RESEARCH AND DEVELOPMENT EXPENDITURES AND FIRM VALUE OF SELECTED INDUSTRIAL GOODS COMPANIES IN NIGERIA

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Abstract
This study examined the effect of research and development expenditures on firm value of industrial goods companies listed on the floor of the Nigerian Stock Exchange over a ten-year period that spanned from 2010 to 2019. The study specifically determined the effect of research and development expenditures on Tobin's Q, earnings per share, market price per share of selected quoted industrial goods in Nigeria. Ex-post facto research design was adopted and the study population consists of all twelve industrial goods companies listed on the floor of the Nigerian Stock Exchange as at 31st December, 2020, however seven companies were purposively selected on the basis of availability of data. Data was sourced from the annual reports and accounts of the selected companies and the descriptive (mean, maximum, minimum values and standard deviation) and inferential (multiple regression) statistical techniques were employed in analyzing the data. The regression results revealed that research and development expenditures do not significantly affect firm value. Hence, it was concluded that, though research and development expenditures insignificantly contribute to firm value, however effective investments in research and development would help in the improvement of existing products, creation of new products and innovation of the production processes of industrial goods companies thereby improving firm value. Based on the findings, the study therefore recommended among others that innovation be encouraged among firms most especially high technology firms such as industrial goods companies in order to increase their core competitiveness, thus giving it a competitive advantage over other firms.
Keywords: Research and development; Tobin's Q, Earnings per share, Market price per share

Introduction

Technology and innovation seem to be synergistic and a great deal of attention has been given to the importance of assessing the contribution of research and development investment to firm value. Research and development is an essential function for many businesses and launching new offerings or improving existing ones is a way for a business to remain competitive and make profit. Also, new product design and development is more often than not a crucial factor in the survival of a company and in an industry that is changing fast. Thus, firms must continually

revise their design and range of products as this is necessary due to continuous technological change and development as well as other competitors and changing preference of customers. A firm that can innovate and adopt new technologies as well as improve existing processes is more likely to succeed in the long-run.

It is well-documented that research and development (R&D) investments play a crucial role in enhancing firm value. R&D is required by almost each and every firm in one way or the other. During the last few decades, emphasis has been on the importance of R&D in the industrial goods sector as a key instrument in increasing its value. However, in recent times, companies have become motivated to carry out R&D as a result of exposure to competition as well as the fact that most of the world's economies have embarked policies reforms on market-oriented liberalization aimed at promoting economic performance. High-growth firms such as Huawei, Apple, Google, and Samsung Electronics, have continued to increase R&D investments so as to improve the quality and attractiveness of their products. Price Waterhouse Coopers report in 2020 showed that over $80.75 billion was spent on innovation and improvements by Amazon, Apple Inc. and Microsoft Corporation in 2020. Thus, while R&D projects are typically associated with high uncertainty and no immediate payoff, these investments have shown to create future opportunities that are both profitable and capable of providing the firms with distinct competitive advantage.

The major aim of enterprise management is to maximize future returns of stockholders. This indicates that a firm is considered to have fulfilled its aim if it successfully maximizes its market capitalization. The expected future value of a company's stock reflects its firm value and this value mostly depend on R&D activities of the firm. R&D expenditures made by enterprises can be considered as an investment instrument that will increase the value of the firm in the long-term. In financial terms, R&D expenditures will enhance future sales, profits and cash flows of the firm. Similarly, the positive effect of R&D on intangible assets like patents, goodwill, etc. can also grant a competitive advantage to the firm in financial terms. In other words, R&D investment of a firm is expected to add value to the firm by generating some intangible assets which in turn enables it accelerate future cash flows and therefore increasing the market value of firm.

Firm value is seen as the forward-looking measure that expresses the stock market expectation about the firm's future performance. Several reasons have been advanced for emphasis on R&D in improving the market value of the firm. One of such emphasis on R&D according to Ouru, Kibet and Kalio (2017), is that it creates new or improved technology that in turn can be converted into a competitive advantage for the business, corporate, and national level. While the process of technological innovation is complex and risky, the reward can be very high. If technology can be safeguarded as proprietary and protected by patents, trade secrets,

non-disclosure agreements, etc., the technology becomes the exclusive property of the company and the value is much higher (Shaari, Abdullah, Nur & Adnan, 2016).

Generally, in an era of global competition, technological competitiveness is vital for the economic well-being of any company. The decisions made by management regarding expending on R&D can influence the viability, growth, and competitiveness of an organization in the future. This study is motivated by the proposition that the expenditures incurred by the firm in respect to its R&D activities could have effects on the firms' value. It is this relationship that guarantees the firm's ability to compete with other similar firms within the same industry locally and globally. The need to examine the effect of R&D on firm value of quoted industrial good company is therefore paramount and it is against this backdrop that this study was carried out.

Statement of Problem

Due to the increasing competition and the ever-changing preferences of customers, firms are systematically compelled to search for growth opportunities in the market in order to outperform their competitors. This invariably implies that firms should innovate at an extraordinary pace by developing and generating ideas expressly intended to become a commercially viable and profitable business venture. The answer to all the challenges seems to be reliance on innovation, a by-product of R&D investment. Notably, this implies that R&D investments create value for the firm because it provides competitive advantage through differentiation strategies. This is clearly evidenced in the development of science and technology in today's society, consumers' demands which are gradually becoming diversified; shortness of the life cycle of new products; and the increasing risk of loss of customers' loyalty because of failure to innovate products or services.

Regardless of the numerous advantages R&D brings to the firm, over 50% of them still shy away from engaging in R&D activities. Most firms avoid R&D as a result of the high level of cost associated with it as well as the complexity of its accounting treatments. Due to the nature of R&D expenditures, firms as well as managers do have a faceoff as to whether such expenses are to be expensed or capitalized. Furthermore, lack of investing in R&D results in poor technology usage which hampers a firm's sustainability, growth and could even facilitate business failure in the long-run.

Given the newly industrialized and globalized economy and the increasing emphasis on the technology and in-house R&D in a developing country like Nigeria, whether R&D activities of firms significantly affect the firm valuation remains an empirical question yet unanswered. To the researchers' knowledge, most of the studies in this area have concentrated on developed countries such as the United States of America (USA) and Japan and the studies from developing countries are rare. In Nigeria,

there are a few empirical studies that have focused on the impact of R&D investment on the market value of firms; particularly as it concerns quoted industrial goods firms.

Hypotheses

The study seeks to examine the effect of R&D on the firm value of selected quoted industrial goods firm in Nigeria. Consequent upon the objectives of the study, three research hypotheses were formulated:

Ho1: Research and development does not have significant effect on the Tobin's Q of quoted industrial goods firms

Ho2: Research and development does not have significant effect on the earnings per share of quoted industrial goods firms

Ho3: Research and development does not significantly affect the market value per share of quoted industrial goods firms.

Literature Review and Theoretical Framework

Overview of Research and Development (R&D)

Several professional bodies as well as scholars have made attempt to define the concept of R&D; however till date, several definitions have evolved for the concept. Broadly speaking, R&D is seen as a main driver of societal and business innovation. According to the Organization for Economic Cooperation and Development (OECD, 2008); and Abdullah and Afshar (2019), R&D is a creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. Similarly, the International Accounting Standards (IAS) 38 paragraph 8 issued by the International Accounting Standard Board (IASB) sees research as an 'original and planned investigation undertaken with the prospects of gaining new scientific or technical knowledge and understanding'. The standard also sees development as the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems or services before the start of commercial production or use (IASB, 2012).

Expenses made by a firm in respect to R&D activities are termed R&D costs. R&D expenditure made by a firm can also be considered as an investment instrument that will increase the value of the firm in the long-run. In financial terms, R&D enhances future sales, profits and also the cash flows. Decisions about R&D projects can be made in different ways. For example, a firm in the can conduct its R&D simply by using in house facilities or in collaboration with other firms. Notwithstanding this, R&D can be conducted for the benefit of other firms under contractual agreements or it can simply be purchased from other firms. Moreover, not all costs incurred during R&D activities are considered R&D expenditures (Rufus, 2012).

Table 1: Some Examples of R&D and Non-R&D Costs.

Some R&D Costs	Non-R&D Costs
A pharmaceutical company spending hundreds of millions of dollars trying to discover a breakthrough drug to fight COVID 19 would record the expense under R&D.	Actual cost of small prototypes or models made outside the statistical unit and materials for laboratories e.g. chemicals etc.
Technology company directing time and talent into developing a new piece of software, this cost can be identified as R&D costs.	Cost of royalties or licenses for the use of patents and intellectual property right, the cost of leasing capital goods (machinery and equipment).
Cost of laboratory research aimed at discovering new knowledge.	Cost for computer software that is used in the performance of R&D for one year or less.
Cost incurred in designing, constructing and operating pilot plant that is not a scale economically feasible to the entity for commercial production.	Cost of trouble shooting in connection with breakdown during commercial production.

Source: Research and Development Survey Compiled by the Authors (2021).

Effect of Research and Development on Firm Value

Research and Development (R&D) plays significant roles in assisting firms maintain or improve on its already existing products as well as in the creation of new products. R&D is a critical element used in determining the firm value and competitive advantage of any business. When a firm effectively accomplish its project of R&D earlier than other competitive firms, it would more likely to get the whole market share with respect to that innovative product thus having the market value which is way higher than that of its competitors. It is more clearly that the performance of a firm will outweigh the costs of R&D; this in turn could affect the value of a firm negatively or positively. After reaching equilibrium, costs on R&D will be compensated by the benefits received. The authors explained that innovative ideas do not have tremendous effects but eventually they prove to be firm specific assets.

In the same way, R&D activities will result in a better performance of the firm which invariably affects the market value of a firm. Prior studies have linked the relationship of R&D with firm value. More so, due to the strong dependence on R&D indicators in industrial structures, R&D intensity has become a key factor in explaining companies' technical efficiency.

Following the findings of the studies *inter-alia*, companies with greater R&D intensity are likely to have a more stable return ratio and earn higher risk-adjusted excess returns. The accountancy literature also suggests that R&D R intensity is an important determinant of firm profitability. High investment in R&D is generally a high-risk return strategy that is attractive to shareholders in anticipation of improved financial performance, indicating that R&D may increase firms' innovative

capability and hence may enhance the ability of the firm to reap better performance in the market place.

Theoretical Framework

This study is anchored on the resource-based theory (RBT) propounded by Wernerfelt in 1984. The RBT recognizes the importance of intangible resources, making it ideal to study such variables as R&D (Branco & Rodrigues, 2006). Barney (1991) formalized the RBT of strategic management. However, scholar such as Barney (1991), examined resources and capabilities of firms, which enables them to obtain a competitive advantage and above average rates of return. According to the RBT, firms with assets that are valuable and rare possess a competitive advantage and may expect to earn superior returns, and those firms whose assets are also difficult to replicate may have a sustained superior financial performance (Barney 1991; and Roberts & Dowling, 2002).

The RBT do not only focus on the internal competencies of the firm but also examines how it's resources is affected by external factors. R&D investment has been regarded as an important factor for an organization to gain competitive advantages and improve organizational performance as advanced by the RBT. This theory holds the view that the strategic capability of an organization is in the shape of its intangible assets.

A number of experts argued that key to a firm's success is based on establishing a set of core capabilities i.e., a bundle of people, process and systems that distinguishes an organization from its competitors and delivers value to its customers. Though core capabilities tend to be limited in number but they provide long-term basis for technology, innovation, product development and service delivery. In many cases, R&D investment can be referred to as the 'key resources' that underlies a firm's core capabilities particularly in the knowledge/technology-based industries like software and information as well as industrial goods industries; success in these industries depends on investment in R&D. The relevance of RBT to this current study is predicated on the postulation that long-term competitiveness of a firm depends upon the resources that not only differentiate it from its competitors but are also durable and difficult to imitate and substitute.

Empirical Review

Empirical researches have been carried out empirically on the subject of how R&D costs affect the valuation of firms, both locally and globally. For instance, Ploypailin and Pongsutti (2020) examined the moderating effect of firm size in the relationship between innovation and firm performance of small and medium enterprises in 29 countries in Eastern European and Central Asia. The partial least square structural equation modeling results indicated that firm size and the financial capital both

moderate and moderate the impact of innovation on firm performance, positively or negatively.

Similarly, Erdogan and Adilya (2019) determined the effect of R&D expenditures on financial performance of 62 production companies listed in Borsa Istanbul for the period of 2008-2017 by using panel data methods. The study used return on assets (ROA), return on equity (ROE) as a proxy to measure company performance and to measure R&D intensity; R&D expenditures were considered over total sales as explanatory variables. Findings proved the existence of inverted-U shape nonlinear relationship between R&D expenditures and financial performance. However, the effect of R&D expenditures was found to be higher in ROE than ROA. It was also found that while firm size increases overall profitability, leverage reduces its profitability thus indicating that there is a positive interaction between R&D expenditures and financial performance.

Nabaz and Parvin (2019) investigated the effects of market share, R&D and advertising expenditures on Iranian industries profitability's over the period of 2016 using rank regression method. Findings revealed that all variables have positive and significant effects on the profitability of Iranian industries. Moreover, the results indicated that the effect of market share on profitability of industries is more than of other explanatory variables.

Negin and Jafar (2018) evaluated the effects of a firm R&D performance using the best-worst-method. This study examined 50 high tech SMEs in Netherlands and data were sourced from a survey by R&D experts and on SME's. Using a multi-criteria decision-making method(best worst method to identify the weights or importance) of R&D R measures and also the measuring of the firm's R&D performance, the study showed that assigning different weights to different R&D measures (in contrast to simple mean) results in a different ranking of firms and allows R&D managers to formulate more effective strategies and improve their firm R&D performance by applying knowledge regarding the importance of differencing R&D measures.

Methodology

This study adopted the *ex-post facto* research design. The population of the study included all the thirteen (13) industrial goods companies that were listed on the floors of the Nigerian Stock Exchange as at 31st December 2020. Purposive sampling technique was used in arriving at the sample size of the study on the basis of availability of complete financial statements (for the period under review) as at the time this study was carried. In view of this, seven (7) companies were selected (Berger Paints Plc., Beta Glass Plc., CAP Plc., Cutix Plc., Dangote Cement Plc., Greif Nigeria Plc., and Lafarge Africa Plc).

Secondary data were obtained from the audited annual reports and financial statements of the selected industrial goods companies from 2010 to 2019. Data obtained were analyzed using both
descriptive (mean, maximum, minimum values and standard deviation) and inferential (multiple regression) statistical techniques. Specifically, the study was designed to determine the effect of R&D expenditures on Tobin's Q, earnings per share, market price per share of selected quoted industrial goods in Nigeria. In this regards, three (3) research hypotheses were formulated and tested at 0.05% level of significance; given the above, the following empirical models were estimated:

$$FV = f(R\&D, PRO)$$

Where: FV = Firm Value, R&D= Research & Development, PRO = Firm Profitability. The econometric form of the equation when all the proxies are included is given as:

$$Y = \beta_0 + \beta_1 X_{it} + \varepsilon_{it} \quad \text{.....eqn (i)}$$

Where, β_0 = Constant (intercept), β_1 = Coefficient of the independent variables; Y = Dependent Variable, X = Independent Variables, ε = Error term; i = the firm in question, t = the time in question; Equation i can now be transformed to get three models for the three hypotheses that shall be tested:

$$TQ_{it} = \beta_0 + \beta_1 R\&D_{it} + \beta_2 PRO_{it} + \varepsilon_{it} \text{.....eqn (ii)}$$

$$EPS_{it} = \beta_0 + \beta_1 R\&D_{it} + \beta_2 PRO_{it} + \varepsilon_{it} \text{.....eqn (iii)}$$

$$MPS_{it} = \beta_0 + \beta_1 R\&D_{it} + \beta_2 PRO_{it} + \varepsilon_{it} \text{.....eqn (iv)}$$

Where, $R\&D_{it}$ = Research and Development cost of company i in period t; TQ_{it} = Tobin's Q for company i in period t; EPS_{it} = Earnings Per Share for company i in period t; MPS = Market Price Per Share for company i in period t; PRO_{it}= Firm Profitability for company i in period t. Notably PRO is a control variable in the relationship between R&D and firm value. The statistical analysis was carried out with the aid of the Statistical Package for Social Sciences (SPSS 22.).

Results and Discussions

Table 2: Regression Result of Hypothesis I

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.138	2.300		.495	.622
	Research and Development	2.871	2.432	.144	1.180	.242
	Firm Profitability	-1.917E-10	.000	-.005	-.042	.966

a. Dependent Variable: Tobin's Q

Source: SPSS Version 22 Output, 2021.

According to the decision rule of the study, if the *p-value* is greater than 5%, the null hypothesis is accepted and vice versa. The *p*-value of the test for the effect of Research and Development (R&D) is 0.242 > 0.05. Therefore, the researchers accepted the null hypothesis and confirmed indeed that research and development does not have a significant effect on the Tobin's q of selected quoted industrial goods firm in Nigeria at 5% level of significance.

Table 3: Regression Result of Hypothesis II

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.155	1.337		1.613	.112
	Research and Development	-.781	1.413	-.041	-.552	.583
	Firm Profitability	2.899E-8	.000	.808	10.989	.000

a. Dependent Variable: EPS

Source: SPSS Version 22 Output, 2021

According to the decision rule of the study, if the *p-value* is greater than 5%, the null hypothesis is accepted and vice versa. The *p*-value of the test for the effect of Research and Development (R&D) is 0.583 > 0.05. Therefore, the researchers accepted the null hypothesis and confirmed indeed that research and development does not have a significant effect on the earnings per share of selected quoted industrial goods firm in Nigeria at 5% level of significance.

Table 4: Regression Result of Hypothesis III

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.601	10.084		1.547	.127
	Research and Development	3.173	10.664	.013	.298	.767
	Firm Profitability	4.108E-7	.000	.929	20.636	.000

a. Dependent Variable: Market Value Per Share

Source: SPSS Version 22 Output, 2021

According to the decision rule of the study, if the *p-value* is greater than 5%, the null hypothesis is accepted and vice versa. The *p*-value of the test for the effect of R&D is 0.767 > 0.05. Therefore, the researchers accepted the null hypothesis and confirmed indeed that research and development does not significantly affect the market value per share of selected quoted industrial goods firms in Nigeria at 5% level of significance.

The findings of the study agreed with those of Yew *et al* (2019); and Rufus (2012), however, do not agree with the results of Nabaz and Parvin (2019). More so, the findings of the study followed the theoretical postulations of the resource-based theory, which is the theoretical underpinning of the study, which maintains that long-term competitiveness of a firm depends upon the resources that not only differentiate it from its competitors but were also durable and difficult to imitate and substitute.

Conclusion and Recommendations

This study was carried out with the view of assessing the effect of research and development (R&D) on firm value of quoted industrial goods companies on the floor of the Nigerian Stock Exchange. Given the regression results, findings indicated that disclosure of R&D expenditures do not contribute significantly to earnings per share, Tobin's Q and market value per share of the quoted industrial goods firms in Nigeria, notwithstanding the vital role played by R&D in assisting firms gain competitive advantage over its current and potential competitors. Though the findings of the study do not show that R&D expenditures significantly improve firm value, effective investments in R&D is encouraged to help in the maintenance or improvement of existing products, creation of new products and innovation of production processes of companies thereby improving the firm value.

Given the findings of the study, the study recommended that managers of industrial goods firms should maintain R&D expenditures especially in high-technology sectors like industrial goods sector due to the high level of rapid change in

technology. Again, firm managers should create R&D expenditure in the annual budget for effective implementation of quality production of their goods and policy makers should encourage innovation and make deeper research on technical innovation in order to improve the core competitiveness of the firm. More so, most of the studies in this issue have concentrated on developed countries and studies from developing countries are rare. In Nigeria, the local studies that were conducted to uncover the empirical nexus between R&D expenditure and firm value are characterized by divergent views; thus leading to inconsistencies in the findings.

Furthermore, the few of the study failed to utilize R&D expenditures as predictors of Tobin's Q (which is a forward-looking measure of corporate value) of the quoted industrial goods sector in Nigeria. Hence there is a justifiable need that this study is conducted to determine the effect of R&D investment on firm value of quoted industrial goods companies in Nigeria. By carrying out this research, this study has contributed to the body of knowledge by filling the gap in the literature in this area.

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