Effect of Technological Innovations on the Competitiveness of Manufacturing Small and Medium Enterprises in Makurdi Metropolis, Benue State

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Abstract: *The study examined the effect of technological innovation on competitiveness of manufacturing small and medium enterprises in Makurdi metropolis, Benue State. The study used disruptive and incremental innovations as dimensions of technological innovation to establish the relationship between technological innovation and competitiveness of manufacturing small and medium enterprises in form of productivity and market share. The study adopted cross-sectional survey design with the target population of 50 owners/managers of manufacturing small and medium enterprises in Makurdi metropolis, Benue State. Census sampling technique was used since the population is small. Questionnaire instrument was used for data collection, and crombach's alpha which tested the average validity index and reliability of 0.847, 0.851 and 0.825 respectively. Multiple regression analysis was adopted with the help of statistical package for social science (SPSS version 0.29) to ascertain the effect of technological innovation on competitiveness of manufacturing small enterprises in Makurdi metropolis, Benue State. Findings disclosed that there is a significant positive relationship between increment and disruptive technological innovation and productivity, market share as competitiveness of manufacturing small and medium enterprises. In a statistical form, disruptive innovation has a (t-value = 3.092 and p – value = .001) while increment innovation has (t-value = 354 and p-value = 0.00). The study concluded that all dimensions of technological innovation used in this research work (disruptive and incremental innovations) has significant effects on competitiveness (productivity and market share) of manufacturing small and medium enterprises in Makurdi metropolis, Benue State. The study recommended among others as owners/managers of manufacturing small and medium enterprises should continue to alter and update the existing production process, products or services in order to significantly add market value and even eventually displace established market, leading firms, products and alliances.*

Keywords: technological innovations, competitiveness, small and medium enterprises.

1.0 INTRODUCTION

1.1 Background to the Study

Global, dynamic, and competitive business environment today has necessitated technological innovation in form of modern machinery, new techniques by manufacturing small and medium enterprises in order to remain competitive and resilient in the global market. In Africa, Nigeria and Benue State to be precise, manufacturing small and medium firm need technological innovation in order to compete favorably with the counterpart elsewhere in the world. Technological innovation remain a strategy to stimulating economic efficiency of SMEs and sustainable development (Bak-Subrahmanya *et al.,* 2014), small and medium enterprises (SMEs) are today leveraging more on use of technological innovation to spur to attain competeiveness, growth and break through. Following the assertions the need for technological innovation can never be underestimated. Innovation has become a tool for manufacturing small and medium enterprises to cope with today's highly competitive environment (Al-Battaineh, 2018).

Technological innovation according to Schumpeter (1939) is a new means of combining factors of production resulting from a change in inputs to produce outputs. Technological innovation means therefore, the invention of modern production method, new techniques, processes and procedures that add value to a product/ service delivery of a manufacturing firm. Technological innovations as embedded in this study are disruptive and incremental innovations. Disruptive innovation refers to any enhanced or completely new technology that replaces and disrupts an existing technology (Techopedi, 2019c). It involves an innovation that brings a complete or total change to the product/service with value addition. Whereas, incremental innovation brings about step by step or gradual changes to a product of a manufacturing firm or service with bit by bit value addition.

According to Adedeji and Adelowotan, (2023), In the U.S., a new wave of technology innovations has arisen, largely due to the national endeavor to advance manufacturing in the thrust areas of national importance. The accelerated innovations entail rapid transfer of new technologies into design and manufacturing of high-performance products and services. Portillo et al. (2021), in their study in Brazil provide strong evidence that technological innovations in the mobile telephony sector, expressed by the variables of technologies and quality in the provision of services as well as the proxies used for price, affected the competitive process, especially in the strategies for expansion and the loyalty of the customer base. In Namibia, Asa (2019), study revealed a positive correlation between technological innovations as a strategy and competitive advantage and increased market share in the banking industry.

Relatively, competitiveness of manufacturing firm is a multidimensional concept. It means differently to different people depending on the context and level. It's originated from the Latin word competer which means indolent in a business rivalry for market. It simply means the ability of firm to compete; design, produce, and market products superior to those offered by competitors, considering the price and non-price qualities (Ajtabh and Momaya, 2019). Competitiveness has become a term that is used to day to describe the level, strength and growth of firms and nation's economy (Ajtabh, 2019). For Chikan

(2008) and Apasia *et al.,* (2017) firms competitiveness refers to the capability of a firm to sustainably fulfill its double purpose. Meeting customer requirements and profit, competitiveness considers the level of productivity and the rate of growth of one firm relative to another (Krugman, 1994). Though there many ways of considering the competiveness of manufacturing firms, as evidenced, this paper dwell on productivity and market share. The study focus on manufacturing small and medium enterprises to assess the effect of technological innovations on SMEs in this area considering the level of competitiveness in terms of productivity and market share (market leadership).

1.2 Statement of the Problem

One of the greatest challenges today confronting manufacturing   small and medium enterprises (SMEs) in Nigeria and Benue State, Makurdi metropolis, Benue State in particular is how to sustain business operation and survive the stiff, and highly competitive, dynamic business environment. This is because of the proliferation of many more manufacturing small and medium enterprises in the operational environment which their presence create more competition among themselves resulting to drop in productivity, market share/ market leadership owing to low customer patronage, consequently some of the firms that do not withstand the competition are faced out of the market despite their contributions to economic growth in terms of job creation, increase in per capital income, increase in GDP and improved standard of living.   In view of this, the study is set to examine the effects of technological innovation on manufacturing small and medium enterprises in Makurdi metropolis, Benue State so that these SMEs will understand the better how critical technological innovation affect their competitiveness.

1.3   Objective of the Study

The main objective of this study is to examine the effect of technological innovation on the competitiveness of manufacturing small and medium enterprises in Makurdi metropolis, Benue State.

The specific objectives are:

i.   Examine the extent of effect of incremental innovation on the competitiveness of manufacturing small and medium enterprises in Makurdi metropolis, Benue State.
ii.   Determine the extent of effect of disruptive innovation on the competitiveness of manufacturing small and medium enterprises in Makurdi metropolis, Benue State.

1.4   Research Questions

i.   To what extent does disruptive innovation affect competitiveness of manufacturing SMEs in Makurdi metropolis, Benue State?
ii.   To what extent does incremental innovation affect the competitiveness of manufacturing SMEs in Makurdi metropolis, Benue State?

1.5   Statement of Hypotheses

 Ho_1: Disruptive innovation has no significant effect on the competitiveness of manufacturing SMEs in Makurdi metropolis, Benue State.

Ho₂: Incremental innovation has no significant effect on the competitiveness of manufacturing SMEs in Makurdi metropolis, Benue State.

In pursuance of the stated objectives, the study is divided in to five major components. Having addressed the first part of the components, part two focuses on review of related literature covering the theoretical, concepts of technological innovations on competitiveness of manufacturing SMEs in Makurdi Metropolis, Benue State. The third section is on methodology employed in carrying out the study. Component four is on analysis of data collected and the component five provides the conclusion and recommendations accordingly. The results and recommendations of the study would contribute towards the unveiling of the contributions of technological innovations on competitiveness of manufacturing SMEs in Makurdi Metropolis, Benue State.

2.0   LITERATURE REVIEW

This section explores the theoretical framework, conceptual framework and review of related empirical studies.

2.1 Theoretical Framework

Demand – Pull Theory and Technological Push Theory (Schmookier, 1966)

These theories or concepts that explain the drivers of innovation and growth in different industries. Demand-pull theory suggests that innovation and growth are driven by market demand, where market demand shocks pull innovation and innovation and innovation pushes market growth. On the other hand, the technology push theory suggests market growth and technology pushes innovation (Kerstin, 2023). According to researcher, these theories have been useful in application by firms such as renewable energy industry in European Union, equipment manufacturing industry in China, Korea military's weapon acquisition (Kerstin, 2023). In Nigeria, research have shown that the theories have been very useful to manufacturing company such as Cocacola Plc and Carbury Nigeria Limited. The theories are relevant to this study because it has all the qualification to improving the market share and productivity of small and medium enterprises in Makurdi metropolis thereby making them to form resilience and more competitive. Though the theories did not state clearly how technological innovation whether demand-pull or technology pushes productivity.

2.2 Conceptual Framework

2.2.1 Concept of Technological Innovation

Technological innovation means different things to different author. For Nick (2023), it is the creation and application of new or improved technologies, tools, systems and processes that bring about significant advancements or breakthroughs in various fields. It involves harnessing knowledge, expertise, m resources to develop innovative solutions that solve problems, improve efficiency, drive progress, and deliver value (Nick, 2023). According to Schumpeter (1939), it is a new means of combining factors of production resulting from a change in inputs to produce outputs.

2.2.2 Dimensions of Technological Innovations
i. Disruptive innovation
Disruptive innovation is a form of technological innovation introduce by Clayton M. Christensen. It means the process in which a new product, service, or technology disrupts an existing market or significantly altering an existing one (Nick, 2013). It is a type of technology innovation that creates a new market and value network or enters at the bottom of an existing market and eventually displaces established market leading firms, products and alliances.

ii. Incremental Innovation
The tem incremental innovation refers to a series of small improvements it made to a company's existing products or services. It helps the firm to build fide competition (Samantha, 2019) and (Ayman, 2021). It is a gradual or step by step continuous improvement in organization's existing concepts, products or services that brings bit by bit value addition.

2.2.3 Concept of Competitiveness

Competiveness means so many things to different authors. Ajtabh and Momaya (2019) competitiveness means the ability of a manufacturing firm to compete, design, produce, and market products superior to those offered by competitors considering the price and non-price qualities. Chikan (2008), and Apasia (2017), firms competitiveness refers to it capability to sustainably fulfill it double purpose meeting customer needs and profit.

2.2.4 Measures of Competitiveness

There are many ways though which competitiveness of manufacturing firms as opined by various authors. This study focuses on productivity and market share by (Buckley *et al.,* 2010)

i. Productivity
Kenon (2024) productivity is a measure of competitiveness or performance that compares the output of a product of a firm with the input or resource required to produce it. The input may be labour, equipment, or money. It is the quantity of products produce by a manufacturing firm within given resource. It can be improve to meet the requirements of the customers for competitiveness through technological innovations.

ii. Market Share
Market share is the percentage of the total market for industry, sales made by a firm (Gale, 2013). It said to be the percentage of the total revenue or sales in a market that a business makes up or a percentage of the market that is controlled by a company. It serves as a measure of competitiveness and can be improved by technological innovation. For Merriam (2024) market share is the percentage of the market for a product or service that a company supplies.

2.2.5 Concept of Manufacturing Small and Medium Enterprises (SMEs)

Manufacturing Small and Medium Enterprises (SMEs) are firms that change or process raw materials into finished goods whose capital, workface, and assets fall below a certain

level according to the national guidelines since every country has it economic measures that guide the definition (Part, 2023).

2.3   Review of Related Empirical Studies

Gudetu *et al*., (2024), investigated the effect of innovation capability on competitiveness. A study on manufacturing firms in Ethiopia. An exploratory research design was use by the study. Primary data was collected with the use of structured questionnaire from manufacturing firms. Stratified random sampling technique was employed and sample of 20 manufacturing companies. Amos V 23 and SPSS V 26 software used to analyze. Multiple regression approach was adopted for test of hypotheses. The study found that product, process, market an organizational innovation has a positive impact on competitiveness of manufacturing firms in Ethiopia. Product innovation ($\beta = 0.355, p < 0.01, t = 8.25$), organizational innovation ($\beta = 333, p <= 0.01, t = 9.00$). The different exist that the study was conducted in Ethiopia and consideration product, process, market and organizational innovation as incremental and destructive innovations and their effective on competitiveness of manufacturing SMEs in Makurdi, Benue State.

Sefeovic *et al.,* (2022), studied impact of technological innovation on performance of manufacturing firms in Switzerland. The study adopted a descriptive research design. The study target a population of 658 respondents from Eastman chemical international GMbH Zoug with the sample size of 249 determined using Taro Yamane formula. Questionnaire instrument was use to collect data. The data collected was analyze using inferential statistics. The study found out that technological innovation had a positive and significant relationship to performance of manufacturing firms in Switzerland ($\beta = 0.684, p = 0.005$). The gap exist that, the study used descriptive research design and Yamane formula for determining the sample size of 249. The latest study used cross-sectional survey research design and census sampling technique for selecting 50 manufacturing SMEs in Makurdi metropolis, Benue State.

Long (2022), examined empirical analysis of technology innovation to promote the international competitiveness of China's manufacturing industry. The study used panel data for the period of 2012 - 2016. Based on the empirical evidence, the study found that introduction and absorption of innovative technology has the capacity to improve significantly the competitiveness of manufacturing companies. This study was an empirical study and more of qualitative while the current study is both quantity and quantitative which is more of field work.

Mary *et al.,* (2019), investigated effect of innovation on firms' competitiveness: the case of manufacturing SMEs in Nairobi County Kenya. Data was collected from a sampled of 284 manufacturing small and medium enterprises for the period of 2012 to 2014. Multiple linear regression was used to analyse the effect of innovation on competitiveness of manufacturing SMEs. Finding indicate incremental, process, marketing and organizational innovation were been implemented by manufacturing SMEs in Nairobi and had a positive significant effect on the competitiveness manufacturing SMEs in Nairobi. The study was carried out using incremental, process, marketing and organizational innovations. The current study covers incremental and destructive innovation in 2024 to

still test the validity of incremental and destructive technological innovations on the competitiveness of manufacturing SMEs in Makurdi metropolis.

Ukpabio and Oyebisi (2017), investigated the impact of technological innovation and the performance of manufacturing firms in Nigeria. A sample of 305 SMEs was drawn from textile/leather, wood/furniture manufacturing industries. Data collected was analyzed correlation analysis and hierarchical regression analysis while concentrating on product and process innovation. Findings generally from his study indicates that technological innovation had significant impact on the performance of manufacturing SMEs in Nigeria. The study concentrated on product and process innovations. The variation exists that this, the current study focus on destructive and incremental technological innovations.

Davinder Sing and Khamba (2017), researched on influence of technological innovation on performance of small manufacturing companies India. An indepth survey approach was adopted targeting 135 firms located in India's Northern Region. Multiple regression analysis analysis was employed to examine the correlation between technological innovations and manufacturing firms' performance which was also validated by statistical t-test and canonical correlation analysis. Findings showed that technological innovation enhance the performance of small manufacturing companies in India. This study was conducted in Northern India targeting 135 small manufacturing companies. The different exist that the current study is carried out in Nigeria targeting 50 manufacturing SMEs in Makurdi metropolis, Benue State.

3.0 METHODOLOGY

The study adopted cross-sectional survey design with the target of 50 manufacturing small and medium enterprises in Makurdi metropolis, Benue State using census sampling technique with the aid of questionnaire instrument for data collection. The average validity index of 0.847 and reliability as 0.851. Multiple regression is used for specifying the model as expressed below:

$$FCPT = F(TI) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

$$FCPT = F, (\text{DI}, \text{INCI}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

$$FCPT = \beta_o + \beta_1 D1 + \beta_2 INCI \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iii)$$

Where:

FCPT =   Firms Competeveness (dependent variable)

TI =   Technological Innovation (independent variable)

DI =   Destructive Innovation

INCI =   Incremental Innovation

β_o =   y intersect on regression line (constant)

$\beta_1 --- \beta_2$ = is the coefficient parameter measured) of DI and INCI

et =   Error Term

4.0   RESULT AND DISCUSSION

The data collected from the participants were analysed presented using descriptive statistics, correlation and regression analysis.

Table 1: Descriptive Statistics

Variable	Mean	Std dev.	Skewness	Kurtois	Cronbach's Alpha
Disruptive innovation	4.29	.781	1.697	2.879	0.847
Incremental innovation	4.34	.726	1.935	3.117	0.851
Competitiveness	4.15	.804	1.629	2.690	0.825

Source: Researchers' Computation from SPSS Output, 2024.

Table 1 provides the means, standard deviations, skewness, and kurtosis for the dimensions of technological innovation and competitiveness. The result shows that incremental innovation has the highest mean score (M = 4.34; SD = 0.726), followed by disruptive innovation (M = 4.29; SD = 0.781) while the mean for competitiveness was the lowest (M = 4.15; SD = 0.804). The skewness and kurtosis values ranged between 1.697 and 1.935 for skewness and 2.879 and 3.117 for kurtosis, thereby not falling within the -1 and +1 normality range recommended for these coefficients. The result also shows the Cronbach's alpha for the variables as follows: disruptive innovation (α = 0.847), incremental innovation (α = 0.851) and competitiveness (α = 0.825).

Table 2: Correlations Matrix

Variable	Disruptive Innovation	Incremental Innovation	Competitiveness
Disruptive Innovation	1		
Incremental Innovation	.528**	1	
Competitiveness	.534**	.546**	1

** Correlation is significant at the 0.01 level (2-tailed)

Source: Researchers' Computation from SPSS Output, 2022.

Table 2 shows the correlation between all the dimensions of technological innovation and competitiveness. The result showed that technological innovation dimensions had high correlation with competitiveness and a positive relationship between the variables. The result found a significant correlation between disruptive innovation and competitiveness (r=.534; *p*<.01) and incremental innovation is significantly correlated with competitiveness (r=.546; *p*<.01).

Table 3: Regression Model Coefficients

Variable	B	T	Sig	Tolerance	VIF
Disruptive Innovation	.253	3.092	.001	.867	1.255
Incremental Innovation	.354	4.084	.000	.875	1.212
R- Square	.614				
Adj. R- Square	.607				
F-Statistics	24.316				
Durbin-Waston	1.725				
Sig.	.000				

Source: Researchers' Computation from SPSS Output, 2024.

The study used regression analysis to ascertain the effect of the independent variables on the dependent variable. The regression model demonstrated that the variables (disruptive innovation and incremental innovation) jointly explained 61.4% variation in competitiveness (R^2= 0.614), while other factors outside the model contributed 38.6 %. The F-statistics (24.316) and sig value (0.000) shows a significant effect of the predictor variables on the dependent variable.

Test of Hypotheses

The outcome of the first hypothesis indicated that disruptive innovation had a positive and significant effect on competitiveness of manufacturing SMEs in Makurdi metropolis, Benue State (β = 0.253; t = 3.092; *p* = 0.001). The hypothesis which states that disruptive innovation has no significant effect on the competitiveness of manufacturing SMEs in Makurdi metropolis, Benue State was thus rejected.

The test of hypothesis two reported a positive and significant effect of incremental innovation on competitiveness of manufacturing SMEs in Makurdi metropolis, Benue State (β = 0.354; t = 4.084; *p* = 0.000). The hypothesis which states that incremental innovation has no significant effect on the competitiveness of manufacturing SMEs in Makurdi metropolis Benue State was therefore rejected.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In line with the findings of the investigation, the study concluded that technological innovation has a strong relationship and significant effect on the competiveness of manufacturing small and medium enterprises in Makurdi metropolis, Benue State.

5.2 Recommendations

The study based on findings and conclusion recommends the following to ameliorate and enhance the competitiveness of Manufacturing Small and Medium Enterprises (SMEs) in Makurdi Metropolis, Benue State. That small and medium manufacturing enterprises owners/ managers are encouraged to step up their incremental technological innovation

in their manufacturing processes so as to add more value to the quality of the products, the enterprises and the economy in general.

Manufacturing small and medium enterprise should continue to alter and update the existing production process, products or services in order to significantly add market value and eventually displace established market, leading firm, products and alliances.

5.3   Contribution to Knowledge

The study revealed that incremental innovation as a form of technological innovation with a beta coefficient of ($\beta = 0.354$) has highest significant effect on competitiveness of manufacturing small and medium enterprises while disruptive innovation which is another form of technological innovation has less significant effects on the competitiveness of manufacturing small and medium enterprises with beta coefficient value of ($\beta = 0.253$).

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