

Innovation Constraints: R&D role in Successful Innovation & Performance: A Literature Review

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Abstract: *Sundry views have enriched academic literature on the impossibility of divorce between innovation and research & development. A deeper understanding of the innovation constraints, research and development role in providing successful innovation and the corresponding relations to firm performance and economic growth has provoked this research. This desk study utilized qualitative data collected from extensive literature review and allowed for a robust discourse. Findings revealed that an obvious significant relationship exists between research and development, innovation, firms' performance and economic growth. The study concludes along the lines of the RBV model for the adoption of unique resources with intentional research and development activities to provide the expected Schumpeter's creative destructive products. The use of this blue ocean strategy will provide new market visibility, gain competitive advantage and eventually result to above average returns of the firm in the long run.*

Key Words: *Innovation, R&D, RBV Model, Schumpeter's innovation theory.*

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I. Introduction

Entrepreneurship and innovation are central to the creative process of any economy and to promoting growth, increasing productivity and creating jobs. As such all firms need to be innovative, as innovation is the lifeblood of future income streams (Ercişa&Ünalamb, 2016). The reality however is that most companies, particularly small and medium-sized enterprises (SMEs), find it difficult to understand what innovation is or how innovation can be effectively managed except they engage in some form of research process targeted at providing improvements or developing new creations (Doruk&Söylemezoğlub, 2014) which can be described in Schumpeter (1934) words as "creative destruction".

Our fast-changing world brings challenges and opportunities for businesses. Innovation can help businesses make the most of changes such as customer needs and expectations, increasing competitors, changing technology, changing external regulatory environment, and an increasingly global and dynamic marketplace as they all bring opportunities for it (Ercişa&Ünalamb, 2016). However, the dilemma remains how firms can or entrepreneurs decide on what new to do. The nagging insatiable desire to bring about innovative change cannot be divorced from research and development (Akinci&Utlu, 2015). The aim of this paper is to establish constraints to innovation and clarify the role of research and development to successful innovation in business firms and the economy of any country. The work is structured as such; introduction, literature review from the conceptual angle, theoretical dispositions, empirical findings, methodology, results and discussion of findings, conclusions.

II. Literature Review

Invention versus Innovation:

The line differentiating invention from innovation is almost extinct because the inventor is a common denominator in both nomenclatures. As such an innovation is seen as an extension of an invention (Katila&Shane, 2005). An invention is the discovery of an idea and/or a possibility that can be carried out anywhere but not produced for market consumption, an innovation on the other hand, occurs mostly in firms (Abdu &Jibir, 2017; Akinci&Utlu, 2015; Vagnani& Volpe, 2017). Innovation is the process of converting an invention into market value and it involves the application of knowledge (production & market), capabilities, skills and facilities (functioning distribution system) and resources (finance) (Akcali, 2015).

Innovation has been described by Drucker (1985) as an entrepreneur's special mechanism used to endow resources with capabilities for wealth creation. The Merriam-Webster dictionary (2018) made efforts to clear the thin line which exists between invention and innovation. It explained an invention as to the utilization of scientific research in arriving at novel products or services, while classifying innovation as the commercialization of the invention itself. Katila and Shane (2005) posited that innovation proceeds with the

development of the invention, and results in the introduction of a new product, process or service in the marketplace. Wiesenthal, Condeço-Melhorado and Leduc (2015) described innovation as the creation of a new product/service or the modification of an existing one, with the purpose of adding value and ultimately providing returns to the inventor. Based on above definitions, innovation then can be described as a compelling creative change process from the norm which required conscious implementation by unique capabilities and ultimately provides returns to the inventor.

The features of innovation which have been identified from the various definitions are: (1) it is a continuous process; (2) it must be an implementation of a new or improved product, process, marketing method or organizational method to a firm; (3) it must have been either introduced to the market place or actually utilized by a firm; (4) it must be done within a specified review period (Yang, 2006). Innovation provides various benefits such as lowering the cost of production over time, building new markets and increasing competitiveness. Also, innovation is capable of driving performance by building profitability, generating employment and increasing market share and growth (Oju, 2017).

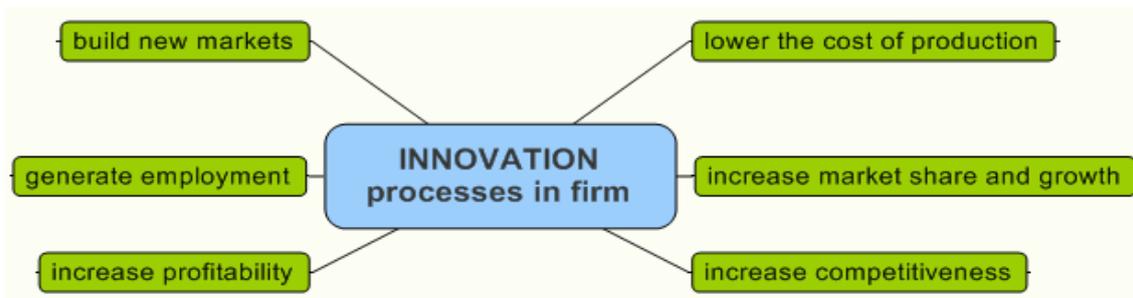


Fig 1: Benefits of Innovation

Source: Innosupport<http://www.innosupport.net/index.php?id=6049>

The Constraints:

Despite the obvious benefits of innovation, firms especially micro, small and medium scales enterprises, particularly find it difficult to carry out innovation activities (Doruk&Söylemezoğlub, 2014). Innovation is a costly task in that new firms often cannot finance themselves as they generate only limited cash flows and seed capital is often scarce. Already startup costs and new business registration in developing countries, like Nigeria are fixed and too high, making it difficult for the firms to easily endure the demands and challenges which the “liability of newness” brings to the fore (Abatecola, Cafferata, &Poggesi, 2012). Zemplinerova and Hromadkov (2012) recognized that the financial buoyancy of large-scale firms tend to allow for innovation, making them more efficient and enhancing their performance when compared to smaller ones as a Schumpeterian view (1939). However, it seems that because competitive firms aim to dominate the market, they tend to be more innovative irrespective of their size (Arrow, 1962; Arvanitis&Stucki, 2013) but it also suggests that the amount for R&D expenses set-aside plays a significant role in determining the level of innovation that will be possible.

The next obvious challenge of innovation is availability of knowledge, capabilities and technology. One of the reasons for this is that most of the small and medium-sized businesses are family companies in which the owners have low level of awareness, knowledge and education about innovation and its activities (Akinci&Utlu, 2015). Underdeveloped R & D awareness and innovation culture together with the incomplete institutionalization process remains a barrier to innovation. Improving the technology infrastructure and adjusting the firms’ culture to scientific research, innovation and technological development can only be advanced by assistance from governments. Akinci and Utlu (2015) posit that small businesses should be supported with technological information related to technology selection and renewal, quality and standardization and quality assurance systems for EU standards, which can be utilized in productive R&D activities and eventual enhance innovation and survival in their various sectors.

Elbaz, Haddoud, &Shehawy (2018) identified the practice of nepotism and favouritism by the management of a firm as barriers to innovation. This practice is majorly inherent in developing countries, making it impossible to identify and engage employees’ that have the requisite knowledge and competency to handle innovation activities. Garriga, Krogh, and Spaeth (2013) emphasized that constraint on application of firms resources as a result of unhealthy work practices, even in the abundance of external knowledge has a direct bearing on the whole firm research strategy and innovative performance after a study of Swiss-based firms.

R&D role in Innovation:

Generally, investment in R&D has been regarded as one of the key strategies to secure technological potential, innovations and thereby SME and economic growth (Akinci&Utlu, 2015; Akinwale, Dada, Oluwadare, Jesuleye, &Siyanbola, 2012; Bayarcelik&Tasel, 2012). When the fierceness of competition becomes intensified in the market place especially as it concerns unhealthy price wars, it tends to end up “drawing blood” from the smaller firms in the industry and may make them go out of business because of their inability to survive “the redness of the ocean” (Lainos, 2011). R&D perhaps provides the only hope of companies towards innovations that can produce new output and enable “a blue ocean” environment which will empower the small company step out of the pack as such invariably improving the economy of the nation (Akinwale, Dada, Oluwadare, Jesuleye, &Siyanbola, 2012)

Research and development (R&D) is therefore, the creative work carried out in a methodical way to grow the existing knowledge base and the utilization of knowledge to devise new applications (Torun &Cicekci, 2007; OECD, 2002). Knowledge according to Torun and Cicekci (2007) refers to knowledge of man, his cultural disposition and inhabiting society. Thus, investments in R&D increases the possibility of achieving a higher standard of technology in firms and regions, which would allow them to introduce new and superior products and/or processes, resulting in higher levels of income and growth. The availability of necessary R&D structure facilitates the development of novel technologies, provides opening and improves their technological positions of countries on the global scene (Akinwale, Dada, Oluwadare, Jesuleye, &Siyanbola, 2012).

Equally it was found that almost the same factors (investing in R&D, formal training, a firm's size, type, and sector) were the significant determinants of product, process, organizational, or marketing innovation (Prifti&Alimehmeti, 2017). Even the endogenous growth model pioneers, Romer (1990) and Lichtenberg (1992) have pointed out that the relationship between investment in technology and R&D expenditure leads to innovations which increase productivity, and therefore growth of both firms and the economy (Bilbao-Osorio & Rodriguez-Pose, 2004). In addition, it should be stressed that in order to achieve high economic growth, developing economies, need to shore up their efforts in R&D activities (Bayarcelik&Tasel, 2012). Experience from developed countries that lead in innovation and R&D activities according to (Prifti&Alimehmeti, 2017; Samimi&Alerasoul, 2009) tend to have higher economic growth in the long run, when compared to other national economies that do not prioritize them.

Theoretical Framework:

The rudimentary principle of most endogenous growth models is that technological progress and economic development are driven by innovation practices (Cohen &Levinthal, 1990; Grossman &Helpman, 1994; Schumpeter, 1934). In the same vein, Schumpeter's (1934) theory posits that innovation helps to increase a firm's power and visibility in the market place. Firms should expect some forms of ex-post market power which prevents the limitation of the new products and processes, as such allows them to recuperate the expenses made in research and development (R&D) and advance towards innovation (Akinci&Utlu, 2015). Van Dijk, Den Hertog, Menkveld, and Thurik (1997) explained that for business expansion purposes, innovation has the capacity to provide firms with huge monopoly profits that can be invested in R&D. However, the highlights from Schumpeter's theory emphasis that the market power to innovate lies more in the hands of larger firms than their smaller counterparts, majorly anchored the finance to engage in R&D. Ironically, according to Cohen and Levinthal (1990), small firms sometimes are more likely to benefit from the local markets as a result of innovations which have been funded by subsidies for R&D given by government.

Despite the inherent benefits of innovation, it is not embraced and adopted by all firms at the same time due to interactions of some factors such as finance, capability, environment, and research and development budget, amongst others, both within and outside the firm's operating network (Rogers, 1971). The lack of reliable capabilities (both tangible and intangible) becomes the obvious crux of the matter (Binuyo&Brevis-Landsberg, 2014). This calls for a reliance on the RBV model views. It emphasizes the need for the appropriate adoption of resources and capabilities that cannot be substituted but are rare, valuable and inimitable and useful in extensive R&D in order to produce truly innovative products with high market value, and have potentials to earn above average returns and gain competitive advantage over its peers (Penrose, 1959; Pitelis, 2004). This position thus posits that when a firm deploys its resources into unique research and development, the resultant outcome shall be an innovation capable of changing the firm's market position and presence in the market place.

R & D Investment, Innovation & Performance:

Diverse studies have tried to explain the interactions between investment in R&D, innovation and performance of firms. Hall's (1996) study revealed that investment in R&D positively interacted with profitability of the firms, as the outcome of the R&D process produced a relatively high private rate of return. Many scholars (Bayarcelik&Tasel, 2012; Rabiei, 2011; and Zachariadis, 2003) provided strong evidence that R&D investment were instrumental to innovations which catapulted into growth of firms in USA. Cameron's

(1996) empirical study investigated the linkage between innovation with measures (such as R&D expenditure, innovation counts patenting, and technological spillovers between firms, industries and nations) against economic growth and observed positive significance. Also, Griffith, Redding and Van Reenen (2004) claimed that research and development (R&D) is capable of stimulating innovation, on the one hand, while creating room for imitation of the new findings by competitors, after an empirical study of various industries across twelve OECD countries. Their study proved that R&D is of statistical and economic benefit in both technological catch-up and innovation.

On the other hand, R&D and innovation intensity was found to be directly linked to the absorptive capacity of the business sector that is the firms' capability to assimilate and exploit external high technology knowledge and to raise the competitiveness of their products for exporting (Sandu&Ciocanel, 2014). The studies that related with the small industrial estates suggested that the effectiveness of these networks in providing the emergence of innovative activities is also related with the R & D capacity (Harrison, 1992; Utlu, 2015). Coincidentally, Sandua and Ciocanel (2014) provided a model which confirmed that the innovation growth strategy (the growth of R&D investments) could lead to growth in competitiveness. They concluded that the export policy and R&D and innovation policy interact in order to maximize effects in both policy fields using the Romanian experience. The various views of these academic scholars all tend to emphasize the role of R&D as one which cannot be divorced from innovation, and which directly tends to impact on a firm's market visibility and enable increased competitive advantage.

III. Material And Methods

The study is a descriptive study which utilized secondary data collected from various published scholarly books and other relevant and reliable scholarly online sources for its qualitative research. The choice of this method was informed by Erciřa&Ünalamb (2016) to enable the researcher make unbiased verdict. This approach provided more efficient use of time and helped in reduction of research cost, that would have otherwise be spent in collecting primary data (Zikmund, 2003). Also, secondary data generally has a pre-established degree of validity and reliability which need not be re-examined by the researcher who is re-using such data. Data collected from these sources assisted the researcher in understanding the constraints of innovation as well as establish the roles of R&D in engendering successful innovation, firms' performance and economic growth. The qualitative data further corroborated the theoretical underpinnings and empirical findings, in order to enable the researcher take a position. The study as a result utilized desk study research design.

IV. Result

The graphs below show the R&D expenditure against GDP of the respective countries all in percentages. It reveals the extent of importance the various countries have put into R&D.

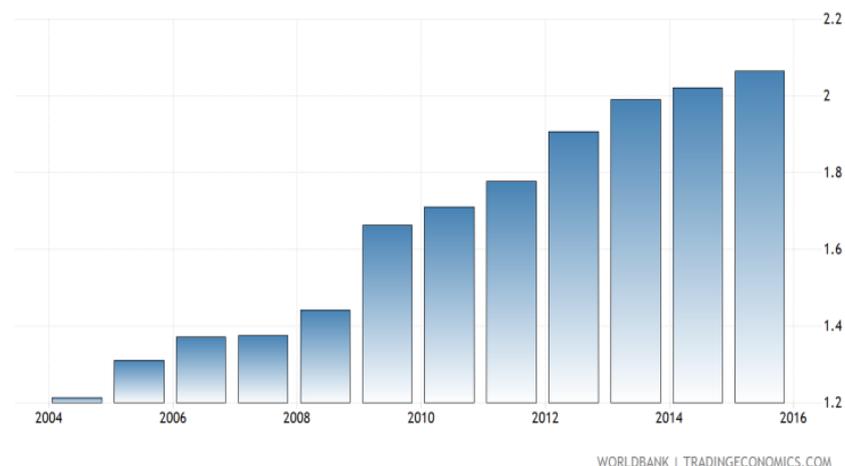


Fig 2 China's R&D expenditure against GDP

Source: World Bank/Trade Economics.com (2017)

Figure 2 shows that about 2.05% of GDP accounts for the R&D investment expenditure in 2016 in China. The trend shows a continuous steady upward growth from 2010 to 2016.

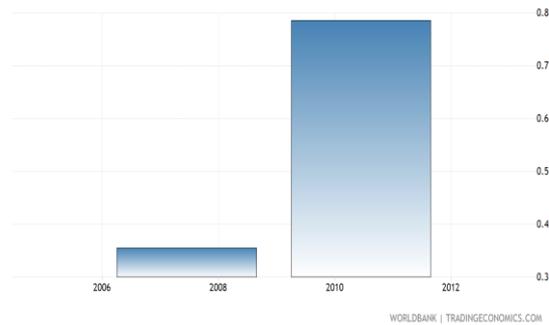


Fig 3 Kenya's R&D expenditure against GDP Source: World Bank/Trade Economics.com (2017)

Figure 3 shows that only about 0.78% of the GDP accounts for the R&D investment expenditure in 2010 and 2011 in Kenya. However, the trend seized from 2012 till 2016, as no data has been made available yet.

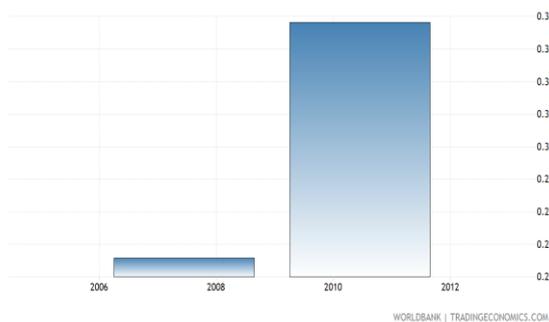


Fig 4 Ghana's R&D expenditure against GDP Source: World Bank/Trade Economics.com (2017)

Figure 4 reveals that only about 0.37% of the GDP of Ghana accounts for investment in R&D expenditure in 2010 and 2011. In 2012, from the graph there was no expenditure in R&D.

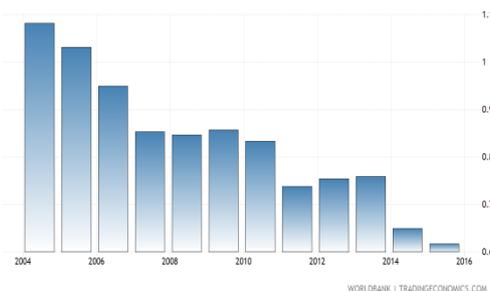


Fig 5 Ukraine's R&D expenditure against GDP Source: World Bank/Trade Economics.com (2017)

Figure 5 reveals that in Ukraine only about 0.62% of the GDP of the country accounted for investment in R&D expenditure in 2016. From the graph, it can be observed that there has been a gliding decline.

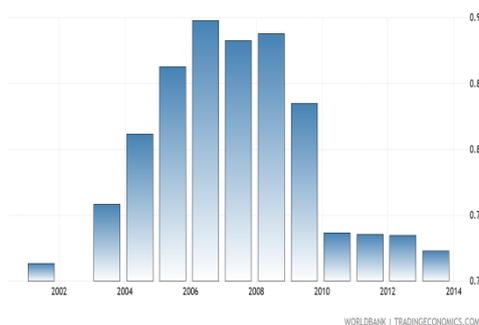


Fig 6 South Africa's R&D expenditure against GDP Source: World Bank/Trade Economics.com (2017)

Figure 6 reveals that South Africa’s investment in R&D expenditure has been declining from 2008 (0.88%), to about 0.72% in 2014.

Table 1 Summary of Selected Country’s R&D Expenditure Investment % of GDP

Countries	R&D expenditure as a % of GDP	Year	GDP @ 2016 USD\$ Billions
South Africa	0.7228	2014	294.89
Kenya	0.7858	2011	70.53
Ukraine	0.6174	2016	93.27
China	2.0700	2016	11,199.15
Ghana	0.3766	2011	42.69
Nigeria	0.2190	2007	405.10

Source: World Bank – Trade Economics.com <https://tradingeconomics.com/country-list/gdp>. (2017).

Table 1 is a summary of percentage of R&D expenditure investment against the GDP of various countries. From the findings, it shows that Nigeria made the least investment in R&D when compared to other African countries like Ghana, South Africa and Kenya with a 0.22%. Aside the poor investment figure, the last available data of Nigeria’s expenditure on R&D was in 2007. Ghana also invests a paltry 0.3766%. It can be observed that countries like China make it a conscious effort to invest in R&D with a 2.07% of its GDP. The findings portend that countries with low R&D expenditure investments are obviously less innovation ready and visibility of their home-made creations/products in the market both locally and internationally will naturally be abysmally low.

V. Conclusion

The purpose of this study is to examine the constraints of innovation and clarify the role of research and development in successful innovation and eventual on economic growth of selected countries. The findings suggest that the country’s culture towards R&D rubs off on the culture of the organizations within its territory. The country with the highest GDP and yet the highest R&D expenditure ratio to GDP is China, while the least in terms of both criteria that is GDP and R&D, is Nigeria. This study corroborates the results of findings of Bayarcelik&Tasel (2012); Rabiei (2011); Sandu&Ciocanel (2014); Tasel (2012); and Zachariadis (2003).

The study emphasized various constraints such as finance, poor organizational management culture of nepotism, favoritism, lack of knowledge, education and technology that meets EU standards, competitiveness of the firm, as barriers to innovation. However, various scholarly discoursed converged on the fact that innovation necessitates R&D, while R&D encourages innovation that could bring about competitive advantage which the firms could leverage on, giving them giving them market visibility, firm growth and eventually impacting on the economy positively.

Further studies to investigate the effect of R&D on export volume of entrepreneurs in a developing economy, shall be required. Also, based on the limitation of time available to deliver on this study, it is advisable that a longitudinal study be carried out across the countries already investigated to give a more robust view of the role of R&D to innovation.

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