1), pp. 85-101.

Lin (2007). Does Innovation lead to Performance? - An Empirical Study of Small and Medium Enterprises in Taiwan. *Management Research News*, 30(2), pp. 115-32.

Love, J. H., Roper, S., & Du, J. (2009). Innovation, ownership and profitability. *International Journal of Industrial Organization*, *27*(3), 424-434.

Love, James, H. & Roper, Stephen (2013). SME innovation, exporting and Growth: A review of existing evidence. *Enterprise Research Centre White Paper* No. 5. www.enterpriseresearch.ac.uk.

Martínez-Román, J. A.; Gamero, J. & Tamayo, J. A. (2011). Analysis of innovation in SMEs using an innovative capability-based non-linear model: A study in the province of Seville (Spain). *Technovation*, 31(9), pp. 459-475.

Matejun, M. (2016). Role of technology entrepreneurship in the development of innovativeness of small and medium-sized enterprises. *Managemen*t, 20(1), pp. 167-183.

Minseo, Kim; Ji-eung, Kim; Yeong-wha, Sawng & Kwang-sun, Lim (2018). Impacts of innovation type SME's R&D capability on patent and new product development. *Asia Pacific Journal of Innovation and Entrepreneurship*, 12(1), pp. 45-61.

MohdNoo, N. A. (2011). Intellectual Property Rights and Agro-based Natural Product: Malaysian Legal Perspective. *Journal of Politics and Law*, 4(1), pp. 138-145.

Ngungi. (2013). Effect of the type of innovation on the growth of small of small and medium enterprises in Kenya: a case of garment enterprises in Jericho, Nairobi. *European Journal of Management sciences and Economics*, 1(2), pp. 49 - 57.

Normann, R. & Ramirez, R. (1993). From value chain to value constellation: Designing interactive strategy. *Harvard business review*, 71(4), pp. 65-77.

Okorie N. et al. (2014). Technopreneurship: an urgent need in the material world for sustainability in Nigeria. *European Scientific Journal October 2014 edition* vol.10, No.30, pp. 59-73.

Pathak, S.; Xavier-Oliveira, E. & Laplume A. (2013). Influence of intellectual property, foreign investment, and technological adoption on technology entrepreneurship. *Journal of Business Research* 66, pp. 2090–2101.

Petti, C. & Zhang, S. (2011). Factors influencing technological entrepreneurship capabilities: Towards an integrated research framework for Chinese enterprises. *Journal of Technology Management in China*, 6(1), pp. 7-25.

Petti, C. (2012). *Technological Entrepreneurship in China: How Does it Work?* Northampton, M.A.: Edward Elgar Publishing.

Piergiovanni, R.; Santarelli, E. & Vivarelli, M. (1997). From which source do small firms derive their innovative inputs? Some evidence from Italian industry. *Review of Industrial Organization*, 12(2), pp. 243-258.

Roper, S.; Du, J., & Love, J. H. (2008). Modelling the innovation value chain. *Research policy*, 37(6-7), pp. 961-977.

Selvarani, A. & Venusamy, K. (2015). A study of technopreneurship in small and medium industry. Technopreneurship as a firm strategy: links to innovation, creation and performance. *Journal Impact Factor*, 6(1), pp. 401-408.

Sukarmijan, S. S. & Sapong, O. D. V. (2014). The importance of intellectual property for SMEs; Challenges and moving forward. *UMK Procedia*, 1, pp. 74-81.

Teece, D. J. (2010). Technological innovation and the theory of the firm: the role of enterprise-level knowledge, complementarities, and (dynamic) capabilities. In *Handbook of the Economics of Innovation*, Vol. 1, pp. 679-730. North-Holland.

Venkataraman, S. (2004). Regional transformation through technological entrepreneurship. *Journal of Business venturing*, 19(1), pp. 153-167.

Wiengarten, F.; Humphreys, P.; Cao, G. & McHugh, M. (2013). Exploring the important role of organizational factors in IT business value: Taking a contingency perspective on the resource-based view. *International Journal of Management Reviews*, 15(1), pp. 30-46.

Wood, M. S. (2011). A process model of academic entrepreneurship. *Business Horizons*, 54(2), pp. 153-161.