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INNOVATION IN NIGERIAN SMALL AND MEDIUM ENTERPRISES: TYPES AND IMPACT

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Abstract: This paper seeks to explore the types of innovation that are predominant in SMEs in developing countries and to investigate the impact of these innovations on different dimensions of firm performance based on an industry-wide innovation survey carried out in Nigeria in 2007. Although innovation is important for superior firm performance, our result found that the type of innovation that SMEs pursue is not a critical consideration in their performance. While there was no difference found in the focus of SMEs on either of product or process innovations, evidence showed that SMEs would focus more on incremental product and process innovations. Incremental innovation was found to be very important for Nigerian SMEs and a significant predictor of product quality and not of revenue. We conclude that SMEs chooses to pursue such innovations that most fit their strategies and available resources. Such level of innovation affords Nigerian SMEs to more extensively exploit the domestic market but cannot support extensive new product development required to enter export markets.

Keywords: innovation; small and medium enterprises; Nigeria; impact

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Introduction

The importance of Small and Medium-sized Enterprises (SMEs) to national economies has been widely recognised. Indeed, there is now a worldwide interest in stimulating entrepreneurship and fostering the growth of small businesses through several mechanisms, chief among which is the provision of risk-free capital (Oyefuga et al, 2008). The general argument is that by their very nature, SMEs are highly innovative and extremely impactful as far as national economic development is concerned. To date, several informative studies have explored the subject of innovation in SMEs but existing gaps in the knowledge about innovation among SMEs beg for more studies. Specifically, studies that explore the types of innovation that SMEs pursue are few and mostly based in the developed country context (e.g. Oke et al, 2004; Rizoni, 1991). Main findings revolve around the facts that product innovations are predominant in SMEs and that there is a significant impact of these on growth of firms' turnover. The results on whether or not these firms focus on incremental/radical innovations are inconclusive and other dimensions of firm performance apart form turnover have been largely unexplored (see for instance, Oke et al, 2004; Kanter, 1985).

The objective of this paper, therefore, based on an innovation survey in Nigeria, is to explore the types of innovation that are predominant in SMEs in developing countries and to investigate the impact of these innovations on different dimensions of firm performance. Following Mytelka (2000), we define innovation within our developing country context as the process by which firms master and implement the design and production of goods and services that are new to them irrespective of whether they are new to their competitors, their customers or the world. The paper is structured thus. First, we review the literature on innovation in SMEs and define the research questions and hypotheses. Next, we discuss the research methodology employed to carry out the empirical work. Next, the analysis is presented and discussed, followed by the implications these hold for practice, policymaking and future studies.

Literature Review

There is no single universally accepted definition of SMEs. For instance, it has been noted in the literature that a small enterprise can be defined along three dimensions: in terms of either employment or investment or turnover, or a combination of any two, or all of the above (Atkins and Lowe, 1997; Bala-Subrahmanya, 2005). Specifically, in Nigeria, ministries, research institutes, agencies, private sector institutions, etc. use different definitions which involve the above three dimensions (Oyefuga et. al, 2008). Notwithstanding, Ramachandran (2002) argued that SMEs in the Nigerian context are best defined as those with fewer than 100 employees and below 50 million naira in assets. The lower limit for this characterisation (in terms of employment) beyond which a firm is regarded as a micro enterprise is 10 employees (see Oyefuga et al, 2008, p. 235).

The subject of innovation has risen in prominence to become a global policy issue. Following this, a plethora of literature on the typology of the innovation concept has emerged. An exhaustive review of such typologies is clearly beyond the scope of this paper. However, it is useful to proceed with a clear understanding of the innovation types and effects within the context of this paper. Popadiuk and Choo (2006) presented a thorough review of the literature

on innovation types; and from them we learn that product and process innovations are sub-sets of technological innovation which can further be resolved into radical or incremental, depending on the degree of novelty (see also García-Muiña and Navas-López, 2007; OECD, 2005; Hadjimanolis, 2003; Souitaris, 2003; Tushman and Anderson, 1986)

Three broad categories of the literature on innovation in SMEs can be identified. A previous similar identification and a relatively systematic and thorough review had been made by Oke et al (2004). However, unlike Oke et al, we limit our review to studies published within the last decade. We have done this for two main reasons. First, these studies would be more recent and probably more well-informed in terms of methods. Secondly, there are an increasingly higher number of empirical studies carried out in the developing context within the decade.

The first category of research studies investigates the characteristics and entrepreneurial behaviour of owner-managers and how these relate to decisions concerning innovative activities in their organizations (Cosh and Hughes, 2000; Kickul and Gundry, 2002; Adegbite et al, 2007). Central to this body of studies is the finding that the entrepreneur/innovator is critical to the success of innovation efforts in the small- or medium-sized firm.

Studies that investigate the importance of innovation in SMEs, their role as drivers of economic growth and policy issues relating to SMEs in national economies make up the second stream of the literature. Like Henderson (2002), Salami (2003) and Oyefuga et al (2008) argued SMEs create jobs; increase wealth and incomes within their host domains; and promote industrial and economic development through the utilisation of local resources, production of intermediate goods and the transfer/transformation of rural technology. Henderson (2002) additionally noted that SMEs connect the community to the larger, global economy. The role of government policies and interventionist schemes for SMEs to overcome barriers to their innovativeness and/or productivity was highlighted by Hadjimanolis (1999) and Oyefuga et al (2008).

The third literature stream dwells on how small firms actually manage the innovation or the process of developing new products and services (e.g. Motwani et al, 1999; Oliver et al, 2000; Keizer et al, 2002 in the developed country context, and Abereijo et al, 2007; Sikka, 1999; Ilori et al, 2000 and Oyelaran-Oyeyinka, 2003; 2005 in the developing country context). A key trend in this body of literature is that both the way of managing innovation and the available supporting structure are important to innovation. Specifically, the availability of innovation subsidies, linkages with knowledge centres, firm-level investments in research and development (R&D) and the firm's internal processes of capability building are identified as crucial for successful innovation.

A particular knowledge gap identified in the review of the literature is that most of the recent studies are unavoidably context-specific, making the knowledge on innovation in SMEs still limited. Also, studies which explore what types of innovations SMEs pursue are generally sparse. Thus, the knowledge about what types of innovation SMEs undertake, how they actually do it and the impact of their innovation efforts on different dimensions of firm performance remains limited (Oke et al, 2004) especially in the developing countries (Bala-Subrahmanya, 2005). However, given the resource constraints and weak/unstructured National Innovation Systems (NIS) that characterise developing economies, it makes sense to assume that SMEs therein would focus on incremental innovations and that these would have some positive impact on firm performance (see for instance Bala-Subrahmanya, 2006).

Research Questions and Hypotheses

From the above discussion, the following questions can then be asked:

What types of innovation are predominant in Nigerian SMEs?
How do these innovations impact on firm performance?

In this study, two types of innovation were identified: product and process innovations. We also distinguished between radical innovation (depicted by the introduction of a completely new product or process) and incremental innovation (depicted by improvements to existing products or processes). Thus, two different hypotheses were formed from the first research question as follows:

H1: SMEs tend to focus more on product innovations than process innovations.

H2: SMEs tend to focus more on incremental than radical innovations.

Radical innovation is thought to have much more impact than incremental but there is little empirical evidence to support this for SMEs (Oke et al, 2004). A third hypothesis was therefore formulated to test this:

H3: The types of innovations that SMEs focus on will have a significant impact on their performance

Methodology

The data for this study was obtained from an industry-wide innovation survey carried out in Nigeria by the National Centre for Technology Management in 2007. The study employed a structured questionnaire to collect data from randomly selected industrial firms. The sampled firms were drawn from a directory of Nigerian businesses compiled for the Commonwealth Heads of Government Meeting (CHOGM) held in Nigeria in 2003. The directory was published in a CD-ROM by the Manufacturers Association of Nigeria (MAN) and contained information on businesses from all sectors of the Nigerian economy. Albeit, only manufacturing SMEs, belonging to ISIC Rev. 3 code 15 – 37, were selected for the purpose of this study. Based on the definition by Nigeria's National Council on Industry, an SME was defined in this study in terms of employment as one with between 10 and 300 employees (Udechukwu, 2003). 54 of these – including a few micro enterprises with less than 10 workers - completed and returned the survey instrument, giving a response rate of over 50% of SMEs.

The survey instrument asked firms directly whether or not they had embarked on introducing or improving a product or process between 2003 and 2006 through a set of 7 dichotomous questionnaire items each of which had a value of 1 if the firm answered in the affirmative and zero otherwise. Two continuous measures for product (PROD) and process (PROC) innovation were then generated from these by taking a sum of all affirmative answers relating to each of product and process innovation. Zero scores meant that the firm did not implement any product or process innovation. The positive score obtained was simply recoded as 1 in each case, to represent the incidence of product (PROD) and process (PROC) innovation.

Although the terms radical and incremental innovation were not used directly in the questionnaire, the questionnaire items were worded to measure these objectively. For instance, it was distinguished whether the firm developed a new product (radical) or simply improved an existing one (incremental). The variables INCPRODINN, RADPRODINN, INCPROCINN and RADPROCINN were then constructed as the sum of all incremental product, radical product, incremental process and radical process innovations respectively.

To enable a regression analysis that involved innovation types, two new dichotomous aggregate variables were computed. The first of these was calculated as the difference between the total number of incremental and radical innovations. A negative score implies the SME focuses predominantly on incremental innovations, and a positive score implies the SME focuses predominantly on radical innovations. The variable DEGNOVINN was then created with a value of 1 representing predominantly incremental innovation and zero otherwise. The second variable, INNTYPE was a collapse of PROD and PROC. Different dimensions of firm performance were captured by asking firms to indicate whether their profit, product quality – as evidenced in returns/rejection, employment and market share had increased, decreased or remained unchanged. Wilcoxon tests as well as regression analyses were used to test the hypotheses.

Results and Discussion

Before turning to addressing our research questions and hypotheses, we first discuss the characteristics of the sample used in this study together with possible explanations for obvious trends and the implications of these trends.

Sample Characteristics

Information on the size and age of the sampled firms is contained in Tables 1 and 2. As can be seen from Table 1, the majority (amounting to 84.1%) of the firms were started during the last 3 decades and about three-quarters of this started in the last 20 years. Average firm age was found to be 22.22 years with a standard deviation of 17.85. This wide variability in the age is apparently due to the wide age range in the sample (80 years). These figures indicate two things.

(Table i here)

First, the indigenisation decree[1] promulgated in Nigeria in the 70s might have resulted in a relatively higher number of firms starting within the country around that period as many foreign-owned firms either had to close shop or metamorphose. However, a deeper insight into the effects of that decree and other factors that might be responsible for the apparent youth of the SMEs may well be the subject of another study. Secondly, as Hallberg (2000) noted, small- and medium-sized firms generally have a high failure rate. Although categorical figures about the average number of years for which SMEs may survive might not be readily available, it would make sense to assume that the majority of them in developing countries like Nigeria may not last longer than a few decades. More so, the prevailing unfavourable ambience in developing countries like Nigeria which might have relatively little influence on

the productivity and costs of large enterprises, are extremely devastating for small- and medium-scale enterprises, thus making them much more vulnerable to failure.

A third but highly unlikely implication of the figures in Table 1 is that some of the firms that were SMEs in the far past could have transformed into large enterprises. This is, however, unlikely to be an intuitive explanation because, according to Smorfitt (2005), that situation usually accompanies economic maturity of nations – an attribute which the Nigerian economy has not displayed in recent times. Nevertheless, when the foregoing indications are taken together, a possible implication that could be drawn is that there is likely to be a high rate of staff turnover in these firms. This would have greatly hampered the build-up of internal capabilities and experience, thereby undermining firm-level potentials for innovation.

(Table ii here)

Most of the firms in the sample have below 50 employees, as seen in Table 2. Average firm size was evaluated to be about 28 employees. Again, the figure is highly polarised because of the large range of the firm size. About 1 in every 3 firm had below 10 employees and almost half of the sampled firms have staff strengths ranging between 10 and 49. It would have been more interesting to know what the educational qualifications and specialisation of these personnel are, as that would enable a more thorough qualitative assessment of the firms' innovative practices. Unfortunately, the data on which this work is based does not contain sufficient information in that regard. Although staff profile was available in a number of cases, the figures were not coherent enough for any systematic analysis.

Discussion of Hypotheses

Hypothesis 1

We now turn to the discussion of our hypotheses. The first hypothesis has to do with a differential in the focus on product and process innovation, in favour of product innovation. In order to test this hypothesis, a Wilcoxon signed ranks test was carried out. This test is a nonparametric alternative to the two-sample *t*-test and does not require normality in the data (Siegel, 1956). A Kolmogorov-Smirnov test carried out had earlier showed that our data was not completely normally distributed so it was more reliable to use a non-parametric test.

(Table iii here)

Table 3 contains information on the innovation activities of the firms. The table shows the incidence of each type of innovation among the firms in the period covered by this study. At first glance, a higher incidence of product innovation is to be seen. This is not surprising because in many instances, changes made to organisations' processes – especially if the changes are in the production processes - do actually give rise to innovative changes in products. In consequence, the count of product innovations may tend to surpass that of process innovations.

The results of the Wilcoxon test are contained in Table 4. The focus on product and process innovations were found not to be significantly different (z = -0.1633; p>0.05). H1 was therefore rejected. This finding, though it contradicts earlier studies that indicate a higher

focus on product innovations (e.g. Oke et al, 2004), is not counter-intuitive, especially within the developing country context. For instance, as Ilori et al (2000) noted, the new product development (NPD) process is generally demanding in terms of time and resources. For the developing country SME, it is therefore not particularly attractive to engage in the process particularly when the harsh environment is factored in. The firm may then prefer to begin its innovative activities from process changes which could lead on to incremental innovative changes in products rather than engage in outright NPD. The differences found in the focus on incremental and radical innovation, as will be shown in the next section, further lends credence to this point.

(Table iv here)

Hypothesis 2

With reference to Table 3, it seems apparent that when the two innovation types in our first hypothesis were examined at a finer level of disaggregation (i.e. radical versus incremental), the results differ. For instance, there is a higher incidence of incremental than radical product innovation. On the other hand, a slightly higher incidence of radical process innovations occurred compared to incremental process innovations. In any case, conclusive inferences cannot be drawn on the basis of the counts. The results of the Wilcoxon tests on the second hypothesis are contained in the right part of Table 4. The figures indicate a significant difference between radical and incremental product innovations ($z = -3.541$; $p<0.001$), and between radical and incremental process innovations ($z = -4.490$; $p<0.001$), both in favour of incremental innovations. These figures suggest a greater focus on incremental innovations, thus H2 was accepted. This result contends the results of some previous studies (e.g. Kanter, 1985) and confirms others (e.g. Oke et al, 2004; Bala-Subrahmanya, 2005; 2006; Ilori et al, 2000).

It is important to note that our results here suggest that while SMEs in developing countries may not selectively concentrate on either of product or process innovations, they seem to be more inclined towards innovations of incremental nature, be it product- or process-related. This is consistent with findings from other studies in the context of developing countries. For instance, Goedhuys (2007) showed with evidences from Brazil that minor and incremental rather than radical changes are at the heart of the innovation process in developing countries.

Hypothesis 3

The third hypothesis deals with the impact of innovation on firm performance. Four proxies were used to capture firm performance and the frequency analysis of these is contained in Table 5. The table was constructed using the number and proportion of firms that indicated an increase in their profit; employment and market share as well a reduction in rejection/return of their products – which speaks of improved product quality. Obviously, most of the innovating firms had seen improvements in their performance, this being more pronounced in profit and market share.

(Table v here)

(Table vi here)

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(Table vii here)

The results of the regression analyses to test whether or not these improvements were associated with the types of innovation undertaken by the firms yielded interesting results because it showed, to a good extent, that innovations – particularly of an incremental nature - really matter for product quality. At the 0.1 confidence level, whether the firm chooses to pursue product or process innovation would not be a significant predictor of performance, both when regressed together or independently against each of the dimensions of performance (Table 6). This issue was explored further by checking firm performance against the degree of novelty of their innovations. The results of regression with the degree of novelty of the innovations lead us to partially accept H3 with a 90% level of confidence (Table 7). The pursuit of incremental over radical innovations in SMEs has a significant impact on their product quality, shown in significantly improved product quality. This makes a lot of sense since most SMEs are likely to fail in their radical innovation efforts due to the prevailing systemic and internal constraints that they are confounded with.

Specifically, incremental innovations accounted for 21.7% of the reduced rejection and return of products among the sampled firms. The apparent non-impact of innovation type on revenue, market share and employment seems to be counter-intuitive and opposed to the extant literature (Bala-Subrahmanya, 2006; Ilori et al, 2000; Goedhuys, 2007). However, the point to note is that these results do not suggest that innovation, in itself, is not important to firms' improved performance. Rather, the results indicate that for the developing country SMEs that do not generally have the luxury of choice, the type of innovation they choose to pursue would not matter. What matters is that the firm chooses to pursue such innovations that most fit its strategies and available resources. Nevertheless, it is apparent that the pursuit of incremental innovations is to be preferred.

Conclusions and Implications for practice, policymaking and further studies

The foregoing results hold important implications for managers and policy makers. Although innovation is important for superior firm performance, our results suggest that the type of innovation that SMEs in a developing country context pursue is not a critical consideration. While we found no difference in the focus of SMEs on either of product or process innovations, we have presented evidence in support of the fact that should they decide to innovate, SMEs would focus more on incremental product and process innovations. Incremental innovations have been brought forward as very important for Nigerian SMEs and it is a significant predictor of product quality though not of revenue. First, it points out that a focus on the firm's existing core market through a deep understanding of the needs of customers and the ability to continuously improve products/processes to meet those needs is very important. Besides other benefits, this helps the firm to contribute more towards the development of the local economy. Second, the importance of innovation is confirmed and empirical support is provided for the encouragement of innovation in SMEs by policy makers. However, the call for extensive new product development and the desire to enter new markets, especially through exports are not exactly supported by the highlighting of the importance of incremental innovation.

This study is a very early attempt to investigate the types and impact of innovation on developing country SMEs in general, and African as well as Nigerian SMEs in particular.

Further studies with larger samples and in different countries would be very useful in facilitating cross-country comparisons. Also, cross-sectoral studies would help in throwing light on how sectoral characteristics influence the types of innovation that SMEs pursue. One particular type of data that was missing in this study was the profile of the firms' personnel in terms of education and specialisation. This would have enabled a more thorough analysis of the firms' innovative activities. Future studies may take cognizance of that. Methodologically, however, the study has shown that a more detailed taxonomy of innovation is likely to yield more meaningful empirical results.

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Table I: Age distribution of the sampled firms

Firm age (years)	Number of Firms	Percentage
Less than 5	6	13.64
5-9	7	15.91
10-19	10	22.73
20-39	14	31.82
40-50	5	11.36
Over 50	2	4.55
Total	**44**	**100**
Descriptive Statistics		
Mean (years)	22.22	
SD	17.85	
Range (years)	80 (81 – 1)	

Source: Authors' Field Survey, 2007

Table II: Size distribution of the sampled firms

Firm size (no. of employees)	Frequency	Percentage
Below 10	15	27.78
10-49	32	59.26
50-99	4	7.41
100-299	3	5.56
Total	**54**	**100**
Descriptive Statistics		
Mean (no. of employees)	28.83	
SD	45.73	
Range	297 (298 – 1)	

Source: Authors' Field Survey, 2007

Table III: Innovation activities among the SMEs

Innovation type	Number of firms	Percentage of sample
PROD	44	81.48
PROC	40	74.07
RADPRODINN	29	53.70
INCPRODINN	39	72.22
RADPROCINN	33	61.11
INCPROCINN	31	57.41
TOTAL	**54**	

Source: Authors' Field Survey, 2007

Table IV: Results of the Wilcoxon test on the difference between the different innovation types considered in the study

Statistics	Process-Product	Product Radical-Incremental	Process Radical-Incremental
Z	-1.633	-3.541	-4.490
Sig.	0.102	0.001	0.001
N	54	34	27

Table V: Impact of innovation on different dimensions of firm performance

Firm performance	Number of firms	Percentage of sample
Increased Profit	33	61.11
Increased Market Share	30	55.56
Improved Product Quality	22	40.74
Increased Employment	17	31.48

Table VI: Results of the regression on the impact of innovation type on firm performance

Variable*	R^2	Adjusted R^2	F	Sig
Profit	0.018	-0.041	0.367	0.739
Market share	0.033	-0.025	0.568	0.572
Employment	0.010	-0.056	0.149	0.862
Product Quality	0.022	-0.048	0.319	0.729

*INNTYPE - Innovation Type (Product or Process) is the dependent variable; N = 54

Table VII: Results of the regression on the impact of degree of novelty of innovation on firm performance

Variable**	R^2	Adjusted R^2	F	Sig
Profit	0.026	-0.032	0.447	0.513
Market share	0.011	-0.048	0.183	0.675
Employment	0.033	-0.036	0.483	0.499
Product Quality	0.217	0.165	4.160	0.059

**DEGNOVINN - Degree of Novelty (Radical or Incremental) is the dependent variable;

N = 54

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[1] The indigenisation decree was promulgated in 1977. The decree required that foreign holdings in any company operating in Nigeria be of a minority nature. It also precluded foreigners from operating in certain sectors of the economy.