POLAC ECONOMIC REVIEW (PER)
DEPARTMENT OF ECONOMICS
NIGERIA POLICE ACADEMY, WUDIL-KANO

TECHNOPRENEURSHIP AND SMES GROWTH IN NORTH CENTRAL NIGERIA

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Abstract

This study examined the effect of technopreneurship on SMEs growth in North Central Nigeria. The specific objectives were to determine the effect of technological innovation, research and development innovation, and technological opportunities on SMEs growth in North Central Nigeria. A survey research design and structured questionnaire was used to collect data from the SMEs in North Central Nigeria. The questionnaire was developed to elicit responses from the owners and managers of SMES on the effect of technopreneurship on SMEs growth in North Central Nigeria. A total number of 400 sample size was used for the study. This study adopted the Partial Least Square Structural Equation Modelling (PLS-SEM). The result revealed that technological innovation, research and development, and technological opportunities had positive and significant effects on SMEs growth in North Central Nigeria. The study recommends that on technological innovation, SMEs should invest in employees' training to provide training and up skilling opportunities for their workforce to adapt to technological changes. A tech-savvy team can drive innovation and effectively implement new technologies, on research and development innovation, SMEs should allocate a portion of their budget specifically for research and development activities, considering both financial resources and dedicated personnel to drive R&D innovation initiatives and on technological opportunities, SMEs should Stay informed about emerging technologies and market trends relevant to their industry, by regularly conducting market research to identify technological shifts and opportunities that can potentially provide a competitive advantage.

Keywords: Technopreneurship, Technological Innovation, Research and Development Innovation, Technological Opportunities and SMEs Growth.

1. Introduction

In today's growing multidimensional world, small and medium enterprises (SMEs) are engaged more on using technology to stimulate growth, client value and market differentiation as such, these businesses are embracing innovation technologies for invention, change and diversification and this is eventually the case in a recovering global economy (Peter, 2011). SMEs are important business organs which form a strong constituent of the global economy. In most emerging countries economic growth and employment are led by SMEs.

Technopreneurship bears vital importance to the growth and development of SMEs in the knowledge based economy. Daily advancement to better structures and strategies are being explored and developed to help technology based enterprise grows especially the small and medium ones offering a promising future within the global marketplace, thereby being able to expand themselves to compete in their borderless world, at the same time create, and add value to their businesses in order to achieve sustainable growth (Fowosire, Idris & Opoola, 2017).

Jusoh and Halim (2006), Olusegun et al. (2019), and Oyedele et al. (2020) identified technological innovations, research and development innovation and technological opportunities as dimensions of technopreneurship.

Technological innovation influences SMEs growth through various mechanisms. Firstly, innovation enhances operational efficiency by streamlining processes, reducing costs, and improving resource utilization. This efficiency gain enables SMEs to allocate resources more effectively, thereby facilitating growth (Villar et al., 2018). Secondly, innovation often leads to the development of new products and services, expanding the SMEs' market reach and attracting new customer segments (Sarasvathy et al., 2014). Technological innovation can also facilitate market entry and internationalization, enabling SMEs to access global markets that were previously inaccessible (Autio et al., 2014). Research and Development Innovation (R&DI) activities contribute to SMEs growth through various mechanisms. Firstly, innovation resulting from R&DI efforts can lead to the development of new products, services, or processes, allowing SMEs to gain a competitive edge (Hagedoorn & Cloodt, 2003). Secondly, R&DI enables SMEs to improve their operational efficiency, streamline processes, and enhance product quality, all of which are essential for sustained growth (Lööf & Heshmati, 2006). Furthermore, R&DI can foster collaboration with academic institutions, other firms, and research organizations, creating networks that stimulate growth (Van de Vrande et al., 2009). Technological opportunities play a pivotal role in SMEs growth through several mechanisms. Firstly, seizing these opportunities can lead to product or service differentiation, enabling SMEs to stand out in the market (Song et al., 2017). Secondly, innovation derived from technological opportunities can enhance operational efficiency and cost-effectiveness, promoting growth (Damanpour, 2014). Additionally, leveraging technological opportunities can facilitate market expansion, both domestically and internationally, by addressing unmet needs or entering new niches (Eisenhardt & Martin, 2000).

Growth is linked to the survival of the business and the accomplishment of organizational objectives. Product development, market share, income, and employment are used to gauge its effectiveness. (Pasanen, 2007). Growth is also linked to the accomplishment of financial objectives and is regarded as a measure of organizational performance (Fadahunsi, 2012).

However, SMEDAN and NBS (2021) reported that, the growth of SMEs measured by their contribution to GDP has decline, in 2017 is 49.81% and in 2020 is 46.31%, indicating a decrease of 3.5% in SMEs contribution to GDP. Mohammed et al. (2022), identified Technological Innovation, Research and Development Innovation and Technological Opportunities among others that can have effect on SMEs growth. Thus, the objectives of this research work are to determine the effect of Technological Innovation, Research and Development Innovation and Technological Opportunities on SMEs Growth in North Central Nigeria.

2. Literature Review

2.1 Conceptual Definitions

Concept of Technopreneurship

Dutse et al (2013) refer to technopreneurship as entrepreneurs who combine their entrepreneurial skills with technology. They are characterized as "technology – based entrepreneurs", technical entrepreneur's high technology entrepreneurs. The emergence of technology and the innovations it brought has opened up new opportunities and challenges into businesses in this regard, technological adoption and advancement act as channel to expand and accelerate the businesses as well as the people (Fowosire et al., 2017). According to Prodan (2007) Technopreneurship is innovative application of technical science and knowledge individually or by a group of persons, who create and manage a business and take it financial risk in order to achieve their goals and perspectives.

Concept of Technological Innovation.

Ingh and Aggarwal (2021) stated that technological innovation involves the creation of novel ideas, processes and products that leads to a constant change in growth and job creation for a nation's economy as well as the generation of profits for innovative companies. Bhatti et al. (2021) argued that technological innovation is the knowledge implemented in processes, products and services. They categorize technological innovation based on technology and organizational features. Also, Bhatti et al. (2021) viewed technological innovation as the means of changing opportunities into new ideas and putting them

into practice. Another definition for technological innovation is that it is a new concept, activity, or object experienced by people or other unit of adoption (Iranmanesh et al., 2020). Wibawa et al. (2020) defined technological innovation as the development of a new or improved product, process or service for businesses. The study views technological innovation as the development and application of new tools, techniques and materials to facilitate the introduction of new products or services and to create customers satisfaction

Concept of Research and Development Innovation.

According to Dodgson et al. (2017) refers to research and development innovation as the creation and application of new knowledge, technologies, or methodologies to develop novel products, processes, or services that contribute to the growth, competitiveness, and sustainability of an organization. Kainulanen (2014) defined research and development innovation to mean the systematic activities in order to increase knowledge and use of this knowledge when developing new products, processes, or services. Research and development innovation comprise creative and systematic work undertaken in order to increase the stock of knowledge including knowledge of humankind, culture and society, and to devise new applications of available knowledge (Frascati, 2015).

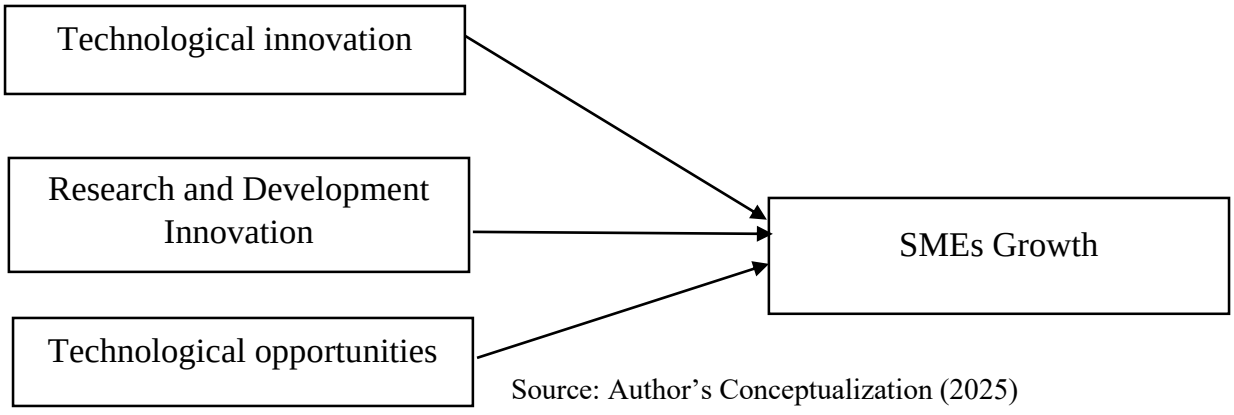
Concept of Technological Opportunities

Chen and Huang (2018) view technological opportunities to mean the potential for companies to leverage virtual reality and augmented reality technologies to revolutionize customer experiences and training programs. Christensen et al. (2015) refer to technological opportunities as the favourable conditions created by technological advancements that enable companies to create disruptive innovations and expand their market presence. Technological opportunities refer to the possibilities for businesses to harness cutting-edge technologies to gain a competitive advantage and create innovative solutions in the marketplace (Berman & Lerman, 2019). The study defines technological opportunities as the use of cutting-edge technologies by businesses to enhance production efficiency and customers satisfaction.

Concept of Small and Medium Enterprises Growth

Growth is associated with the firm survival and achievement of organizational goals. It is measured in terms of employment, revenue, market share and product development (Pasanen, 2007). Generally, the term "business growth" is used to refer to various things, such as increase in total sales volume, increase in production capacity, increase in employment, increase in production volume, increase in the use of raw material and power. These factors indicate growth, but do not provide a specific meaning of growth. Business growth is typically defined and measured using absolute or relative changes in sales, assets, employment, productivity, profits and profit margins (Delmar, et al. 2003).

Figure 1: Conceptual Framework of Technopreneurship and SMEs Growth



Source: Author's Conceptualization (2025)

2.2 Empirical Review

Technological Innovation and SMEs Growth.

Ansho et al. (2021), investigated Technological Innovation on SMEs Performance. a study of SMEs in Wukari Metropolis, Taraba state. They used primary data through questionnaire to 100 SMEs as sample size, the multiple regression was used to test the hypothesis. The result revealed that there is a positive and significant relationship between technological innovation and SMEs performance. The study area is different with this study, which means that the findings may not be the same, because the unique characteristics of a particular study area may limit the external validity of the study.

Umar et al (2016) examined Technological Innovation and SMEs growth. A well-structured questionnaire was administered on conveniently selected 108 manufacturing small and medium enterprises in Yola, Adamawa State of Nigeria. Both descriptive and inferential statistical tools such as frequencies, means, standard deviation, Pearson correlation, multiple regression, independent samples t-test and analysis of variance were used in analyzing data and reporting results. Findings revealed that, there is positive and significant relationship between technological innovation and SMEs growth. The method of data analysis is not the same; multiple regression has limitation of assuming a linear relationship between the independent and dependent variables. If the true relationship is nonlinear, the results may be inaccurate and alternative methods like PLS-SEM will be more appropriate

Tong and Azwmawani (2022) studied technological Innovation of High-Tech SMEs in China. The objective of the study was to examine the effect of technological innovation on SMEs performance. The study based on a survey of 378 high-tech SMEs in Sichuan Province, China, structural equation modeling (SEM) was employed to examine the research model. The result showed that technological innovation has a positive and significantly effect on SMEs performance.

Olusegun et al. (2019) studied the Impact of technological innovation on Business Performance in Abeokuta in Ogun state, Nigeria. The researchers adopted a survey research design, primary method of data collection was used to collect necessary data through a field survey of agro-business with the aid of purposive well-structured questionnaires. A sample of 126 respondents was identified, Linear Regression analysis was used to test the research hypothesis and the result showed that, technological innovation has a positive significant relationship with SMEs growth. They recommended that, technological innovation should be a central concern for government and policy makers; technological innovation development programs need to be launched to sharpen business skills discourse on growth or performance of SMEs.

Research and Development Innovation and SMEs Growth

Oyedele et al. (2020): Investigated research and development innovation on SMEs growth in Nigeria. A sample of 126 respondents was selected, structured questionnaire was administered, and responses were analyzed using linear regression. The result revealed that research and development and innovation (R&D&I) have a positive and significant effect o on SMEs growth. The difference in study areas can influence the interpretation of findings due to cultural or socioeconomic context which may not necessarily apply to another, leading to challenges in broad conclusion Okoronkwo et al. (2021) studied Research and Development innovation on Selected Manufacturing SMEs growth in Lagos State, Nigeria. The study adopted a survey research design with a sample size of 437. A structured questionnaire was adapted and validated and the data collected were analyzed using the regression analysis. The result showed that research and development innovation have positive and significant effect on the selected manufacturing SMEs in Lagos State, Nigeria. The weakness of multiple regression data analysis for the study is that, multiple regression assumes a linear relationship between the independent and dependent variables if the true relationship is nonlinear, the results may be inaccurate and PLS-SEM method is more appropriate.

Seo and Cho (2020) studied Research and Development Innovation support for SMES using Latent Growth Modeling in South Korea. Using 87 SMEs as sample size, with t-test in analysis the data. The result revealed that SMEs that received Research and Development Innovation support have an increase in sales

twice compared to those that do not, and the analysis also indicated that Research and Development Innovation help technological innovation growth of SMEs. The limitation of using t-test for data analysis as used for the study is that, t-test are sensitive to outliers, especially a few extreme values can have a significant impact on the results, potentially leading to erroneous conclusion.

Technological Opportunities and SMEs Growth.

Kim et al. (2021) examined Technological opportunities and SMEs growth. They collected data from 150 SMEs and used panel regression to analyze the firms' growth indicators over a three-year period. The results demonstrated that SMEs leveraging on Technological Opportunities achieved higher productivity levels and innovation rates, leading to substantial growth in terms of market share and profitability. The limitation of using panel regression for data analysis is that, many panel regression model assume common slopes across entities, if the relation between independent and dependent variables varies across entities, using common slope may lead to misspecification and biased results.

Olusegun et al, (2019) studied Technological Opportunities on SMEs growth in Abeokuta in Ogun state, Nigeria. A sample of 126 respondents was identified, Linear Regression analysis was used to test the research hypothesis and the result showed that, Technological Opportunities have a strong, significant, linear and positive relationship with growth of SMEs.

Smith et al. (2018) examined Technological Opportunities on SMEs' growth in the United States. Their research utilized data from a sample of 500 SMEs across various industries. They employed a panel regression model to analyze the relationship between technological opportunity and SMEs' revenue growth over a five-year period. The study found a positive and statistically significant correlation between Technology Opportunities and SMEs' growth. SMEs that effectively utilized technological opportunity experienced higher revenue growth rates compared to those lagging in technology adoption. The weakness of panel regression is that, incorporating lagged values of the dependent variable or independent variables in dynamic panel regression models may introduce endogeneity issues and complicate model interpretation.

2.3 Theoretical Review

Resource- Based View Theory

Resource-based theory was propounded by wernerfelt (1984) to understand how organizations achieve sustainable competitive advantages. The theory focuses on the idea of costly-to-copy attributes of the firm as sources of business returns and the means to achieve superior performance and competitive advantage (Barney, 1986; Conner, 1991; Hamel & Prahalad, 1996). A firm can be understood as a collection of physical capital resources, human capital resources and organizational resources (Barney, 1991). Resources that cannot be easily purchased, that require an extended learning process or a change in the corporate culture, are more likely to be unique to the enterprise and, therefore, more difficult to imitate by competitors. It is argued that performance differentials between firms depend on having a set of unique inputs and capabilities (Conner, 1991).

According to resource-based theory, competitive advantage occur only when there is a situation of resource heterogeneity (different resources across firms) and resource immobility (the inability of competing firms to obtain resources from other firms) (Barney, 1991). Therefore, this paper is underpinned by the resource-based view theory, because RBV can guide firms in understanding the role of their resources and capabilities in technological innovation research and development innovation, and technological opportunities.

It emphasizes the strategic importance of resource management, resource development, and resource alignment to gain a competitive edge in technology-driven industries. By applying RBV principles, firms can better leverage their internal strengths to navigate the challenges and opportunities presented by technological innovation, research and development innovation, and technological opportunities.

3. Methodology

This study adopts the survey research design. The survey research design explains or describes the causal relationships among variables. Jeremy (2006) opines that survey research design is useful to studies that explore

effects of independent variables on dependent variable.

The population of this study is the entire registered small and medium scale enterprise in North Central Nigeria. The population consists of 130,862 registered SMEs (NBS & SMEDAN 2021) situated in North Central Nigeria and the sample is 400 using Yamane 1967.

The study adopts the multi-stage sampling technique. The multi-stage sampling technique comprises both the probability and nonprobability sampling methods. These two methods enable sampling to be carried out in stages. A non-probability sampling method (purposive sampling) was used in the first stage to select the target sector which is the SMEs. Simple random sampling was applied for the selection of the respondents to answer the questionnaire for this study. For this study, individual SMEs owners are expected to respond to the questionnaire.

Data analysis was conducted using partial least square (PLS) software 4.0.9.5, an approach to structural equation modeling and presented as required. The PLS-SEM in this study tested for the measurement model and the structural model.

4. Results and Discussion

4.1 Assessment of Measurement model

The measurement model assesses the constructs involved in the study, which is to determine whether the indicators such as, Composite reliability (CR), convergent validity, average variance extracted (AVE) and discriminant validity, as described by Hair et al. (2011), Hair et al (2012) and Henseler et al (2009) met their required threshold.

Table 1: Convergent Validity

Variables	Code	Loadings	CR	AVE	Cronbach Alpha
Research & Development Innovation	RDI1	0.822	0.874	0.634	0.811
	RDI2	0.765			
	RDI4	0.803			
	RDI7	0.794			
Growth of SMEs	SGR1	0.817	0.887	0.662	0.834
	SGR2	0.857			
	SGR3	0.846			
	SGR5	0.729			
Technological innovation	TI4	0.896	0.877	0.781	0.725
	TI5	0.871			
Technological Opportunities	TO4	0.781	0.803	0.671	0.524
	TO7	0.855			

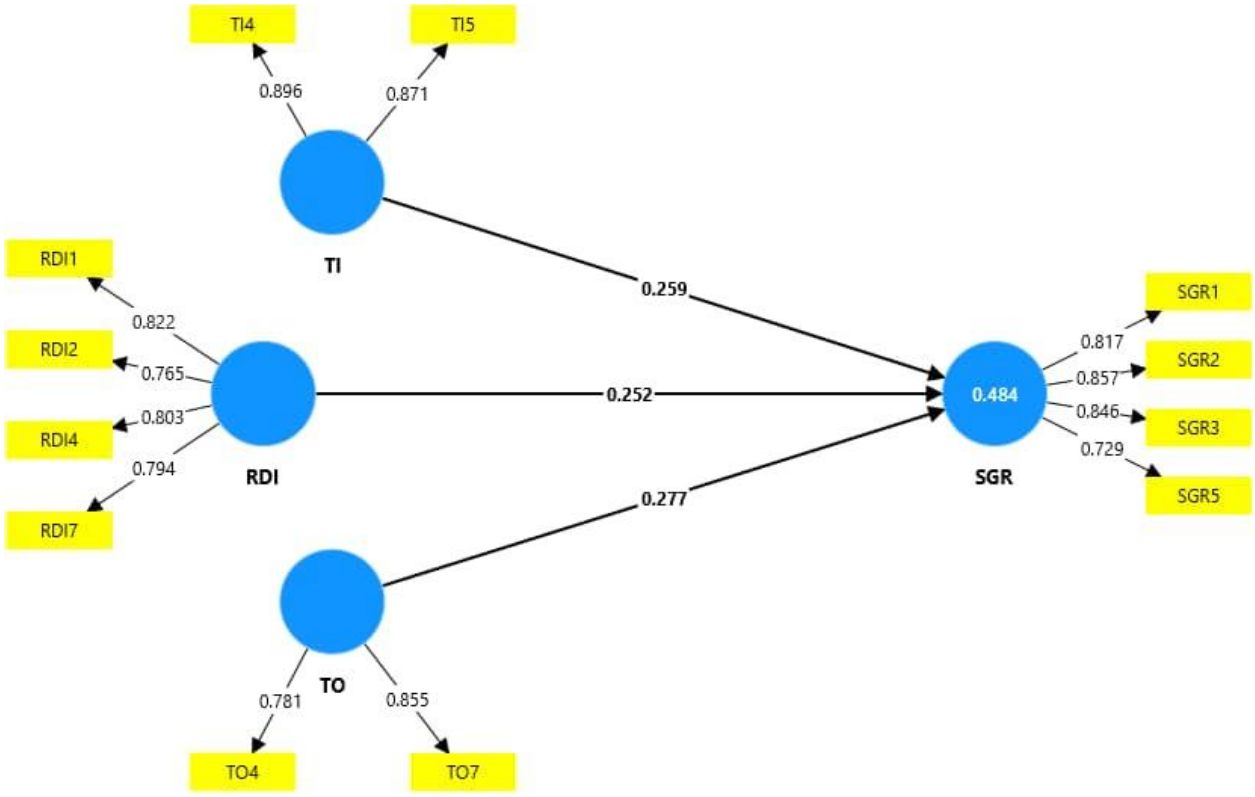
The result in Table 1 shows the convergent validity of the constructs under study. The results thus demonstrated a high level of convergent validity of the latent construct used in the model. An AVE value of at least 0.5 indicates sufficient convergent validity, meaning that a latent variable can explain at least half of the variance of its indicators on average.

Table 2: Discriminant Validity (Fornell-Larcker Criterion)

	RDI	**SGR**	**TI**	**TO**
RDI	**0.796**			
SGR	0.634	**0.814**		
TI	0.794	0.622	**0.884**	
TO	0.637	0.590	0.589	**0.819**

Table 3 shows the discriminant validity result from the Fornell-Larcker method. It was found that the diagonal bolden values are greater than the inner correlation values, thereby establishing that the discriminant validity was achieved.

Figure 2: Measurement Model



4.2 Evaluation of structural model

Structural model fitness is examined after measurement model assessment has been met and fitness is shown to be acceptable. The structural or inner model consists of the factors and the arrows that connect one factor to another. The loadings of the direct paths connecting factors are standardized regression coefficients. To ensure that the final estimated result from the PLS is true, it is important to determine the fitness of the model. The fitness of the model can be assessed in the following ways; testing for collinearity of the structural model, assessing the significance and relevance of the structural model relationships, the level of the R^2 values, and the f^2 effect size (Tenenhaus, Vinzi, Chatelin& Lauro 2005). Höck& Ringle, (2006) described results above the cutoffs 0.67, 0.33 and 0.19 to be "substantial", "moderate" and "weak" respectively. The R-square here would be considered to be of moderate strength or effect. To assess multicollinearity in the structural model, tolerance or VIF criteria may be applied, discussed and illustrated. The VIF benchmark should be less than 4.

The f-square effect size measure is another name for the R-square change effect. The f-square coefficient can be constructed equal to (R^2original – R^2omitted)/(1-R^2original). The denominator in this equation is "Unexplained". The f-square equation expresses how large a proportion of unexplained variance is accounted for by R^2 change (Hair et al., 2014). Following Cohen (1988), .02 represents a "small" f^2 effect size, .15 represents a "medium" effect, and .35 represents a "high" effect size.

Table 3: Structural Fitness Indices

Variables	Code	VIF	R^2	F^2	Q^2	SRMR
Research & Development Innovation	RDI1	1.871		0.040		0.081
	RDI2	1.670				
	RDI4	1.789				
	RDI7	1.822				
Growth of SMEs	SGR1	1.784	0.484		0.458	
	SGR2	2.247				
	SGR3	2.033				
	SGR5	1.443				
Technological innovation	TI4	1.463		0.046		
	TI5	1.463				
Technological Opportunities	TO4	1.135		0.086		
	TO7	1.135				

Table 3 also presents the VIF diagnostic and estimated PLS weights for the indicators of all the items from the questionnaire. A common rule of thumb is that problematic multicollinearity may exist when the variance inflation factor (VIF) coefficient is higher than 4.0 (some use the more lenient cutoff of 5.0). None of the original indicators had VIF greater than 5.

The overall effect size measure for the structural model, as in regression, indicated that 48.4% variation in SMEs growth is explained by the effect of Research & Development Innovation, Technological innovation and Technological Opportunities.

The f-squared for Research & Development Innovation, Technological innovation and Technological Opportunitiesare considered to have small effect size on SMEs growth. The $Q^2$was estimated by the blindfolding method. The values of the $Q^2$are 0.458 indicated that since it is greater than zero, they have predictive relevance for this study and the model is a good fit given that the SRMR is below 0.090.

Table 4: PLS-SEM Result

Hypo	Relationship	Coeff	P-values	Decision
H1	Technological innovation -->SMEs growth	0.259	0.002	Significant
H2	Research &Development Innovation --> SMEs growth	0.252	0.004	Significant
H3	Technological Opportunities --> SMEs growth	0.277	0.000	Significant

The outcome showed that there is a positive and significant effect of technology Innovation on growth of small and medium scale enterprise in North Central Nigeria with (β =.259, p = 0.002). This implied that technology Innovation improve the growth of small and medium scale enterprise in north central Nigeria by 25.9%. The result agrees with the findings of Ansho et al. (2021), Umar et al. (2016) and Tong and Azwmawani (2022).

The second objective claimed that Research and Development Innovation has a positive and significant effect on growth of small and medium scale enterprise in North Central Nigeria. The results of this study reveal that Research and Development Innovation significantly influences growth of SMEs with coefficient and p-value of (β=0.252, p = 0.004). The result is consistent with the findings of Okoronkwo et al. (2021), Seo and Cho (2020) and Oyedele et al. (2020).

The third objective was to examine the effect of Technological Opportunities on growth of SMEs. This result demonstrated that Technological Opportunities has a significant effect on growth of SMEs in North Central Nigeria with coefficient and p-value of (β=0.277, p = 0.000). The result agrees with the findings of Kim et al. (2021), Olusegun et al. (2019) and Smith et al. (2018).

5. Conclusion and Recommendations

The objectives of this study are to determine the effect of technological innovation, research and development innovation, and technological opportunities on growth of small and medium enterprises in the North-Central States of Nigeria. It was found that technological innovation, research and development innovation, and technological opportunities have positive and significant effects on growth of small and medium enterprises in the North-Central States of Nigeria.

The study recommends that on technological innovation, SMEs should invest in employees' training to provide training and up skilling opportunities for their workforce to adapt to technological changes. A tech-savvy team can drive innovation and effectively implement new technologies, on research and development innovation, SMEs should allocate a portion of their budget specifically for research and development activities, considering both financial resources and dedicated personnel to drive R&D innovation initiatives and on technological opportunities, SMEs should Stay informed about emerging technologies and market trends relevant to their industry, by regularly conducting market research to identify technological shifts and opportunities that can potentially provide a competitive advantage.

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Acknowledgment:

tetfund
TERTIARY EDUCATION TRUST FUND