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# Effect of Research and Development Cost (R&D) on Automotive Component Firms in South East, Nigeria

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**Abstract:** The study examined the effect of research and development cost (R&D) on automotive component firms in South East, Nigeria. The study comprised adopted survey method. Primary sources of data were mainly used. The area of the study was the selected automotive component firms in South East. Questionnaire and semi structured interview were used to collect data from manager-owners and other key officers in the selected firms. The population of the study was 1741 staff, and a sample size of 357 was determined using Taro Yamane. Statistics such as frequency count and percentages were put to use in the analysis of research questions while research hypotheses were tested using ANOVA with the aid of Statistical Package for Social Sciences. From the analyses tested, the study found that, Research and development cost (R&D) has significant effect on automotive component firm in South East. The study recommended that Firms are required to consciously make investments in R&D and training to developing a stock of knowledge capital. R&D was found to be the significant driver of technological innovation in this study however, An industrial policy that would encourage firms to hire R&D staff to perform in-house R&D should be planned by management as a matter of urgency. This has been proven to increase performance in this study

**Keywords:** R&D, Innovation, Automotive, Component, ANOVA, Technology

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## 1. INTRODUCTION

At some stage in the last few decades scholars have progressively stressed the significance of research and development (R&D) in the manufacturing sector. Technology-based companies in this sector put forth huge expenditures for R&D in order to keep up their competitive advantage and ensure their future feasibility (Lee Kim, & Lee, 2011). This implies that due to escalating competition, firms should innovate at an astonishing pace by developing and improving new products and services, and by generating ideas explicitly intended to become commercially viable and profitable business ventures (Ehie & Olibe, 2010).

Improving the performance of firms there are many positive and economic benefits for both the micro and the macro economy. Consequently, the performance of companies is of great interest

and has been generally considered from various perspectives in the research. However, each company and sector has different trait that control its performance. For instance, several researchers have proved that R&D activities have a positive influence on company performance (Abdel & Kanakriyah, 2017), (Ayaydin, & Karaaslan, 2014), (Öztürk, & Zeren, 2015)

In today's competitive landscape, firms' investments in innovative activities have become one of the most vital factors that allow for their sustainability. In the computer age of the 21st century, timely and adequate investment in knowledge and innovation will provide firms with a competitive advantage. Since the 1980s, when the globalization process gained impetus, the companies that have played a principal role in bringing innovation to their industries have increased their market share and provided added value to their economies, (Kiraci, Celikay, & Celikay, 2016).

Abdel and Kanakriyah (2017) importance of R&D stems from its ability to foster a company's economic growth as it leads to the innovation and application of new technologies that can augment a company's competitive advantage and prolong its life and advance its position in the market. Which is considered the basis for generating new products, processes and services, particularly in the industry and technology sectors, It is a critical component in the process of innovation that can provide a company with a competitive advantage (Orian & Hall, 2006) enabling it to become a market leader.

Due to the rising costs of R&D and the increasing dependence of companies on technology for competitive advantage, managers seek evidence of the impact of R&D on firm performance. Past studies have documented that a firm's R&D investment consistently and positively affects its market value such studies were: Abdel and Kanakriyah, (2017) who found that there is a significant impact of R&D expenditure on company performance as measured by ROA, ROE and EPS, Kiraci, Celikay, and Celikay, (2016) their findings revealed that although research and development expenditures do not have a statistically significant effect on the short-term profitability of a firm, Ayaydin, and Karaaslan, (2014) found evidences of positive effect of R&D intensity on the firm performance by using GMM system estimators for a sample of 145 manufacturing firms registered BIST for the 2008–2013 periods. This study gives empirical support to those recommendations from policy makers and business leaders for maintaining the R&D expenditures especially in high-technology sectors even when facing a recession. Öztürk, and Zeren, (2015) their findings indicate that R&D expenditures have a positive effect on sales growth in the manufacturing industry. Moreover, it has been found that this effect has continued for six months. Adeyeye, Jegede, and Akinwale, (2013) their result shows that technological acquisition, training and in-house R&D positively influence technological innovation while government support and embodied knowledge are insignificant.

Against this reviewed studied, the present study improves on the previous study on the following ground; firstly, this study used an updated literature on the effect of research and development cost (R&D) on the firms in Nigeria. Secondly, it is carried out in Nigeria to ascertain the true situation since the results of some of the reviewed empirical studies done are with conflicting findings. Thirdly, the study sought to adopt ANOVA package to critically examine the effect of research and development cost (R&D) on automotive component firms in South East, Nigeria

## **2. LITERATURE REVIEW**

### **2.1 Concepts of R & D**

Research and development is the generation of new knowledge. In a business context, it is an activity that companies undertake in order to develop new products, processes or services, or improve those that already exist. In order to do this, businesses often take on risk. This is because uncertainties exist around if what they are attempting is technologically feasible, or, more commonly, they don't know how they will achieve their objectives in practical terms. R&D is an essential function for many businesses. Launching new offerings or improving existing ones is a way for a business to remain competitive and make profit. When developing a new product, process or service, or refining an existing one, R&D is one of the earliest phases. Experimentation and innovation is often rife at this stage, along with risk. The R&D cycle often begins with ideation and theorizing, followed by research and exploration and then into design and development.

Research and development – R&D – is the process by which a company works to obtain new knowledge that it might use to create new technology, products, services, or systems that it will either use or sell. The goal most often is to add to the company's bottom line. R&D activities differ from institution to institution, with two primary models of an R&D department either staffed by engineers and tasked with directly developing new products, or staffed with industrial scientists and tasked with applied research in scientific or technological fields, which may facilitate future product development. R&D differs from the vast majority of corporate activities in that it is not intended to yield immediate profit, and generally carries greater risk and an uncertain return on investment. However R&D is crucial for acquiring larger shares of the market through the marketisation of new products.

### **2.2 Previous Studies**

Abdel and Kanakriyah, (2017) investigated whether expenditure on research and development (R&D) has an impact on the performance of Jordanian pharmaceutical companies listed on the Amman Stock Exchange in Jordan. For this purpose, the study used a quantitative approach to study data on the whole population, which consists of six firms, for the period 2006 to 2015. Data about R&D were collected over the period 2006-2010 and about performance over the period 2011-2015. The study conducted an empirical study using simple linear regression analyses to discover the effect of R&D on company performance. The study employ return on assets (ROA), return on equity (ROE) and earnings per share (EPS) as a proxy to measure company performance, and to measure R&D expenditure they considered the following items: research, experiments, studies, and courses. The result found that there is a significant impact of R&D expenditure on company performance as measured by (ROA, ROE and EPS), which is consistent with the results for developed countries. Also R&D expenditure in the current year leads to future benefit such as larger market share, higher share price, better reputation in current and subsequent year's. These results imply that it is very important for companies to change their policy with respect to investment in R&D activities.

Kiraci, Celikay, and Celikay, (2016) determine the impact of research and development expenditures on a firm's short-and long-term profitability. A dynamic panel data analysis was carried out on data collected between 1998 and 2012 from a sample of 46 publicly traded manufacturing firms on the Borsa Istanbul. The findings revealed that although research and development expenditures do not have a statistically significant effect on the short-term profitability of a firm, they do have a significantly positive and strong effect on long-term profitability. It show that for a one-unit increase in research and development expenditure, the gross profit increases by 10.19 units, the net operating income increases by 2.37 units, and the net income increases by 1.39 units.

Ayaydin, and Karaaslan, (2014) examined the effect of research and development investment on firm's financial performance. Return on assets used as a measure of financial performance. Capital structure, liquidity, efficiency and firm size factors determining firm performance also are investigated. Manufacturing firms registered Istanbul Stock Market (BIST) were classified according to the sectoral approach. The sectoral approach is an aggregation of the manufacturing industries according to technological intensity and based on the Statistical Classification of Economic Activities in the European Community (NACE) at 3-digit level. The level of R&D intensity served as a criterion of classification of economic sectors into high-technology, medium high-technology, medium low-technology and low-technology industries. The study show a positive effect of R&D intensity on the firm performance by using GMM system estimators for a sample of 145 manufacturing firms registered BIST for the 2008–2013 periods.

Öztürk, and Zeren, (2015) examined the effects of research and development (R&D) activities on firm performance in developing countries. Accordingly, this study aims to determine how firms performance is affected by R&D expenditures, and this effect is tested and discussed with manufacturing firms data, which range from 2007-Q1 to 2014-Q3 in Turkey, both by using Durbin-Hausman panel co integration test developed by Westerlund (2008) and Common Correlated Effects (CCE) coefficient estimator developed by Pesaran(2006). The findings indicate that R&D expenditures have a positive effect on sales growth in the manufacturing industry. Moreover, it has been found that this effect has continued for six months.

Adeyeye, Jegede, and Akinwale, (2013) analyzed the impact of technological innovation and R&D on firm performance in the Nigerian service sector. The analysis is based on data obtained from the Nigeria's innovation survey, 2008 undertaken among 500 enterprises in the service sector with about 41% response rate. The instrument was guided by the third edition of the Oslo Manual standardised through validation workshops under the NEPAD ASTII initiative. The result shows that technological acquisition, training and in-house R&D positively influence technological innovation while government support and embodied knowledge are insignificant. Also, technology innovation and R&D have positive impact on firms' performance. Their studied offers an opportunity to understanding the impact of technology innovation and R&D on performance of service firms in developing country context.

Luisa, Ji and Prieger. (2013) estimated the impact of R&D on TFP and output in the private sector at the state level in the US from 1963 to 2007. R&D has a large effect on both output and TFP at the state level in the long run. The R&D elasticity in a state averages 0.056 to 0.143, implying returns to state GDP from R&D spending of 83% to 213%. There are also positive

R&D spillovers, with 77% of the total returns accruing to other states. The R&D elasticities are either stable or increase slightly after 1993. The effects of R&D are dependent on the levels of human capital and development. States with more human capital have higher own-and other-R&D elasticities. States in the lowest tier of economic development have the least own-state R&D elasticity but the highest other-R&D elasticity.

Kwon-Ndung, Kwon-Ndung, and Migap (2014) examined research and innovation strategies for economic competitiveness and industrial growth: lessons for Nigeria. One of the leading unrealized opportunities in Nigerian industrial organizations is the full influence of research ideas and knowledge to transform business products and processes into long-term innovation. Business research and innovation contribute significantly to improvement in enterprise productivity and quality and in the integral components of business strategy and success. Drawing heavily from published literature, this study highlights the enormous benefits of continual research and innovation on national economies, and proffers recommendations on how Nigeria could key into this concept to promote its economic competitiveness at the global level

Ebhota, (2014) examined Engineering research and development (r&d) infrastructure for developing economy. It considers tertiary institutions, specialized research institutions and industries as the primary areas where R&D activities take place and pointed out inadequate funding, government's insensitivity and lack of political will and inadequate R&D human capacity as the factors that have bedeviled R&D in Nigeria with consequence of low source of new product and processes, improved products and source of new market. The study went further to discuss capacity building in reverse engineering, emerging technologies in manufacturing, R&D personnel, research facility and pro R&D government policies and concluded that the nation's future global competitiveness depends on R&D in engineering.

Onuoha, (2013) studied the Challenges of Research and Development (R & D) Efforts on Small-to-Medium scale Industries (SMIs) in Abia State, Nigeria. The survey findings include: that SMIs in Abia State have no R & D activities going on in their firms; their production techniques are both manual and machine operated; they only produce light and consumer – oriented goods; operating below installed capacity, have no relationship with any research institute in the country; have no technical partners; and are technically and technologically dependent the result of all these is that SMIs in Abia State cannot compete effectively both nationally and globally. Based on these findings, the study made far reaching recommendations in aid of a vibrant research and developments activities by SMIs, the organized private sector (OPS) and government owned research institutes, all to the benefit of the Nigerian economy.

### **3. METHODOLOGY**

#### **3.1 Research Design**

The research design that was adopted in this study is the survey design, oral interview and questionnaires were used in this study to seek clarifications and convenience on the part of the respondent.

### 3.2 Population

The populations of the study were all the employees of the three selected automotive component firms in South East, Nigeria.

**Table 3. 1 Distribution of the Population**

S/N	COMPANY’S NAME	NUMBER OF EMPLOYEES	LOCATION
1	Tonimas Industries	654	Aba, Abia State
2	A-Z Petroleum	737	Nnewi, Anambra State
3	Innoson Technical Co.	350	Enugu, Enugu State
	<b>Total</b>	<b>1741</b>	

Source: Oguchienti (2020)

### 3.3 Sample Size and Sampling Technique

To determine the sample size is a crucial part of the process for collecting accurate data within a quantitative survey design. One of the real advantages of quantitative methods is their ability to use smaller group of people to make inferences about larger group that would be expensive to study (Fisher, 2007). In other to ensure a clear determination of a sample size, Taro Yamane formula was used to determine the sample size. The formula stated as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where n= sample size

N= total population (1741)

e= Allowable margin of error. In this case, we consider 5% (0.05) error margin adequate.:

$$(e)^2 = 0.0025$$

$$n = \frac{1741}{1 + 1741(0.0025)}$$

$$= 356.93$$

$$\underline{\quad 357}$$

### Proportional Representation of the Sample Size

Tonimas Industries Aba:

$$654 \div 1741 = 0.37564618 \times 357 = 134.11$$

$$= 134$$

A-Z Petroleum Nnewi:

$$737 \div 1741 = 0.42331993 \times 357 = 151.1 = 151$$

Innoson Technical Enugu:

$$350 \div 1741 = 0.20103389 \times 357 = 71.77$$

Thus, the sample size of 357 respondents is shown below:

**Table 3.2 The Sample Size of the Selected Automotive Component Firms**

S/N	Automotive component firms	Sample
1	Tonimas Industries	134

2	A-Z Petroleum	151
3	Innoson Technical Co.	72
	<b>Total</b>	<b>357</b>

Source: Oguchienti (2020)

Thereafter, simple random sampling was employed to choose respondents from each of the sampled Automotive Components Firms. The essence is to give every element in the population a known and equal chance of being selected as a subject. The researcher therefore distributed a total of 357 copies of the questionnaire to the enterprises under study.

### 3.4 Method of Data Collection

The research instrument used for this study was questionnaire. The questionnaire was structured and constructed for the staff of the selected automotive component firms in South East

### 3.5 Method of Data Analysis

Statistics such as frequency count and percentages were put to use in the analysis of research questions while research hypotheses were tested using ANOVA with the aid of Statistical Package for Social Sciences (SPSS).

## 4.0 DATA PRESENTATION AND ANALYSIS

### 4.1 Introduction

This chapter presents the data obtained from the respondents through the administered copies of questionnaire. Three hundred and fifty-seven (357) were administered. However, Three hundred and thirty-eight (338) copies of the questionnaire were retrieved. Therefore the analysis and interpretation of data is based on the returned questionnaire.

### 4.2 BIO-DATA ANALYSIS OF RESPONDENTS

**Table 4.2.1 GENDER**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Male	220	64.0	65.1	65.1
Female	118	34.3	34.9	100.0
Total	338	98.3	100.0	

Source: Field Survey 2021

The above table reveals that the 65.1% of the respondents which represents two hundred and twenty (220) persons were male respondents, while one hundred and eighteen (118) respondents which represent 34.9% were female respondents. By implication, male respondents were more than male respondents by 30.2% in our selected population sample for this study. The implication of this is to enable us to know the number of female and male that successfully returned their questionnaire.

**Table 4.2.2 MARITAL STATUS**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	158	45.9	46.7
	Single	155	45.1	92.6
	Divorced	25	7.3	100.0
	Total	338	98.3	100.0

**Source: Field Survey 2021**

In the table above, out of the three hundred and thirty-eight (338) respondents, one hundred and fifty-eight (158) of the respondents, representing 46.7% are married while one hundred and fifty-five (155) respondents which represent 45.9 percent are single. While the least which is twenty-five respondents (25) which represents 7.4 percent were divorced, it is therefore glaring that the majority of the respondents are married as at the time of this study. Thus marital status table help us to know the number of single, married, and divorce respondents that answered the distributed questionnaire.

**TABLE 4.2.3 LEVEL OF EDUCATION**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WAEC/NECO	29	8.4	8.6
	BSC/HND	112	32.6	41.7
	MSC/MBA	174	50.6	93.2
	PHD	23	6.7	100.0
	Total	338	98.3	100.0

**Source: field survey 2021**

The table above indicates that twenty-nine (29) respondents which representing 8.6% percent maintain to acquired WAEC OR NECO while 33.1% percent of the respondents which represents one hundred and twelve (112) have BSC/HND. However one hundred and seventy-four respondents which represent 51.5 percent either have MSC or MBA. The respondents that have PHD are numbered twenty-three which represent 6.8%. This as the one of demographic item helps us to identify the education qualification of the respondents.



**TABLE 4.2.4 AGE**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 18-25 YEARS	37	10.8	10.9	10.9
26-33 YEARS	70	20.3	20.7	31.7
34-40 YEARS	127	36.9	37.6	69.2
41-50 YEARS	53	15.4	15.7	84.9
51-ABOVE	51	14.8	15.1	100.0
Total	338	98.3	100.0	

**Source: Field Survey 2021**

The table above shows that respondents whose age bracket falls between 18-25 yrs were thirty-seven (37) which represents 10.9 percent. This is followed by those with age bracket of 26-33 years with seventy (70) which represents 20.7%. Also those within age bracket of 34-40 yrs were one hundred and twenty-seven (127) which represents 37.6%. Lastly, those within 51-above were fifty-one which represents 15.1 percent. The implication of this age distribution is to enable us to check if the questionnaire was directed to the right age group.

**TABLE 4.2.5 YEARS IN SERVICE**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1-10	117	34.0	34.6	34.6
11-15	107	31.1	31.7	66.3
16-20	78	22.7	23.1	89.3
21-ABOVE	36	10.5	10.7	100.0
Total	338	98.3	100.0	

**Source: Field Survey 2021**

The table above shows that respondents whose are in service falls between 1-10 yrs were one hundred and seventeen (117) which represents 34.6 percent. This is followed by those in service between 11-15 years with one hundred and seven (107) which represents 31.7%. Also those in service between 16-20 yrs were seventy-eight (78) which represents 23.1%. Lastly, those within 21-above were thirty-six which represents 10.7 percent. The implication of years in-service is to enables us have a clear view of those who have been in service for a particular period of time

### Hypothesis Testing

**Ho:** Research and development cost (R&D) has no significant effect on automotive component firm in South East

**TABLE 4.2.6 ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.149	5	6.287	9.453	.000 <sup>b</sup>
	Residual	51.656	333	.155		
	Total	76.805	338			

**Source: SPSS, Version, 2021**

From the regression result, we discovered that in the F-statistics column the value for Research and development cost is 9.453, while its probability is 0.00 since its probability is less than 0.05% desired level of significance, we reject the null hypothesis and accept alternative hypothesis, which say that Research and development cost (R&D) has significant effect on automotive component firm in South East. This finding can explain by the fact that innovation in Automotive Component Firms is geared towards organisational and marketing changes than development of new products and processes. Indeed, it is an inherent feature of Automotive Component Firms that the final product is difficult to distinguish from the organisation that provides it, or from the manner in which it is provided. Also, the nature of automotive industry makes interaction with customers, suppliers and competitors more important to the innovation process than undertaking in-house R&D activities.

The study found out that Research and development cost (R&D) has significant effect on firm profitability in South East. The implication of these findings is that, for Research and development to be functional to achieve their aim and purposes, the cost need to satisfy the expected needs of the company, and must be seen to be fair or equitably satisfying in the firm performance. The findings are in line with the following study Abdel & Kanakriyah, (2017) who found that there is a significant impact of R&D expenditure on company performance as measured by (ROA, ROE and EPS), Kiraci, Celikay, & Celikay, (2016) their findings revealed that although research and development expenditures do not have a statistically significant effect on the short-term profitability of a firm, Ayaydin, & Karaaslan, (2014) found evidences of positive effect of R&D intensity on the firm performance by using GMM system estimators for a sample of 145 manufacturing firms registered BIST for the 2008–2013 periods. This study gives empirical support to those recommendations from policy makers and business leaders for maintaining the R&D expenditures especially in high-technology sectors even when facing a recession. Öztürk, & Zeren, (2015) their findings indicate that R&D expenditures have a positive effect on sales growth in the manufacturing industry. Moreover, it has been found that this effect has continued for six months. Adeyeye, Jegede, and Akinwale, (2013) their result shows that technological acquisition, training and in-house R&D positively influence technological innovation while government support and embodied knowledge are insignificant.

## **Conclusion and Recommendation**

A healthy and effective R&D in engineering will guarantee large, strong, diversified, sustainable and competitive economy that will effectively harness the talents and energies of its people and responsibly exploits its natural endowments for a high standard of living and quality of life. The importance of firm-level investment in technology innovation, R&D in firms' performance is established in this study. Firms are required to consciously make investments in R&D and training to developing a stock of knowledge capital. R&D was found to be the significant driver of technological innovation in this study however, An industrial policy that would encourage firms to hire R&D staff to perform in-house R&D should be planned by management as a matter of urgency. This has been proven to increase performance in this study. In Nigeria, as in many developing countries, government has a crucial role to play in the innovation process by creating conducive environment for firms. This comes in the form of appropriate policies, institutions, legal frameworks and instruments. These support innovative activity by reducing obstacles, enabling demand-driven R&D and fostering a receptive and creative population (World Bank, 2010b). It also important for government to drive interaction between the academia and the industry with appropriate policies as this will help knowledge generation and diffusion in the industry. Bridging institutions like the intellectual property and technology transfer offices (IPTTO) established in Nigerian universities should be strengthened. Also government needs to encourage firms by reducing taxes and tariffs in a competitive manner; innovative firms can be encouraged using tax holidays and tax rebates. Firms would be well assisted if they can make use of highly-subsidized public utilities in their production. For rapid industrialization, funds and infrastructure are important. Therefore, it is important for government to create the enabling political and economic environment characterized by strong institutions, access to funds and dynamic but stable policy regimes and also address the challenge of infrastructural constraints as a matter of urgency.

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