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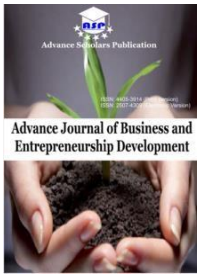

EFFECT OF GREEN INNOVATION ON COMPETITIVE ADVANTAGE OF MANUFACTURING FIRMS IN ENUGU STATE, NIGERIA

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Keywords: *Green innovation, Competitive advantage, product innovation, Market share, Process innovation, Cost, Manufacturing*

Abstract: *The aim of this study is to determine the effect of green innovation on competitive advantage of manufacturing firms in Enugu State, Nigeria. The objectives of the study were to determine the effect of green product innovation on market share, ascertain the relationship between green process innovation and cost of production. The research questions and hypotheses were formulated to align with the research objectives. This study adopted the survey research design in which five (5) manufacturing firms in Enugu State, Nigeria were studied. The population of the study was 2196 and the sample size was calculated to be 328 using the trek formula. A structured questionnaire and oral interview guide were the research instruments used for this study. Pearson product moment correlation coefficient and linear regression was used in the hypotheses testing. This was done with the aid of Statistical Package for Social Sciences (SPSS) software ver.22. The study revealed that green product innovation had a positive significant effect on the market share of a firm. The statistical results is given as; (Green product innovation β =.230; t=4.272; p>000.05).The study revealed that green process innovation had a positive significant relationship with a firms cost of production. This is as result of the computed r = .898, is greater than the table value of .195 with 206 degrees of freedom (df. = n-2) at alpha level for a two-tailed test (r = .898, p< .05). It also concluded that green product innovation had a higher impact on organizational performance compared to green process innovation as it is easier to develop new green product than to alter the manufacturing process itself. based on the findings, the study recommended that manufacturing firms should make efforts to understand customer needs and expectations in order to align green product innovation initiatives with consumer values to satisfy market demand thus gain competitive advantage, manufacturing firms should try to reduce any unnecessary costs in the entire manufacturing process by going green, manufacturing firms should pay more attention to excel their competencies in innovating their products and processes to lead the market and finally manufacturing firms should produce environmentally friendly products that significantly help firms surpass competitors.*

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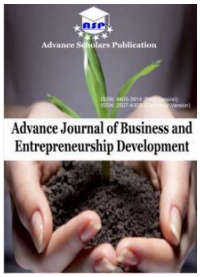

1.1 Introduction

Rapid industrialization and urbanisation in Western nations resulted in a rapid loss of normal assets that lasted until 1945, creating worries about pollution, personal happiness, and environmental degradation. Schumter (1934) swiftly developed the concept of innovation, defining it as the extension of free enterprise and its potential to manage the common living environment. The relationship between innovation and sustainability first gained widespread attention in the 1960s. In the mid-1960s, financiers anticipated that their activities would have an influence on the environment, assets, raw materials, and people. As a result, the recipients were resolved to safeguard the environment.

Nonetheless, in response to the ongoing environmental advances of the 1960s, several countries began to take steps to protect the environment within their borders. This was many states' awareness that pollution did not end within their boundaries. To solve the world's environmental challenges, worldwide action, understanding, and collaboration are required. This spurred the United Nations Conference on the Human Environment to convene in June 1972 in Stockholm, Sweden. The 1992 Rio Conference, often known as the "Earth Summit," was held in Brazil. Pickering and Owen (1997) highlight how the Earth Summit provided exciting chances for global pioneers to connect with the environment and how countries should collaborate to save the environment.

In any event, it is clear that manufacturing enterprises' actions have actively and directly contributed to air and water pollution, as well as environmental damage and degradation. According to Juan (2011), resolving conflicts between economic progress, excessive energy use, and environmental deterioration is a test of one's ability to confront the complete contemporary reality. According to Huber (2004), one of the current challenges is achieving a naturally sustainable way of living. Environmental contamination is frequently the source of green inventions (Huber, 2008). Green innovation institutions, according to Rave, Goetzke, and Larch (2011), play a critical role in enterprises' environmental exhibition outcomes and complete fulfilment of environmental management competence.

Green innovation, according to Chen (2006), is described as equipment and software innovation linked with green goods or processes through energy savings, pollution avoidance, waste reuse, green product planning, and operational environmental management. Green innovation is the development and dissemination of items, hardware, and frameworks used to safeguard normal living spaces and assets while lowering the negative environmental repercussions of human activities. With all of the concerns about the environment, the prosperity of the planet, global warming, and the reality that the earth's resources may one day be depleted, green innovation is a passionately contested subject in Nigeria. In response to environmental issues, the Nigerian government created a number of rules between 1958 and 1992 that proposed ways to mitigate the consequences of these issues. The Forestry Act of 1958, the Management of Solid and Hazardous Waste Regulations of 1991, the Rules and Standards for Environmental Pollution Control in Nigeria, 1991, the Environmental Impact Evaluation Proclamation of 1992, the Government Environmental Protection Organization (FEPA) in all 36 Nigerian States, and bureaucratic and state environmental

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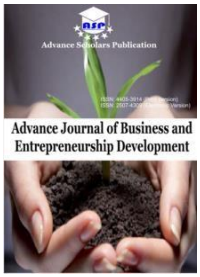

departments were established in 1999. (Adekunle, 1998).

Despite the various regulations enacted by the Nigerian government and the global environmental change that has led to a shift in perspectives, the adaptation and adoption of eco-friendly practices, and full compliance with local and international environmental regulations, the manufacturing situation in Nigeria appears to be affecting organisations and their environments. The 1995 World Bank report revealed that the oil exploration and exploitation activities of multinational oil organisations in southern Nigeria lead to oil slicks, gas spills, normal resource depletion, water and air pollution from oil slicks, and carbon emissions from rock-solid oil exploration engines, all of which affect the productivity of manufacturing companies. Oil slicks, gas spills, land grabs, and construction activities by multinational oil organisations have resulted in lost wages and profitability for organisations in the Niger Delta region of Nigeria (Opukri and Ibaba, 2008). This is reflected in their unfortunate product quality and limited quantity offered in the market at a costly price (Oteh and Eze, 2012). Gas eruptions generate heat that kills vegetation around the flare region, obliterates mangrove swamps and salt marshes, smothers the development and flowering of certain plants, causes soil degradation, and reduces horticultural production (UNDP, 2006; Mba, 2000).

This circumstance has an impact on the productivity and market shares of the manufacturing companies operating in the region, as well as on the controllable further development of the host networks (UNDP, 2006; MBA, 2000). Choosing the right tools to carry out green innovation is still difficult due to costs and meeting partners' management requirements (Montabon, Sroufe, and Narasimhan, 2007). Failure to comply and implement green environmental practises can deplete normal living space and strain livelihoods, which can directly impact organisations as inventory network disruption can lead to failures that affect the organization's long-term execution.. The study therefore determines the effect of green innovation on competitive advantage of manufacturing firm in Enugu State, Nigeria.

1.2 Statement of the Problem

Green innovation is typically viewed as a method of measuring the overall level of green engagement in organizations. Green innovations are important in manufacturing companies because they protect the environment from pollution, save energy, and reuse waste materials. In terms of energy conservation, the use of alternative energies such as machines and instruments that work with nearby planetary groups will save the environment from synthetic substances. Green innovation can take the form of product or process innovation (Chen 2006). Green innovation, an environmentally responsible innovation, is used to protect the environment, preserve normal assets, and help organisations escape the ongoing bind before things take a tragic turn. Green practises work on environmental execution, including advancing education, reducing response time, reducing energy consumption, reducing waste, using toxic materials, and reducing emissions performance. Green innovation is carried out in a green environment: green image, green innovation, green pursuit, green product innovation, green process innovation, green procurement, eco-plan and pooling, and green construction. This influences socio-ecological compatibility.

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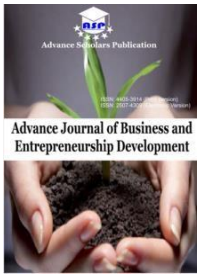

Many formed nations have handled these activities by adopting codes of conduct and rules to work on the issue. Unfortunately, this is not the case in most farming nations, including Nigeria, where only laws and motivators are available. And the majority of eco-friendly actions in Nigerian industrial businesses are deliberate on the part of top management, demonstrating the relevance of environmental management behaviour in determining the amount of environmental awareness inside the organisation. In Enugu State, minimal attention is placed on the green environment: green reputation, green innovation, green business, green product innovation, green process innovation, green procurement, eco-plan and pooling, warehousing, and green building. This is responsible for contamination of air, water, land, materials, minerals, and energy; regular territory and assets; deforestation; rapid population growth; migration to metropolitan regions; and waste.

This study will examine the effect of green innovation for competitive advantage of manufacturing firms and its impact on the organizational performance. However these studies have been conducted in well-developed and developed countries, very few studies can be found in developing countries. Given the level of green adoption in Nigeria, this study will try to find the nature of green innovation impact on organizational performance through competitive advantage.

1.3 Objectives of the Study

The broad objective of this study is to examine the effect of green innovation on competitive advantage of manufacturing firms in Nigeria. However, the specific objectives of the study are to:

i. Determine the effect of green product innovation on market share in manufacturing firms.
ii. Ascertain the nature of the relationship between green process innovation and cost of production in manufacturing firms.

1.4 Research Questions

In line with the objectives of the study, the following research questions were put forward:

i. What is the effect of green product innovation on market share of manufacturing firms?
ii. What is the nature of the relationship between green process innovation and cost of production in manufacturing firms?

1.5 Statement of Hypotheses

In line with the objectives and research questions, the following hypotheses were put forward for test:

i. Green product innovation has a positive significant effect on the market share of manufacturing firms.
ii. Green process innovation has a positive significant relationship with the cost of production of manufacturing firms.

1.6 Scope of the Study

The study focused on the effect of green innovation on competitive advantage of manufacturing firms in Enugu, Nigeria. The scope of the study comprised of theoretical and geographical scope.

Theoretical Scope: The study was limited to the independent and dependent variable. The independent variable used was green product innovation, green process innovation, green managerial innovation and eco design and, while the scope of the dependent variables included market share, cost of production, firm's reputation and waste minimization.

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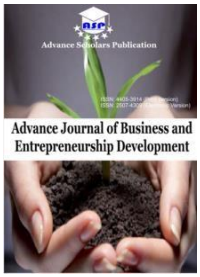

1.7 Significance of the Study

The findings of this study are of immense relevance and benefit to several interest groups. The study will help manufacturing firms and its owners know the importance of green innovation not just to the environment but also to the firm. It will help manufacturing firms to know the competitive advantage green innovation can give them in its competitive environment in which it exists and processes of adoption. More so, this study will help manufacturing firms understand the effect green innovation can have on its image, reputation, productivity, sustainability development, market share and environmental performance.

To the researcher, this study will be useful in future as sources of secondary data for the researcher and academic inquiry. This study will give the researcher detailed information about the effect of green innovation in manufacturing firms and the competitive advantage it gives.

To the general public, this study will enable them acquire knowledge and gain experience on green innovation, its importance to environment, its effect and advantages in manufacturing firms.

LITERATURE REVIEW

2.1 Conceptual Framework

2.1.1 Innovation

Larsen (2005) defines innovation as the application of specialised or organisational innovation. The OECD's Olso Handbook (2005) defined innovation as the development of new or considerably developed goods or processes for organisational applications, a different marketing strategy, or a different organisational approach in any business. Damanpour (1996) defines innovation as the production, improvement, and adaptation of novel thinking or activities for an organisation. Cumming (1998) defined innovation as the most important and beneficial use of a product or method. The OECD has classified inventions into four categories based on the field of innovation. These are classified as "product innovation," "process innovation," "organizational innovation," and "marketing innovation" (OECD, 2005).

2.1.2 Green Innovation

It has been noted that other terms (e.g. eco-innovation, eco-innovation and sustainable innovation) are used by other scientists on similar topics. Therefore, these different terms are discussed first to help better understand how green innovation is defined and which terms can be used as synonyms, but which terms have different meanings. To define green innovation, Driessen and Hillebrand (2002) use a more pragmatic definition, stating that it does not have to be developed with the aim of reducing environmental impact. However, it brings significant environmental benefits. Chen, Lai (2006) define green innovation as hardware or software innovation related to green products or processes, including innovation in technologies related to energy saving, pollution prevention, waste recycling, green product design or corporate environmental management. Green innovation generally aims at reducing pollution, energy productivity, reducing waste, substituting limited resources with sustainable resources and recycling (Kemp & Arundel, 1998). Rave, Goetzke & Larch (2011) find that green innovation institutions play a key role in corporate environmental performance outcomes and the full realization of environmental sustainability. There is also a firm competitive advantage in its industry.

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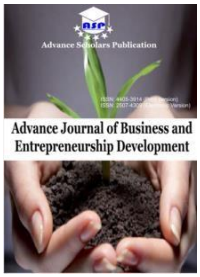

Green innovation can be viewed as a subset of all innovations.

2.1.3 Green Product Innovation

Chen (2006), Kammerer (2009), and Carrillo-Hermosilla (2010) define green product innovation as the introduction of new or significantly improved products for environmental reasons (e.g. resource use efficiency, green design, energy saving, recycling, waste). product life cycle and increasing competition) that are carried out under the strain of shortened product life cycles and increased competition. Pujari (2006) views green product innovation as a cost-effective means for consumers and producers. Green product innovation refers to the application of innovative ideas that result in the development, manufacture, and marketing of new products that are significantly superior in novelty and environmental friendliness to traditional or competing products (Soylu & Dumville, 2011). Dangelico & Pujari (2010) state that green product innovation has emerged as a result of the interaction between sustainability and innovation.

Examples of green product innovation activities are: reducing toxic components in products; reducing emissions and energy consumption during product use; extending the useful life of products, including product remanufacturing systems, which can be a differentiation tool for marketing activities and allow for maintaining market share (Rave, Goetzke & Larch, 2011). Green product innovation also means developing products that have positive or less negative impacts on the environment during their life cycle (Durif, Bolvin & Julien, 2010). Green product innovation is a multi-faceted process that involves three main types of environmental aspects—materials, energy, and pollution—based on their greatest environmental impacts at different stages of the product's physical lifecycle—manufacturing process, product use, and end-of-life. Measuring green product innovation consists of three main elements related to new product development. First, the company must select the materials that cause the least pollution. Second, the company must use the least amount of materials to make products, and third, the company must carefully consider whether the product is easy to recycle, reuse, and decompose (Utterback & Abernathy, 1975; Guoyou, 2013).

2.1.3 Competitive Advantage

Competitive advantage refers to an edge that allows an organization to deal with market and environmental forces better than its competitors (Porter, 1985). Competitive advantage is anything that a firm does especially well compared to rival firms. When a firm can do something that rival firms cannot do, or owns something that rival firms desire, that can represent a competitive advantage. Getting and keeping competitive advantage is essential for long-term success in an organization. Imitation will be difficult for competitors if the firm has sustainable competitive advantage which effectively positions the firm against its competitors (Porter, 1985).

Two basic types of competitive advantage: cost and differentiation advantage have been identified, (Porter, 1980). In cost advantage, Porter argued that a company could achieve superior performance by producing similar quality products or services but at lower costs. In this case, a company sells products at the same price as competitors but reaps higher profit margins because of lower production costs. The company that tries to achieve cost advantage is pursuing cost leadership strategy. Higher profit margins lead to further price

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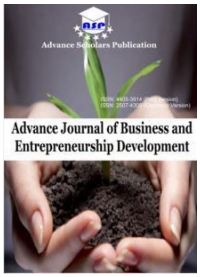

reductions, more investments in process innovation and ultimately greater value for customers and better performance for the firms.

Firms that have achieved competitive advantage over their competitors not only has better performance than its competitors but also delivers better values to their customers, and hence strengthening their market position (Bani-Hani & AlHawary, 2009). The most vital value of a corporate competitive advantage is that the firms have the capability that is impossible for competitors to imitate or replicate (Sinha, 1998). Superior profitability can be realized with competitive advantage where the firm is able to command a premium price than competitors or enjoying lower cost (Porter, 1991). Corporations can gain competitive advantage by adapting environmental technologies. With environment technologies, corporations can adapt to new management approach to minimize ecological impacts of economic production while in the meantime strengthening the competitive advantage of the firms (Shrivastava, 1995).

2.2 Theoretical Framework

2.2.1 Ecological Modernization Theory

Ecological modernization theory was first used by Joseph Huber (2000). Since then, environmental analysis and organizations have widely adopted or adapted this theory to explain green economics, green growth initiatives, green management and green technology. Ecological modernization theory is view as a systematic eco-innovation theory that is applied at the micro level and macro level, such as at the organizational or supply chain level and production process. This theory supports the idea that manufacturing companies can invest in process/product innovation to decrease environmental degradation and thus help with economic gains. Ideally, ecological modernization theory describes a "win-win" scenario whereby technological development and innovation can help industries and countries to achieve both economic and environmental sustainability (Murphy and Gouldson, 2000; Sarkis, 2011).

In effect, ecological modernization theory is related to this study and the hypotheses that green managerial innovation promotes a firm's reputation. A review of the related literature reveals additional research supporting and enriching the ecological modernization theory. Zhu (2012) applies ecological modernization theory to the Chinese manufacturing industry, stating that manufacturers can implement environmental and technological innovations, such as new, cleaner production equipment, green product innovation, green process innovation, green procurement, and eco-design, to obtain organizational sustainability. More empirical evidence has come from Demark, where Søndergård (2004) investigated the Danish textile industry. They concluded that environmental innovations could help companies to build innovative competencies within the organization. Such competencies can even extend to the companies' supply chains. Another empirical study by Huber (2008) tested technological, environmental innovations from a chain-analytical and life-cycle-analytical perspective. Huber concluded that such innovations usually occur upstream of the supply chain, i.e., with suppliers, instead of downstream, i.e., with customers. Ecological modernization theory explains companies' motivations for improving environmental practices, suggesting that green practices can help organizations to achieve organizational sustainability in environmental, economic and social.

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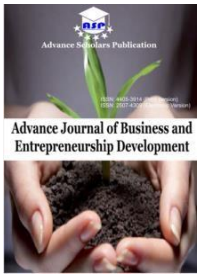

2.3 Empirical Reviews

In a study done in France, Delmas and Pekovic (2012) investigated the effect of green business practices on employee's productivity in French green companies. They were set out to solve the problem of how a firm's environmental commitment affects its productivity. The methodology used for the study is survey design which includes the collection of data from a survey of employees at 5,220 French companies, randomly selecting two employees from each company for a pool of more than 10,000 people. Companies that had voluntarily adopted international standards and labels such as "trade "and companies with International Organization for Standardization's ISO 14001 certification, a voluntary industry standard programme were also considered green for the purposes of the study. "It's a counterpoint to people thinking that environmental practices are detrimental to the firm." The research findings include that companies that adopt eco friendly green practices have employees that are more productive than those that do not. On average, employees at companies that observe eco-friendly practices were 16 percent more productive than average employees. Delmas (2012) further states that adopting green practices aren't just good for the environment, "It's good for your employees and it's good for your bottom line. Employees in such green firms are more motivated, receive more training and benefit from better interpersonal relationships. The employees at green companies are therefore more productive than employees in more conventional firms" (Delmas 2013).

Russo and Fouts (2014) investigated the effect of corporate environmental sustainability on profitability and economic performance. They were set out to solve a problem of how corporate environmental sustainability, profitability and economic performance relate. The methodology used was survey design which includes the collection of data from a survey and the test of hypotheses with an analysis of 243 firms over two years, using independently developed environmental ratings. Results indicate that "it pays to be green" and that this relationship strengthens with industry growth. They concluded by highlighting the study's academic and managerial implications, making special reference to the social issues in management literature. The finding of the study was that environmental sustainability, profitability and economic performance are positively linked and that industry growth moderates the relationship, with the returns to environmental performance higher in high-growth industries.

Lin and Geng (2013) in a study done in Vietnam investigated "market demand, green product, and eco-innovation on firm's performance". The study examined how market demand affects green product innovation, and firm performance in the context of Vietnamese motorcycle industry. The study seeks to answer two key questions: how does market demand influence a firm's green product innovation? And how can green product innovation affect firm performance? The methodology used for the study was survey design through the collection of a total of 208 valid questionnaires from four leading foreign motorcycle firms in Vietnam. Findings revealed that green product innovation performance has positive correlation with firm performance and that green product innovation and firm performance should incorporate considerations related to the access of knowledge about market demand characteristics.

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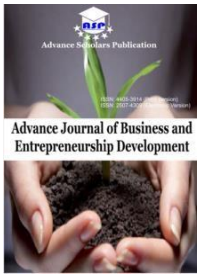

In a study done in Kenya, Mercyline and Kamande (2014) investigated an "eco efficiency and eco-commitment analysis of Kenyan manufacturing firms". This study examines the linkage between the profitability of firms measured by Return on Assets (ROA) and environmental performance measured by eco-efficiency and eco-commitment and also the impact of a good Environmental Management System on profitability and eco efficiency of firms. The methodology used for the study is survey design through which questionnaire was shared to six Kenyan manufacturing firms. The finding of the study showed that there is a potential gain in the profitability of the firm by improving eco-efficiency in resource use. Further, proactive firms are found to perform better than reactive firms in terms of profitability and eco-efficiency but firms that combine both proactive and reactive EMS perform even better which shows the benefit of adopting commitment based approaches alongside the compliance based approaches to environmental management.

Ilker (2012) studied the gap between green product innovations and firm performance and firms' ability to enhance their competitive capability under moderating effect of managerial environmental concern in this relation. Ilker constructed a model to link the aforementioned constructs, and data collected through a questionnaire based survey across 140 Turkish manufacturing firms from various sectors, which were then analyzed using structural equation modeling. That study showed that green product innovation generally has a positive effect on firm performance. This result demonstrated the strongest and significant influence of green product innovation on firm performance and competitive capability, with a strong effect of moderates.

METHODOLOGY

3.1 Research Design

For the purpose of this study, survey design will be adopted. Survey design will be adopted because it gives the researcher the opportunity to sample the opinion of people and obtain current information from the respondents. A descriptive method of research was used for this study, and well-structured questionnaires were used for the study.

However, the primary source of data used in this study was generated mainly with the aid of a structured questionnaire administered to respondent. This is used when a researcher intends to generate data directly from respondents without relying on pre-existing data sources.

3.2 Sources of Data

3.2.1 Primary data

The primary source of data used in this study was generated mainly with the aid of a structured questionnaire administered to respondent. This is used when a researcher intends to generate data directly from respondents without relying on pre-existing data sources.

3.2.2 Secondary data

Secondary data are historic in nature and was gathered through reviewing existing literatures relevant to the study; journals and articles, books, conference papers, and the internet. The literatures review was done in order to give the reader a clear understanding of the study based on already existing information.

3.3 Population of the Study

The population of study for this research comprises of five manufacturing firms in Enugu, Nigeria. The target population for this study consists of the entire staff of the selected

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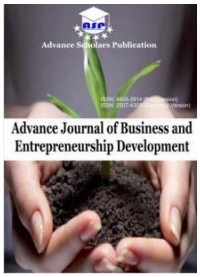

organizations. The manufacturing firms are therefore tabulated below:

Table 1: Population Distribution

S/N	Manufacturing firms	Number of staff
1	Juhel Nigeria	126
2	Innoson group	100
3	Hardis&Dromedas Limited	300
4	Emenite	538
5	Nigeria Brewery Enugu	1132
	Total	2196

Source: Field Survey, 2022.

3.4 Sample Size Determination

Sampling is the process of selecting a number of study units from a predefined study population (Polit and Hungler, 1978). The sample size determination was done using Trek (2004) sample size determination formula.

$$\frac{Z^2Pq + e^2}{e^2 + \left(\frac{Z^2Pq}{N}\right)}$$

The formula is given by (Trek, 2004; Bartlett, Kotrlik and Higgings, 2001)

Where, n = sample size

z = standard error of the mean (usually 95%, corresponding to 1.96 in the z-distribution table).

p = proportion of the population likely to be included in the sample (50% or 0.5 is assumed).

e = level of significance (assumed to be 5% or 0.05)

N = population size (N = 2196).

Substituting in the formula, we obtain:

n = $(1.96^2 \times 0.5 \times 0.5) + 0.05^2) / (0.05^2 + (1.96^2 \times 0.5 \times 0.5/2196)$

n = (3.8416 x 0.5 x 0.5) + 0.0025) / (0.0025 + (3.8416 x 0.5 x 0.5/2196)

n = (0.9604 + 0.0025)/ (0.0025 + (0.9604/2196)

n = 0.9629/0.0025 + 0.0004373

n = 0.9629/0.0029373

= 327.81806

≈ 328

3.5 Method of Data Analyses

The objective of the study is to examine the effect of green innovation on competitive advantage of manufacturing firms. A descriptive method was used and descriptive statistics has to do with presenting the data collected and the correlation of the variables i.e. the degree of the relationship existing between two variables so as to explain the data (Offredy and Vickers, 2010). However, Pearson product moment correlation coefficient and linear regression was used in the hypotheses testing. This was done with the aid of Statistical Package for Social Sciences (SPSS) software ver.22 to fully analyze the data by coding the items and entering them into the SPSS for analyses.

DATA ANALYSIS

4.1 Presentation of Data

The presentation of data collected means arranging the different forms of data obtained through various data collecting techniques to enable the researcher perform analysis and exact new meaning from it. The copies of questionnaire administered were 328 representing (100%) from which 250 (76.2%) were returned, while 78 representing (23.8%) were not returned. The 240 copies of questionnaire that were returned were considered adequate enough for making valid deductions and conclusions. Hence, the research analysis was based on the returned copies of questionnaire.

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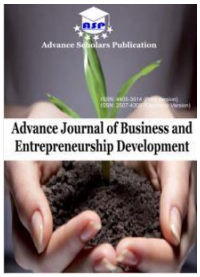

Table 1: Mean rating of Responses of Respondents on the Effect of Green Product Innovation on Market Share in manufacturing firms in Enugu State.

S/N	ITEMS	SA	A	U	D	SD	N	FX	X	Decision
1	The production of environmental friendly products influences our customer's attitude positively	126	92	-	10	22	250	1040	4.2	Accepted
2	Our innovative method of product packaging significantly increase brand awareness	119	93	1	9	28	250	1016	4.1	Accepted
3	The increase of our product's life span through green product innovation affects product purchase	85	36	9	70	50	250	786	3.1	Accepted
Total	**Mean**								**3.8**	**Accepted**

(Source: Field survey, 2023)

Table 1 above shows the mean mark calculated from the response of the respondents on the effect of green product innovation on market share in manufacturing firms in Enugu State. Based on the decision rule, that if $\bar{x}$ is below 2.5 it is considered rejected and if $\bar{x}$is 2.5 and above it is considered accepted. However, all the items in the table were accepted because they score the mean score of 3.8. Thus, it is obvious that green product innovation affect market share in manufacturing firms in Enugu State.

Table 2: Mean rating of Responses of Respondents on the Relationship between Green Process Innovation and Cost of production in manufacturing firms in Enugu State.

S/N	ITEMS	SA	A	U	D	SD	N	FX	X	Decision
1	The use of energy saving product by our organization reduces cost	97	90	2	29	32	250	941	3.7	Accepted
2	The use of new technology during production helps to eliminate pollution and reduce overhead cost	110	79	1	50	10	250	979	3.9	Accepted
3	Reduction in consumption of water, electricity and raw material reduces cost	113	84	2	40	10	250	997	3.9	Accepted
Total	**Mean**								**3.9**	**Accepted**

(Source: Field survey, 2022)

Table 2 above shows the mean mark calculated from the response of the respondents on the relationship between green process innovation and cost of production in manufacturing firms in Enugu State. Based on the decision rule, that if $\bar{x}$ is below 2.5 it is considered rejected and if $\bar{x}$is 2.5 and above it is considered accepted. However, all the items in the table were accepted because they score the mean score of 3.9. Thus, it is obvious that there is relationship between green process innovation and cost of production in manufacturing firms in Enugu State.

4.2 Test of Hypotheses

The results for the various tests of hypotheses, which were tested with the Pearson Product Moment Correlation coefficient and Linear Regression and the results are presented below:

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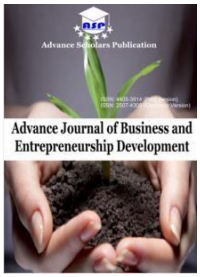

Test of Hypothesis One

H_0: Green product innovation has no positive significant effect on the market share of a firm.

Table 4.3a: Model Summary

Model	R	R Square	Adjusted RSquare	Std. Error of The Estimate
1	.663[a]	.440	.431	.37617

a Predictors: (Constant), Green product innovation

The Model summary as shown in Table 4.3a indicates a significant effect of green product innovation accounting on the market share of a firm of 0.663 as indicated by the R, which is the correlation coefficient of the two variables. The R Square value, 0.440 further revealed that green product innovation accounts for 44.0% contribution in market share of a firm. The Adjusted R square, 0.431 depicts that the model formulated has 43.1% predictability.

Table 4.3b: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	20.123	3	6.708	47.403	.000[b]
	Residual	25.612	246	.142		
	Total	45.735	249			

a Predictors: (Constant), market share of a firm
b Dependent Variable: Green product innovation

Table 4.3b shows that the F-value is the Mean Square Regression (47.403) divided by the Mean Square Residual (0.142), yielding F=47.403. The model in this table shows that green product innovation is statistically significant at (Sig =.000) and is a significant predictor of the market share of a firm at $F_{(3,184)} = 16.556$.

Table 4.3c: Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.782	.236		3.309	.001
	GPI	.230	.054	.663	4.272	.000

a Dependent Variable: Market Share of a Firm

The Regression coefficient table 4.3c had the value of the constant in the regression equation as 0.782 and beta coefficient of 0.230 at t=4.272 and sig=p=.000. This also shows significance as sig=p=.000<.05 which is the level of significance adopted for this study. The regression analysis also indicates that green product innovation accounted for 23.0% of every change of the market share of a firm.

The regression model restated is:

MSF= 0.782 + 0.230GPI + 5.86

In order to make a decision as to the acceptance or rejection of the null hypothesis, the F-statistic value on the ANOVA table was used.

F_{cal}= 47.403; F_{tab}= $F_{(2,100)}$ = 3.94

$F_{cal} > F_{tab}$

Following the decision rule, we reject the null hypothesis and accept the alternate hypothesis that green product innovation has significant effect on the market share of a firm. This implies that green product innovation has significant effect on the market share of a firm.

Test of Hypothesis Two

H_0: Green process innovation has no positive significant relationship with a firms cost.

Table 4.4a Descriptive Statistics between Green Process Innovation and Firms Cost

	Mean	Std. Deviation	N
Green Process Innovation	1.8654	1.11258	250
Firms cost	2.2452	1.31967	250

Table 4.4a shows the descriptive statistics of the green process innovation via firms cost, with a mean response of 1.8654 and std. deviation of 1.11258 for green process innovation and a mean response of 2.2452

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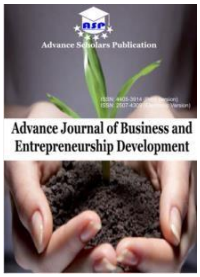

and std. deviation of 1.31967 for green process innovation and number of respondents (250). By careful observation of standard deviation values, there is no much difference in terms of the standard deviation scores. This implies that there is about the same variability of data points between the dependent and independent variables.

Table 4.4b: Correlations between Green Process Innovation and Firms cost

		Green Process Innovation	Firms cost
Green Process Innovation	Pearson Correlation	1	.898(**)
	Sig. (2-tailed)		.000
	N	250	250
Firms cost	Pearson Correlation	.898(**)	1
	Sig. (2-tailed)	.000	
	N	250	250

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

The above table 4.4b is the Pearson correlation coefficient for green process innovation and firms cost. The correlation coefficient shows 0.898. This value indicates that correlation is significant at 0.05 level (2tailed) and implies that there is a positive relationship between green process innovation and firms cost (r= .898). The computed correlations coefficient is greater than the table value of r = .195 with 206 degrees of freedom (df. = n-2) at alpha level for a two-tailed test (r = .898, p< .05). However, since the computed r = .898, is greater than the table value of .195 we reject the null hypothesis and conclude that green process innovation has positive significant relationship with a firms cost (r =.898, P<.05).

4.3 Discussion of Findings

The result revealed that green product innovation has a positive significant effect on the market share of a firm. This is consistent with international previous studies of Chen et al., (2006) and Azorin et al., (2009) which results showed that green product innovation has a higher impact on organizational performance compared to green process innovation, apparently its easer to develop new green product than altering the manufacturing process itself. As for the moderate variable environmental management behavior, it is clear that the environmental management behavior deeply effect the relationship between green innovation and organizational performance since in Jordan green adoption is self imposed as mentioned previously there for it is logical to say that the higher the environmental management behavior toward green practices the better the outcome for organizations (Wong, 2012). Furthermore a study done by Chuang & Yang (2014) concluded that green innovation is considered as one of the key factors for improving firms environmentally, social and financial outcomes.

The result revealed that green process innovation has a positive significant relationship with a firms cost of production. This result is coherent with the study conducted by Chen et. al., (2006) found that green process innovation has a positive impact on corporate competitive advantages. The main reason for this is that with greener process, waste could be reduced and recycled as well as energy is used in a more efficient way. Additionally, Kuo (2007) claimed that by implementing green manufacturing, business will achieve better competitive edge from having improved quality and efficient usage of energy and resources during production. Firms can also achieve higher profits with

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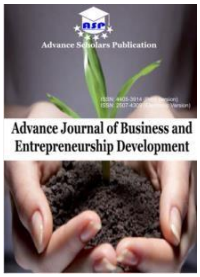

lower number of environmental incidents because finished products contain more natural materials and processed without toxic materials. For example, 3M saved $1 billion from its pollution prevention practices in 2005 (Wolf 2014).

5.1 Summary of Findings

Having carried out this research project, the researcher made the following findings:

1. The study revealed that green product innovation had a positive significant effect on the market share of a firm. The statistical results is given as; (Green product innovation β =.230; t=4.272; p>000.05)
2. The study revealed that green process innovation had a positive significant relationship with a firms cost of production. This is as result of the computed r = .898, is greater than the table value of .195 with 206 degrees of freedom (df. = n-2) at alpha level for a two-tailed test (r = .898, p< .05)

5.2 Conclusions

This research was conducted to examine the effect of green innovation on competitive advantage of manufacturing firm in Enugu State, Nigeria. Based on the findings of statistical analysis, green product innovation and green process innovation positively impact the organizational performance. The hypotheses testing showed that green product innovation has a higher impact on organizational performance compared to green process innovation, apparently its easer to develop new green product than altering the manufacturing process itself. As for the moderate variable environmental management behavior, it is clear that the environmental management behavior deeply affect the relationship between green innovation and organizational performance since the higher the environmental management behavior toward green practices the better the outcome for organizations. Hence, this study concludes that green innovation affects competitive advantage of manufacturing firms in Enugu State.

5.3 Recommendations

Based on the findings and conclusion, the researcher made the following recommendations:

i. Manufacturing firms should make more efforts to understand customer needs and expectations in order to better anticipate their changing preferences and align green product innovation initiatives with consumer values to promptly satisfy market demand, thus gain competitive advantage.
ii. In addition, since market demand can be influenced by price, firms should attempt to reduce any unnecessary costs in the entire manufacturing processes to maintain stable and reasonable prices in consistent with customer needs.

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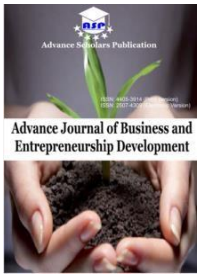

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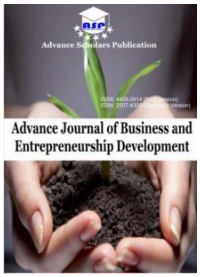

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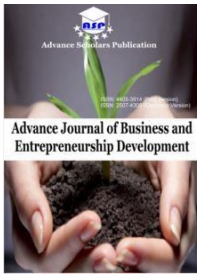

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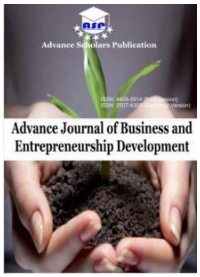

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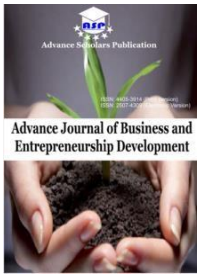

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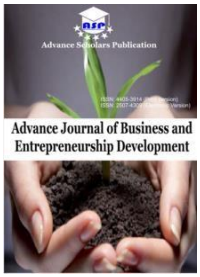

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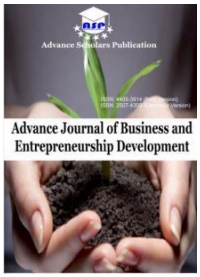

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