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Bridging Research-Industry divide in Food and Beverage Enterprises: Empirical evidence from Southwestern Nigeria

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A B S T R A C T

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Research and Development (R&D), SMEs, Competitiveness, Support services, Nigeria, Technological Innovations, Food and Beverage companies

This paper investigates the gaps between research institutions and industry in R&D collaboration towards the promotion of innovation, creativity and competitiveness among food and beverage enterprises (FBEs) in Nigeria. This was measured by the level impact of R&D institutional support services for technological innovations in the industry. A multi-staged sampling method was adopted to select 150 registered FBEs from three small and medium scale enterprises (SMEs) populated States in Southwestern Nigeria with a response rate of 64% recorded. Adopting model regression analysis, the study showed that the contributions of R&D institutions to innovative performance of the industry was low ($R^2 = 0.008$). However, training and information dissemination ($\beta=36.49$, $P \leq 0.05$) and provision of analytical services ($\beta = 36.67$, $P \leq 0.05$) were found to have significant impact on the innovative performance of the industry. No significant difference ($F=0.336$, $P \leq 0.05$) between the two methods of support services was confirmed in the study. The study concludes that the R&D support services from research institutions to FBEs were inadequate. Policy intervention is needed to encourage R&D institutions to adequately support the food and beverage industry in Nigeria.

1.0 Introduction

The role of research and development (R&D) institutions in promoting innovation, creativity, and competitiveness among small and medium scale enterprises (SMEs) is vital in developing countries as often the private sector have no resources to raise business enterprise capital to conduct R&D (Siyanbola, 2014; Dada, 2016; Dada and Oyebisi, 2016). One of the important factors for measuring the production of new ideas in the knowledge-intensive economy is the country's expenditure on R&D. Deliberate investment R&D is a key to the generation of knowledge and the level of investment in innovative research and development determines the global competitiveness of nations (Bogoro, 2014). Research has shown that domestic R&D affects the rate of innovation and the quantity of knowledge that can be absorbed from other nations (Akinwale *et al.*, 2012; Bogoro,

2014). Through adequate R&D funding, more than 50% of wealth created in developed and emerging nations is derived from product of research and development. Accordingly, several countries invested in research which has shown multiplier effects on their economy. For instance, in the United States of America (USA), through the Bayh-Dole Act of 1980, government funded R&D drove America's economic growth (Oyewale *et al.*, 2015).

As succinctly put by Salter and Martin (1999) in Siyanbola (2008):

'...no nations can "free-ride" on the world scientific system. In order to participate in the system, a nation needs the capability to understand the knowledge produced by others and that understanding can only be developed through performing research'.

Several emerging economies are also increasing the level of their R&D expenditure. For example, over the year, nations such as Israel, China, South Korea has increased their gross domestic

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expenditure on R&D (GERD). The importance of R&D to economic development cannot be better discussed than the experience of Malaysia in the oil palm industry. Research and development activities aims at increasing the stock of knowledge and solving several challenges such as technology inadequacy, food insecurity, and disease outbreak confronting the nations. This knowledge may be acquired through R&D activities within the knowledge institutions. Private involvement in the R&D expenditure of any nation equally serves as impetus to strengthening the technological advancement. However, the Nigerian economy has been traditionally driven by natural resources, primary processing and manufacturing as well as other primary products such as minerals and hydro-carbon (Siyanbola, 2008; 2013). This over-dependence on a few commodities for foreign exchange earnings has made the economy vulnerable to the rise and fall in the prices of these commodities in the global market (Siyanbola, 2016). The oil sector is the major source of income in Nigeria since crude oil discovery and the rise in crude oil price in the 1970s (Dada, 2010, Siyanbola, 2016). Moreover, Nigeria largely relies on imported technologies in spite of the visible science and technology (S&T) infrastructural network and the R&D activities in a broad range of fields (Siyanbola, 2008; Siyanbola, *et al.*, 2012). As governments in Nigeria are confronted with the issues of technological advancement, there had been focus on how domestic universities and research institutes can promote sustainable economic growth by supporting and generating innovations for the industrial sector (Akinwale *et al.*, 2012; Dada, 2016; Dada and Oyebisi, 2016). Thus, government has often step in to fill the gap through R&D institutions, otherwise; there will be little chance that the innovations will take place in these SMEs (Dada, 2014; Dada and Oyebisi, 2016). It is globally acknowledged that SMEs create significant impacts on any economy (Pena, 2002). The transition to new economy and knowledge-based economy in the 1990s and early 21st century created an atmosphere that SMEs became critical to economic growth (Oyelaran-Oyeyinka, 2002). The development of new or improved products, processes or business systems through technological innovation can help SMEs in Nigeria to better satisfy consumers' needs, stay ahead of competition, explore new markets, grow and survive.

The small and medium scale food and beverage enterprises are one of the key sectors to sustainable economic development in Nigeria (RMRDC, 2003; Dada *et al.*, 2011; Dada *et al.*, 2016). The industry contributes about 13% of gross manufacturing output, and accounts for about 20% of the total number of manufacturing firms in Nigeria (Oyedoyin, 2006; Dada, 2016). The sector invested between zero and 2.5% of their annual turnover in R&D leading mostly to incremental

innovations (Ilori, *et al.*, 2000; Ilori, 2006). Dada, *et al.* (2011) later found an improvement in the firms' average in-house R&D investments of up to 5% in the sector.

Some innovations were generated from the R&D activities which were found to be incremental in nature. To run successful technology-based businesses, SMEs need the support of R&D institutions. For example, the development of joint initiatives between the public and private sectors for SME development has considerably played a strategic role in fostering the Australian innovation process thus becoming a significant source of national wealth creation in the country (Braun, 2007). SMEs suffer technological innovations related disadvantages in Nigeria as a result of weak technical support (Oyelaran-Oyeyinka; 2002; Dada *et al.*, 2011); the SMEs have limited internal ability to develop and manage technology. Consequently, there is limited adoption and application of technology for product and process innovation by the SMEs.

A number of previous studies had recorded the existence of incremental innovations in the food and beverage industry in Nigeria (Ilori *et al.*, 2000; Ilori, *et al.*, 2002; Oyedoyin, 2006; Dada *et al.*, 2011), however, there are limited studies on the impact of collaborations of research and industry towards the generation and utilisation of innovations in the small and medium scale food and beverage enterprises in Nigeria. This paper contributes to the body of knowledge by ascertaining the quality of the technology support services for the technological innovations in the Nigeria food and beverage SMEs. This was with a view to developing technological strategies of improving competitiveness both nationally and internationally in the industry.

2.0 Methodology

This study adopted survey technique with two research instruments. These are questionnaire and interview guide. A set of well-structured questionnaire was used to elicit information from 150 small and medium scale food and beverage companies in Southwestern Nigeria. The choice of this zone was informed by high number of the food and beverage firms which make it convenient to have fair representative of the firms in Nigeria. The study recorded a response rate of 64 percent. The Nigeria food, beverage and tobacco industry is sub-divided into 17 sub-sectors (Olalere, *et al.* 2014). The study population comprised of all small and medium scale food and beverage enterprises in Nigeria with about 70% based in Southwestern Nigeria (Oyedoyin, 2006; Dada *et al.*, 2011). Five sub-sectors were selected for this study; these are dairy products; soft drinks and carbonated water; biscuits and bakery products; flavoring; and beer. The choice of these sectors was informed by high level of SMEs in them. A multi-stage sampling technique was employed. The first stage is stratified

sampling technique of selecting five strata followed by the random selection of the respondents from each stratum relative to the size of the sub-sector. Both descriptive and appropriate inferential statistics were for the processing of the data where inferences were drawn.

3.0 Results and Discussion

This section presents the results of the analysis of data as well as discussed the outcome in this study. Such results and discussion include engagement and factors influencing firms in R&D activities, firms' collaborations with R&D institutions; reasons why companies would not interact with R&D institutions; impact of R&D support services on the performance of food and beverage SMEs. Other items reported in this section are nature and extent of government support services for R&D and innovation to food and beverage firms. The respondents' perception on the level of impact of government support services for R&D and innovation to food and beverage companies was also presented here.

3.1 Companies' Location by State

Out of a total of 96 company respondents retrieved and found useful for this study, 43% were located in Lagos State. The reason for the highest companies in Lagos State may not be unconnected from the fact that the State is the industrial hub of the Southwestern States and by extension in Nigeria. About 36% and 21% of the firms were located in Ogun and Oyo States respectively.

3.2 Distribution of Firms by Sub-sectors

The 96 copies of the questionnaire that were retrieved got 43% from biscuit and bakery firms and 25% from the soft drink and carbonated water. The study retrieved 18% from fruit juices sub-sector, 12% from meat, poultry and fish as well as 2% copies of questionnaire from beer sub-sectors respectively (Table 1). The sample size in each of these sub-sectors revealed the relativity of the population of firms in each of the sub-sectors in the study area.

Table 1: Division of firms by Sub-sectors

Food and Beverage Sub-Sector	Frequency	Percentage
Biscuits and bakery products	42	43.0
Soft drinks and carbonated water	24	25.0
Fruit Juices	17	18.0
Meat, Poultry and Fish	11	12.0
Beer	2	2.0
Total	96	100.0

Source: Field Survey

3.3 Engagement in R&D activities and Product development by food and beverage companies

The paper discusses here the R&D activities engagement and product development of the selected firms. The study revealed that one third of the responding firms claimed to have been engaged in one form of R&D activities as shown in Figures 2a, 2b and 2c. Out of the 33% of the firms that had developed products, about 29% claimed to have developed one form of product or process (Table 2). Product development is a key feature of companies' strategies to remain competitive and to grow. In the food and beverage industry, product and process development has been considered vital part of business strategy. Consequently, the low level of new and improved product develop might have affected the firms to favourably compete in the industry. The ultimate test of product and process development occurs in the market while such new product and process can only be considered successful with market and financial success. Innovation is the technical and marketing process of translating R&D activities into products and processes. Research usually turns money to knowledge but innovation turns knowledge to money.

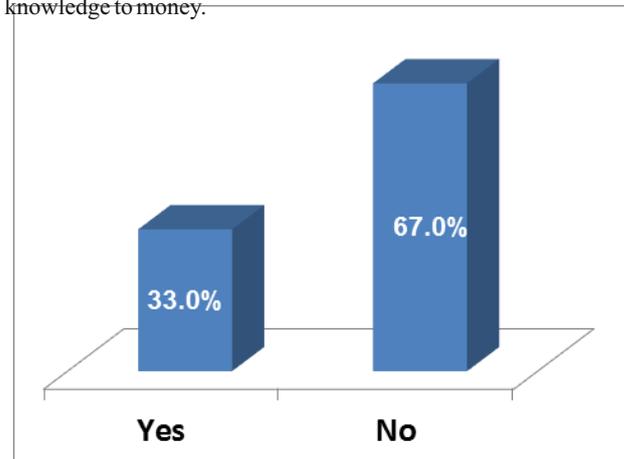


Figure 2a: Engagement in R&D activities of the selected firms (N = 94)

Source: Field Survey

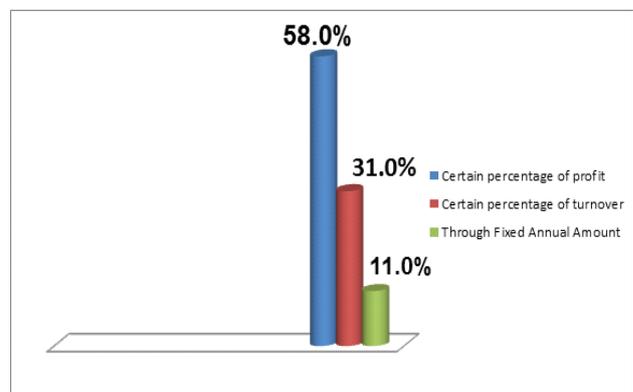


Figure 2b: Investment in R&D Activities (N = 31)

Source: Field Survey

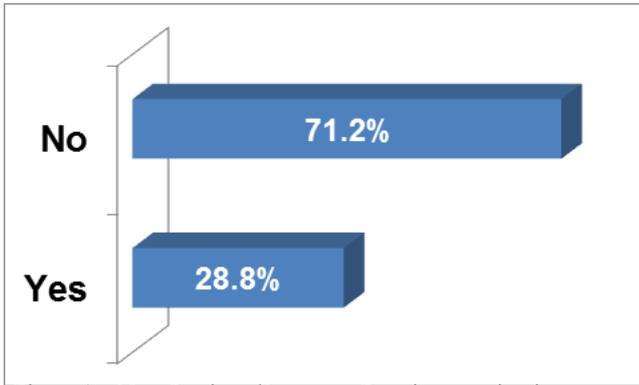


Figure 2c: New Products/Processes Development by the respondents' firms in the last 3 years (N = 31)
Source: Field Survey

3.4 Interactions of the Firms with R&D Institutions

The study revealed that only few (21.0%) of the firms claimed to have one form of interaction with universities and research institutes. Similar results were found by Oyewale (2005); Oyewale *et al.* (2009); Dada (2014); Obembe (2014) among SMEs in Nigeria. Interviews with the respondents further revealed that the companies were in close contact with the federal institute of industrial research, Oshodi (FIRO), Lagos. This may not be unconnected with the mandate of the institute in Nigeria. Majority (50.0%) of the companies had relationship with the R&D institutions “once a while” while about 33.3% of the companies did have relationship with R&D institutions when crisis arises in their firms.

3.5 Impact of R&D Support Services on the Performance of the Food and Beverage Firms

Table 2 shows the impact of R&D support services on the performances of the sampled food and beverage firms. The performance was measured on a 5-point likert scale. On the level of impact of the support services provided by the R&D institutions to the food and beverage firms, training and information dissemination was most (4.24) adequate. Provision of analytical services (4.00) and new process development (2.63) were also adequate. Fairly adequate services were provided by the R&D institutions in form of business development support services (business plan, market expansion) (2.25), resolution of industrial problems (2.06), provision of information on utilization of local raw materials (2.00) and support for new product development (1.84) as shown in Table 2. These variables were subjected to binary logistic regression analysis. The outcome of the analysis revealed training and information dissemination services ($\beta=36.67$, $P<0.05$) and analytical testing services ($F=0.336$,

$P<0.05$) to have significant impact on the technological innovations of the food and beverage firms as shown in Table 3.

Table 2: Support Services from Research Institutions to the Industry***

Type of Support Service	Degree of Impact
Training and Information Dissemination Services(X_1)	4.25 ^a
Testing Analytical Services (X_2)	4.00 ^a
New Process Development (X_3)	2.63 ^b
Business Development Support Services (X_4)	2.25 ^c
Resolution of Industrial Problems (X_5)	2.06 ^c
Provision of Information on Utilization of Local Raw Materials (X_6)	2.00 ^c
New Product Development (X_7)	1.84 ^c

Means Ranks: (1) Not adequate – (5) Very adequate
Multiple Responses ***

Means with the same alphabets are not significantly different ($F=0.336$, $P<0.05$)

Source: Field Survey

Table 3: Binary Logistic Regression Analysis of the Impact of R&D and Innovation Performance Support Services for Food and Beverage Firms

Variable	B	S.E	Wald	Sig.
X_1				
	36.49	1.7326	1.31E-03	***0.04
X_2	36.67	1.0084	1.12E-51	***0.03
X_3	96.08	1.3408	6.82E-24	0.59
X_4	42.46	0.4739	7.86E-07	0.26
X_5	6.07	1.4839	1.58E-22	0.49
X_6	1.24	1.0084	1.12E-51	0.64
X_7	18.48	0.5623	4.35E-22	0.72
Constant	-63.6	0.8469	4.35E-07	

*** Significant at 95% level of significance ($p<0.05$);
 $R^2 = 0.088$ (8.8%)

Source: Field Survey

$$4Y = -63.3 + 36.49X_1^{***} + 36.67X_2^{***} + 96.08X_3 + 42.46X_4 + 6.07X_5 + 1.24X_6 + 18.8X_7$$

(1.733) (1.008) (1.341) (0.471) (1.484) (0.053) (0.562)

Where,

- Y = Performance of Small and Medium Scale Food and Beverage Enterprises
- X_1 = Training and Information Dissemination Services

- X_2 = Analytical Testing Services
 X_3 = New Product Development
 X_4 = New Process Development
 X_5 = Resolution of Industrial Problems
 X_6 = Business Development Support Services (Business Plan, Market Expansion)
 X_7 = Provision of Information on Utilization of Local Raw Materials

Reviews of literature and discussions with the technical staff of the firms indicated that in spite of food and beverage industrial efforts in Nigeria to create more innovative and exciting products to the customers, there seem to be low product innovations in the industry. One simple reason could be that the food and beverage industry suffers low technology and weak interactions among actors of the food sectoral innovation in Nigeria. One conclusion that might be drawn from this is that new product and process development in the industry is highly dependent upon the support services that can be received from the relevant departments such food science and technology, agricultural engineering, chemistry in the Nigeria Universities and relevant research institutes such as federal institute of industrial research, Oshodi (FIIRO), Lagos, Nigeria. Such innovations through the creation, diffusion and use of knowledge have been recognised as key driver to economic growth. Some (N=72) of the food companies did not interact with R&D institutions and universities because of some reasons which included reliance on their laboratory to resolve problems and developing new products (42%), fear of exposing their problems to other competitors (26%) and perception that the research institutions have incompetent researchers and staff (7%). Other reasons included non-affordability of fund for contract research.

3.6 Level of Impact of Government Support Services for R&D and Innovation to Food and Beverage Firms

Several nations have recognized the importance of SMEs, and have formulated policies to encourage and support them for better performance. The contributions of SMEs to any economy include: creation of jobs, development of skilled and semi-skilled workers, and developing and adapting appropriate technological approaches. Promoting SMEs have therefore, been one of the best strategies for achieving economic development. Figure 3 showed the respondents' views on the level of impact of government supports for R&D and innovation for food and beverage industry. The result showed that about 74.0% of the firms believed that government supports for R&D and innovation in Nigerian food and beverage firms are inadequate. The remaining 26.0% believed that these supports were low.

3.7 Areas of government interventions on R&D and Innovations in Food and Beverage Industrial Sector in Nigeria

Table 4 shows the ways government can assist SMEs food and beverage companies and attached weight (position). A multiple of responses were presented by the respondents, these include promotion and encouragement of the utilisation of local raw materials (80.64%), provision of stable power generation and supply (78.83%), strengthening of linkages between R&D institutions and industrial sector (75.24%), provision of basic infrastructure and amenities (75.24%) and formulation of favourable industrial policies (72.70 %). Other suggestions included encouragement of R&D institutions to conduct market – driven R&D (70.67%), provision of subsidy on raw material (65.28%), adequate funding of R&D and Innovation activities in the industry (62.48%), Provision of Tax Holiday to Outstanding Companies (60.91%) as well as companies be encouraged to Sponsor R&D activities of Knowledge institutions (58.42%), by both government and the private sector (53.18%) while regulatory organisations such as standard organisation of Nigeria (SON) and national agency for food and drug administration control (NAFDAC)(52.10%).

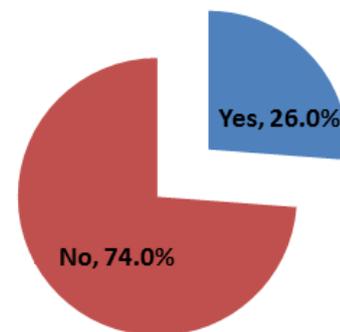


Figure 3: Respondents' Perception on the Level of Impact of Government Support Services for R&D and Innovations in the Nigeria Food and Beverage Industry

Source: Field Survey

Few of the Respondents also argued that bribery and corruption be abolished and smuggling be controlled (57.82%), proper monitoring of R&D and innovation activities be put in place by the government (56.55%), researchers in food and beverages be sponsored to workshops and conferences.

4.0 Conclusion and Recommendations

This paper presents the extent of R&D and innovation supports the Nigeria Food and Beverage Industry. The study confirmed the low

level of impact ($R^2=0.088$) of support services for food and beverage firms in southwestern Nigeria. The low support for the sector called for the need to use policy for encouraging R&D institutions to adequately support food and beverage industry in Southwestern Nigeria. There is also the need to close the existing interaction gap between the R&D institutions and the industrial sector.

Following the findings and conclusion of this study, Food and beverage companies should be ready to sponsor some R&D activities of knowledge institutions that are useful to their sector/sub-sector. Industry can sponsor researchers to workshops and

conferences so that such researchers can expand their frontier of knowledge in the sector/sub-sectors of the companies. Industrial sectors should be willing to be involved in the formulation of R&D and innovation policies. Establishment of Innovation-Biased Fund: It is important for governments at all levels to promote the creation of Venture Capital (VC) and encourage the emergence of business angels to finance technological innovation in Nigeria and private utilization of R&D results. There is the need for the government to urgently upgrade the capabilities of the knowledge institutions to assist SMEs, especially in their ability to identify, develop and disseminate best practices to support food and beverage SME technology diffusion.

Table 4: Government Policy Assistance in R&D and Innovation Activities for Food and Beverage Firms

Government Policy Assistance for R&D and Innovation ***	Frequency	Percent	Position
Promotion and Encouragement of the Utilisation of Local Raw Materials	49	80.64	1
Provision of Stable Power Generation and Supply	42	78.83	2
Strengthening of Linkages between R&D Institutions and Industrial Sector	36	75.24	3
Provision of Basic Infrastructure and Amenities	36	75.24	3
Formulation of favourable Industrial Policies	35	72.70	5
Involvement of Industrial Sectors in Formulation of R&D and Innovation Policies	28	70.67	6
R&D and innovation activities be Market/Demand Driven	26	68.77	7
Government Subsidy on Raw Material Supply to Industrial Sector	23	65.28	8
Adequate funding of R&D and Innovation activities	20	62.48	9
Provision of Tax Holiday to Outstanding Companies	18	60.91	10
Companies be encouraged to Sponsor R&D activities of Knowledge institutions	14	58.42	11
Bribery and Corruption be Abolished and Smuggling be Controlled	13	57.82	12
Proper Monitoring of R&D and Innovation activities by the Government	12	56.55	13
Sponsoring of Researchers to Workshops and Conferences	7	53.18	14
Empowerment of Regulatory Organisation such as SON & NAFDAC	6	52.10	15

***Multiple ResponsesSource: Field Survey

There is the need for government to properly monitor the R&D and innovation activities of the R&D institutions. Promotion of collaboration among food and beverage industry, knowledge institutions and government: The aim of collaboration is to create new industries. R&D and innovation activities should be Market-Driven: The knowledge institutions should embark on researches

that are market/demand driven. R&D institutions and researchers should seek out problems confronting food and beverage companies and make their research relevant to these problems to avoid wasting time and resources.

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