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MEASURING AND ASSESSING THE STATE OF TECHNOLOGICAL INNOVATIONS AND THE LEVEL OF INTERACTION BETWEEN RICE PROCESSORS AND STAKEHOLDERS IN RICE PROCESSING INDUSTRY IN NIGERIA

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ABSTRACT

The study examined the state of technological innovations in rice processing industry and investigated the level of interaction that exists between rice processors and stakeholders involved in rice processing operations in Nigeria. Data were collected from 35 (12 integrated and 23 medium and small-scale mills) rice processing firms in four geopolitical zones of Nigeria through the use of questionnaire. These firms were selected using snow balling sampling technique. The questionnaire elicited information on the state of technological innovations in the firms and the level of existing interactions among rice processors and relevant stakeholders. Data were analyzed using descriptive statistics. The result showed that majority (71.4%) of the firms had technological innovations involving introduction and improvement of existing product and 45.7% of them had technological innovations involving introduction of a new process and improvement of the existing process. More than two thirds (82.9%) of the firms carried out technological innovations mainly by themselves. Also, 65.7% of the technological innovations originated mainly in Nigeria, 31.4% were imported while 2.9% were sourced jointly in Nigeria and abroad. The results further showed that the firms have low (mean < 2.58) level of interactions with important stakeholders such as banks, local suppliers of equipment, universities/research institutes, foreign firms and government with a mean of 2.91, 2.57, 2.49, 2.09 and 1.86 respectively. The study concluded that to enhance technological innovation in Nigerian rice processing industry, there is a need for the development of strong linkage between the industry and the stakeholders involved in rice processing operations.

Contribution/Originality: This study has contributed to the existing literature through the establishment of the state of technological innovations identifiable in rice processing industry. It also provides the existing relationship between rice processors and stakeholders involved in rice processing operations.

1. INTRODUCTION

Rice is an important food crop that most households in Nigeria consume on daily basis. The crop is the second largest consumed cereal in the world, and more than half of the world's population depend on it for about 80 percent of their food calorie requirements (Raw Materials Research and Development Council RMRDC, 2000; Seck *et al.*, 2012). Rice is cultivated in virtually all the agro-ecological zones in Nigeria and covers both the upland and the swamps, depending on the variety (Kano State Agricultural and Rural Development Authority KNARDA, 2007). The demand for rice has increased at a very fast rate in Nigeria and the country is one of the largest producers of all varieties of rice in Africa (Food and Agricultural Organization FAO, 2007; Ajala and Gana, 2015).

However, in spite of this production level, Nigeria remains one of the largest importers of the commodity in Africa. This is as a result of considerable increase in the annual per capita consumption levels of rice in Nigeria (Okoruwa and Ogundele, 2005; Bamidele *et al.*, 2010). Some of the research institutes and programmes established by the Nigerian governments in order to address the widening demand-supply gap for rice include National Cereal Research Institute (NCRI), National Acceleration Crops Production Programme (NAICPP), Agricultural Development Programme (ADP), Agricultural Input Supply Agency (AISA) and Agricultural Transformation Agenda (ATA) among others. The Bank of Industries (BOI) in Nigeria has also collaborated with the Federal Ministry of Agriculture and Rural Development (FMARD) to increase rice reservation fund to help boost rice production in Nigeria (Bamidele *et al.*, 2010) yet, the rate at which rice is being imported into the country remains substantial (Hoogvelt, 2000; Longtau, 2003b; Kareem *et al.*, 2009; Bamidele *et al.*, 2010; Okpe, 2010; Ajala and Gana, 2015).

Several studies have discussed the economic production and consumption of rice in the country (Hussien, 2004; Bamidele *et al.*, 2010; Terwase and Madu, 2014; Ige *et al.*, 2016). Studies have also shown that out-dated processing technologies and ill-equipped infrastructure are some of the factors responsible for the increase in the demand for rice consumption (Seck *et al.*, 2010; Seck *et al.*, 2013; Styker, 2013; Ajala and Gana, 2015). Akintelu (2017) also mentioned that rice processing technological capability can only be enhanced if adequate technologies are in place. According to Kim (1997) absence of joint projects with the various types of stakeholders prevents companies from achieving new sources of scientific and technical information, which are crucial, as they can significantly increase the technological capability of the company. The scientific and technological infrastructures are a vital resource for the company's competitiveness for product innovation. These indicate that building technological innovation is critical for a sustainable rice processing industry in Nigeria. The aim of the paper is to examine the state of technological innovation of rice processing sector and investigate the level of interaction that exists between rice processors and stakeholders in the industry in Nigeria with a view of providing information that could assist in building full-bodied technological innovation.

2. LITERATURE REVIEW

Technology is defined in many dimensions, embodying various areas, which has changed significantly over the last 200 years. Before the 20th century, the term was referred to as the study of useful arts (George, 1823). Stratton and Mannix (2005) often connected technology to technical education as in the Massachusetts Institute of Technology. Technology rose to prominence in the 20th century in connection with the Second Industrial Revolution. The term changed in the early 20th century when American social scientists, translated ideas from the German concept of Technik into "technology". In German and other European languages, a distinction exists between technik and technology. By the 1930s, technology referred not only to the study of industrial arts but extends to the industrial arts themselves (Eric, 2006).

Bain (1937) defined technology to include all tools, machines, utensils, weapons, instruments, housing, clothing, communicating and transporting devices and the skills by which we produce and use them. Bain's definition remains common among scholars today, especially among social scientists. MacKenzie and Wajcman (1999) defined technology as applied science. More recently, scholars especially scientists and engineers have referred to technology as technique due to various instrumental reason. It is the know-how, physical things, and procedures used to produce products and services. An important tool used to monitor the production and manufacturing process, thus improving quality management and ensuring compliance with environmental standards.

In this study, technology refers to tools and machines that may be used to enhance rice processing operations. The word "technology" can also be used to refer to a collection of techniques. It is a way of utilizing human knowledge and combine resources to produce desired products, solve problems, fulfil needs, and satisfy wants. It includes technical methods, skills, processes, techniques, tools and raw materials (Rhodes, 2000; Akpomi, 2003).

Consequently, capabilities are to be taken as outputs of adaptive learning processes that are sustained through a variety of external connections and sources for innovation (Von and Wang, 2003;2007) at least partially embedded in the regional environment of the firm. Nelson and Winter (1982) contributions in the area of firm specific capabilities have proliferated in and among resource-based views, evolutionary economics, the economics and history of technical change, strategic management and, more recently, evolutionary economic geography. The main extensions to conventional static notions of capabilities involve both interactive and dynamic capabilities.

The term "capabilities" has been used severally to describe a large variety of processes and a variety of functions through different levels of systems from individual to global (Abramovitz, 1986). Lall (1992); Bell and Pavitt (1995) explained that their works focused on technological capabilities as the knowledge and skills that firms need to acquire, use, adapt, improve and create technology, interacting with the external environment. One may think of firm's endowment of adequate skills as the necessary internal competences to obtain value from R&D and innovation investments (Piva and Vivarelli, 2009).

Capabilities involve learning and accumulation of new knowledge on the part of the firm, and also the integration of behavioural, social and economic factors into a specific set of outcomes. Consequently, capabilities are to be taken as the results of adaptive learning processes that, in their collective dimension, can be highly localized, giving rise to 'system' capabilities (Iammarino and McCann, 2012). Variables related to human resources, or cooperative linkages for innovation with external actors, are to be considered as determinants of a firm's technological capabilities, rather than as the capabilities themselves (Von and Wang, 2003;2007).

Many authors viewed the result of innovation as economic gains arising from technical change and firms' performance. Innovation can take several forms ranging from product, production process, organizational structure, people and policy innovation (Olaposi, 2017). Out of these forms of innovations, only product and process innovation are recognized as technological innovation. Technological product innovation is the implementation or commercialization of a new or improved performance and delivery of new or improved services to consumers (OECD, 1997). While technological process innovation is a new or significantly improved production method with significant changes in techniques, equipment and software. Technological process innovation may involve the adoption of technologically new or improved production methods of product delivery (Olaposi, 2017). Process innovation as it relates to rice processing industry focus on improving rice processors' capabilities and improvement of the industry quality of output. This involves the deployment of modern rice processing technologies for parboiling and milling operations.

2.1. Linkages along the Rice Commodity Chain

The innovative performance of any economy depends on how the individual actors perform in isolation and how they interact with each other as elements of a collective system of knowledge creation and use, and on their interplay with social institutions. Without adequate development of these actors and institutions in the national settings, the rice processing industry remains weak. Strong linkages between various actors along the rice commodity chain can greatly improve the efficiency of the sub-sector. Linkages evolve through the relationships between various actors involved in rice processing operations. Given the huge inflow of imported rice in the markets, the linkages between the local actors along the commodity chain define and shape the competitiveness of locally produced rice.

2.2. Stakeholders of the National Rice Processing industry in Nigeria

The key Stakeholders of industrial sectors include: Education and Research institutes, suppliers of technologies, financial institutes, foreign firms and Government (Lundvall, 1992; Adeoti, 2002; Jegede, 2015). Antonio and Marcelo (2016) also affirmed that the interaction with the various players represents one of the most important

learning and innovation efforts for industrial development and competitiveness. His findings revealed a weak link between companies and other stakeholders. The systematic relationship with universities is virtually non-existent.

2.3. Education and Research Institutes

The education and research institutes comprise the primary, secondary and tertiary institutions (universities and polytechnics and other specialised research institutes). Within these actors, universities play prominent roles, for which attention are paid to them. Universities traditionally fulfil the dual roles of manpower development and conduct research. However, an additional demand of transferring technology to business sector was later added to their roles.

Higher educational institutions, particularly universities, perform the traditional functions of teaching and talent filtering by which new generations of students are trained. They also have a social and statutory responsibility to participate in the generation of new knowledge through research and development deeds which can be channelled and diffused by new venture. Public research and development institutes are expected to undertake different lines of research that are of commercial applicability. These institutes vary in their mandates and sizes but derive their funding mainly from government sources (Oyewale, 2003).

2.4. Financial Institutes

Financial Institutions such as Bank of Industry are instituted by government in-order to intervene in facilitating the acquisition of technologies that will enhance the industry to boost their technological capability. Finance that is needed for the sustainability of the industry is provided by the financial institute also through a special fund called Venture Capital (VC), which is often referred to as risk capital.VC is invested in the early stage of high technology companies in the form of equity, quasi-equity or conditional loan. Public Venture Capital Funds can be established by the State, Federal, or Regional government as development agencies. Private Venture Capital organisations can also be established as professional or institutional investors. Individual investors called Business Angels also provide venture capital in an informal approach.

2.5. Government

There is a pervasive influence of government to support industry that is strongly collaborated and connected with the actor. This will help to improve overall firm performance (Peng and Luo, 2000). Government as a stakeholder ranges from ministries, agencies and other government bodies at various level that are involved in regulating industry and their applications in industrial production. The government develops innovative policies that stimulate organisation linkages and directs the flow of goods and services for industrial production. The core function of government includes the general functions such as policy formulation and resource allocation. Other functions include that of implementation (financing, performance, human resource development and capability-building). These functions (both policy-related and implementation-related) are carried out by different stakeholders with the particular combination being unique to the country.

Government role in facilitating industrial growth is important to industry in all forms. This help in providing basic infrastructure to enable firms to adhere to international standards, building accredited control laboratories that support firms in the agro-processing industry, formulation of policies to promote technological transfer to the domestic economy. "This has been affirmed to foster entrepreneurship in Georgia" (Kuriakose, 2013).

2.6. Foreign Firms and Local Supplier of Technologies

Industry generally engaged stakeholder's in project execution in order to build institutional knowledge and capability. This can be achieved through the use of laboratory facilities, staff internship, licensing of local supplier held patents, training, workshops and conferences. It can also be achieved through industrial involvement in joint

research with trained personnel to help industry build strong relationships and develop global and local solutions to common sustainability challenges. Foreign corporate and local supplier's existence facilitate the production of positive result in the host developing economy technology transfers as the most important channel through which many firms assist local suppliers in purchasing raw materials and intermediate goods in modernising or upgrading production facilities. MNEs generally are found to provide technical assistance, training and other information to raise the quality of the suppliers' products (OECD, 2002).

3. METHODOLOGY

The study was carried out in rice processing firms that engage in parboiling and processing operations in all the rice producing states across four of the six geopolitical zones in Nigeria. The zones were selected because they have good cluster of rice processing firms that can contribute to the national rice production in Nigeria (Ezedinwa, 2005). Eight (8) states were purposively selected from four geo-political zones in Nigeria. The states consist of Lagos (South West), Edo and Cross-River (South South), Benue, Kwara and Nasarawa (North Central) and Ebonyi and Enugu (South East). These states were chosen because the states formed about 75% of the share of the national rice producing areas in Nigeria (Wudiri, 1990; Ezedinwa, 2005).

The population of the study consists of all rice processing firms in the selected geopolitical zone in Nigeria. There are forty five (45) existing rice processing firms in the study area. The industries cut across fourteen (14) Integrated and thirty-one (31) medium and small-scale mills; totalling forty-five (45) firms for the study. However, thirty-five (35) firms were found functional and were used for the study. The industries are mainly government and privately-owned rice processing firms.

A structured questionnaire was administered on thirty-five (35) rice processing firms in the study area. The questionnaire elicited information on both the level and extent of interaction that exists between rice processing firms and other stakeholders involved in rice processing operations using variables such as interactions with universities and research institutes, Government agencies, suppliers of tools and equipment, banks and foreign firms. Others variables used to investigate the extent of interactions with these stakeholders were the use of staff, student, workshops/conference and laboratories for rice processing operations etc. The questions were coded on a four-point rating scale; ranging from Not at all (1) Low (2) Medium (3) to High (4). Data were collected using both primary and secondary sources. Primary data were obtained using questionnaire, interview schedule as well as personal observations while secondary data were collected from journals, business directories, internet, as well as published and unpublished research works. Data were also retrieved from Federal Ministry of Agriculture and Rural Development (FMARD).

The data collected were analysed using frequency and percentage. Mean rating was used for the analysis of technological innovativeness of the firms as well as the existing relationship between the firms and other actors in the industry. Statistical Package for Social Sciences (SPSS) 20 edition was used for the statistical analysis.

4. RESULTS AND DISCUSSION

Table 1 presents the analyses of the level of innovativeness of rice processing industry in Nigeria. The Table shows that majority (71.4%) of the respondents had technological innovation which involved introduction and improvement of existing product in the past three years (2014-2016) and 45.7% of them had technological innovation involving introduction of a new process and improvement of the existing process of rice processing method in the past three years (2014-2016). The table further shows that, more than two thirds (82.9%) of the firms carried out the technological innovation and developed technology capabilities mainly by the firms while 17.1% of the firms carried out technological innovations in partnership with other companies and institutions. The table finally shows that 65.7% of the technological innovations originated mainly in Nigeria, 31.4% were imported technologies while 2.9% were sourced jointly in Nigeria and abroad. This indicates that rice processing firms in

Nigeria have the potentials (knowledge and skills) needed to find new ways of carrying out the firm's activities, if properly harmonized.

The results are indications of the fact that technological innovation activities are taking place in the firms. The work of Sobanke *et al.* (2014) shows that innovation capability is necessary for the successful development of new or improved processes, products or equipment and has the ability to make minor improvement and modifications to existing technologies and to create new technologies. García-Muiña and Navas-López (2007) also recognizes technological capability as the tool for creating value in any given environment with the ability to jointly mobilize different scientific and technical resources which enables a firm to successfully develop its innovative products or productive processes.

Table-1. Results of the technological innovation carried out by rice processing firms

Innovation is carried out	Classification	Frequency	Percent
My firm introduced new product or improved on the existing product in the last three years	Yes	25	71.4
	No	10	28.6
My firm introduced new process or improved on the existing process in the last three years	Yes	16	45.7
	No	19	54.3
Innovation is carried out	Mainly by your firm	29	82.9
	partnership with other companies	6	17.1
Source of technological innovations in the firm	Nigeria	23	65.7
	Abroad	11	31.4
	Jointly in Nigeria and abroad	1	2.9
	Total	**35**	**100.0**

Field survey (2016)

Table 2 shows the level of interaction that exists between the firms and other actors in the industry. The results revealed that the firms have low level of interactions with majority of the actors involved in rice processing industry. As indicated in Table 2, out of the five actors identified, the firms only had fair (mean = 2.91) level of interaction with the banking sector. The mean rating of the interactions of the firms with those of the local suppliers of equipment, universities/research institutes and foreign firms were 2.57, 2.49 and 2.09 respectively. While interaction between the firms and government was rated relatively low (mean = 1.86).

The findings indicate that there is a weak linkage capability in the industry. This can affect the contribution of all these actors and in return hinder the technological capability output of the firms. Findings of Sobanke *et al.* (2012) and Oluwale *et al.* (2013) have registered low level of interactions between Nigeria firms and their stakeholders, especially, metal fabricating industry and auto mechanic industry in Nigeria. The results reaffirmed Shapira *et al.* (1992) and Oluwale *et al.* (2013) views that technological capability of a firm can be improved through a variety of sources including private vendors, public technology centres, government laboratories, universities and suppliers of technologies. Bell and Pavitt (1995); Ogbimi (2007) supported the findings that technological capability of an industry requires knowledge and skills derived through these stakeholders to improve and create technology. Oluwale *et al.* (2013) also buttressed that learning mechanisms available to firms determine the extent to which they augment their endowments of production and investment capabilities over time. Linkage capability can be seen as a strong determinant for efficient creation of product through transformation of resource. It has helped in transmitting information, skills and technology about the market, technologies, technical knowledge and other facilities (Olamade, 2001). Thus, rice processing stakeholders serve as mechanisms for the firms to enhance their production capabilities over time. The firms may therefore not be able to meet up with the consumers' expectation if they fail to strengthen their level of linkage capability with other actors involved in rice processing operation.

Table-2. Results of the level of firm interaction with the stakeholders

Stakeholders	Not at all F (%)	Low F(%)	Medium F (%)	High F(%)	Mean
Banks	3(8.6)	18(51.4)	5(14.3)	9(25.7)	2.91
Local supplier of rice processing equipment	11(31.4)	7(20.0)	6(17.1)	11(31.4)	2.57
Universities/Research Institutes (URI)	11(31.4)	10(28.6)	5(14.3)	9(25.7)	2.49
Foreign firms	21(60.0)	5(14.3)	2(5.7)	7(20.0)	2.09
Government	1(2.9)	14(40.0)	7(20.0)	13(37.1)	1.86

Legend: Not at all = 1, Low = 2, Medium = 3, High = 4

Table 3 further shows the extent of interactions that exist between rice processing firms and universities/ research institutes (URI). Various indicators were used to measure these interactions as shown in Table 3. The result shows that licensing of URI held patents is fairly (mean = 2.37) recorded regarding the interaction between firm and universities/research institutes. Other indicators that had low record include attendance of training program, workshops and conferences (mean = 1.97), joint research between the rice milling firms and URI academics (mean = 1.89), university student internship (mean = 1.80), use of university/ research institutes (URI) laboratory facilities (mean = 1.74) and engagement of academic staff in project (mean = 1.74).

As shown in Table 4, top among the area of interaction between firm and local supplier of rice processing equipment were on the use of their laboratory facilities (mean = 2.46), local suppliers' staff internship (mean = 2.26), licensing of local supplier held patents (mean = 2.14) , attendance of training program, workshops and conferences (mean = 2.09), joint research between a firm and local suppliers of field equipment (mean = 1.97), and engagement of local suppliers' staff in project/ consultancy (mean = 1.74).

Table 5 shows that the interaction between firm and Nigerian banks were mostly observed in the areas of invoice discounting to get product/service from third parties (mean = 2.17), project financing credit from commercial banks (mean = 2.06), level of interest rate concessions for local rice processing and milling firms (mean = 2.03), while the mean rating for each of bank guarantee from commercial banks and overdraft facilities to meet daily activities from banks is 1.74.

Table-3. Results of the extent of interactions that exists between firms and   universities/research institutes (URI)

S/N	Indicators	Not at all F(%)	Low F(%)	Medium F(%)	High F(%)	Mean
i	Licensing of URI held patents	20(57.1)	9(25.7)	1(2.9)	5(14.3)	2.37
ii	Attendance of training program, workshops and conferences	11(31.4)	10(28.6)	4(11.4)	10(28.6)	1.97
iii	Joint research with the URI academics	15(42.9)	10(28.6)	6(17.1)	4(11.4)	1.89
iv	University student internship	18(51.4)	11(31.4)	3(8.6)	3(8.6)	1.80
V	Use of laboratory facilities	16(45.7)	7(20.0)	5(14.3)	7(20.0)	1.74
vi	Engagement of academic staff in project and consultancy	16(45.7)	14(40.0)	1(.2.9)	4(11.4)	1.74

Legend: Not at all = 1, Low = 2, Medium = 3, High = 4

Table-4. Results of the extent of interactions that exists between firm and local supplier of rice processing technologies

S/N	Indicators	Not at all F(%)	Low F(%)	Medium F(%)	High F(%)	Mean
i	Use of laboratory facilities	17(48.6)	9(25.7)	5(25.7)	4(11.4)	2.46
ii	Staff internship	11(31.4)	7(20.0)	7(20.0)	10(28.6)	2.26
iii	Licensing of local supplier held patents	20(57.1)	8(22.9)	3(8.6)	4(11.4)	2.14
iv	Joint training program, workshops and conferences	11(31.4)	13(37.1)	6(17.1)	5(14.3)	2.09
v	Joint research with local suppliers of equipment	14(40.0)	8(22.9)	9(25.7)	4(11.4)	1.97
vi	Collaboration in project and consultancy	14(40.0)	7(20.0)	5(14.3)	9(25.7)	1.74

Legend: Not at all = 1, Low = 2, Medium = 3, High = 4

Table-5. Results of the extent of interactions that exists between firm and banks

S/N	Indicators	Not at all F(%)	Low F(%)	Medium F(%)	High F(%)	Mean
i	Invoice discounting to get service from third parties	17(48.6)	11(31.4)	6(17.1)	1(2.9)	2.17
ii	Project financing credit from commercial banks	11(31.4)	15(42.9)	8(22.9)	1(2.9)	2.06
iii	interest rate concessions for local rice processing firms	9(25.7)	15(42.9)	7(20.0)	4(11.4)	2.03
iv	Bank guarantee from commercial banks	11(31.4)	13(37.1)	9(25.7)	2(5.7)	1.74
v	Overdraft facilities to meet daily activities from banks	16(45.7)	13(37.1)	5(14.3)	1(2.9)	1.74

Legend: Not at all = 1, Low = 2, Medium = 3, High = 4

Table 6 shows that government policy specifically directed to assist rice processing within Nigeria was the most (mean = 2.60) reported interaction between firm and Nigerian government. Other indicators used to measure the extent of interactions include "Nigerian government's effort in training and developing people are commensurate with the laudable local rice production initiative" (mean = 2.49), "getting financial support from government in the area of technological innovation to develop rice production" (mean = 2.11) and lastly "level of awareness of any research and development that Nigerian government fund in order to develop expertise in rice processing, milling and production" (mean = 1.77). In all, the extent of interactions that exist between rice processing firms and government is low. The government's role in facilitating industrial growth is very important to industry in all forms. This helps in providing basic facilities to enable firms conform to international standard. Peng and Luo (2000) in their work, agreed that there is a pervasive influence of government in supporting industry that is strongly collaborated and connected with these stakeholders. Kuriakose (2013) also mentioned that parts of government responsibility include building accredited control laboratories, formulation of policies, and recruitment and training of man power to support firms in agro-processing industry. Table 7 presents the results of the extent of interactions that exists between local firms and foreign firms. On the table, "knowledge obtained from foreign suppliers of equipment" was rated highest with a mean of 1.94; following this is "interaction with foreign firms to operate and continually maintain the equipment supplied" with a mean of 1.86 and "interaction with foreign firms to supply and set up equipment in Nigeria" which has a mean of 1.77. These results indicate that the extent of interaction between local rice processing firms and foreign firms are very low and there is need for these firms to relate well with foreign firms to enhance rice processing operations in Nigeria. In summary, the results shows that there is weak linkage capabilities between rice processing firms and other institutions involved in rice processing activities. This indicates that there is weak linkage among the firms and other stakeholders such as local suppliers of technologies, universities, research institutes, banks, government and foreign firms. Oluwale et al. (2013); Oyewale (2003); Biggs and Shah (2006) have observed that Nigerian enterprises is lacking in linkage capabilities with other institutions. Linkage capability forms the basis for interaction among these stakeholders. It can evolve through the relationship among rice processing firms and stakeholders involved in rice processing operations. Egbetokun (2009) submitted that the interactions with local and foreign competitors, government, and domestic and international institutions are determinants for firms development. Kim (1997) believed that absence of joint projects with various types of stakeholders will prevent firms from achieving new sources of technical information which are crucial to the development of technological innovation capability of firms. Antonio and Marcelo (2016) findings also revealed a weak linkage capability between manufacturing firms and other stakeholders and he concluded that the interactions with the various stakeholders represent one of the most important learning and innovation efforts for industrial development and competitiveness. Without adequate linkage with these stakeholders, rice processing industry may not be able to raise output above domestic consumption in Nigeria. The implication of the result is that, strong linkage between various stakeholders along the rice value added stage can greatly improve the performance of rice processing sector and if the firms will achieve growth and improvement on

the state of its technological innovation capability, the sub-sector must ensure that necessary action is taken to collaborate with these stakeholders. Otherwise, the effort of Nigerian rice processing stakeholders to attain optimum production capacity in the country may be hindered.

Table-6. Results of the extent of interactions that exists between firm and Nigerian government

S/N	Indicators	Not at all F(%)	Low F(%)	Medium F(%)	High F(%)	Mean
I	Government policy to assist rice processing industry	3(8.6)	17(48.6)	10(28.6)	5(14.3)	2.60
Ii	Government effort in training and developing local rice initiative	9(25.7)	15(42.9)	7(20.0)	4(11.4)	2.49
iii	Government support on technological innovation	17(48.6)	11(31.4)	6(17.1)	1(2.9)	2.11
Iv	R&D fund to develop expertise in rice processing	3(8.6)	15(42.9)	10(28.6)	7(20.0)	1.77

Legend: Not at all = 1, Low = 2, Medium = 3, High = 4

Table-7. Results of the extent of interactions that exists between firm and foreign firms

S/N	Indicators	Not at all F(%)	Low F(%)	Medium F(%)	High F(%)	Mean
I	Knowledge obtained from suppliers of equipment	19(54.3)	6(17.1)	3(8.6)	7(20.0)	1.94
ii	Interaction with foreign firms to operate and continually maintain the equipment	22(62.9)	3(8.6)	3(8.6)	7(20.0)	1.86
iii	Training of staff by foreign firms on processing	20(57.1)	5(14.3)	5(14.3)	5(14.3)	1.86
iv	Supply and set up the equipment in Nigeria	24(68.6)	2(5.7)	2(5.7)	7(20.0)	1.77

Legend: Not at all = 1, Low = 2, Medium = 3, High = 4

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

The study examined the state of technological innovations in rice processing industry in Nigeria and it investigated the level of interaction that exists among the rice processors and other stakeholders. The study revealed that majority (71.4%) of the firms had technological innovations which involve introduction and improvement of existing products in the past three years and 45.7% of the firms had technological innovations involving introduction of a new process and improvement of the existing process of rice processing method in the last three years. More than two thirds 82.9% of the respondents admitted that the introduction of the new technological innovation was mainly done by the firms and originated mainly in Nigeria. The results revealed that the firms had low level of interactions with other stakeholders involved in rice processing. The firms had relatively fair level of interaction with the banking sector, local supplier of equipment, universities/research institutes and foreign firms. While interaction with government was very low. This indicates a weak linkage capability in the Industry.

5.2. Conclusions

The state of technological capability in rice processing industry in Nigeria is relatively innovative which reflects in the output (product and processing innovation) of the firms. The development of external links has a worse evaluation. Interaction and cooperation relations with other stakeholders are still very weak, limiting the acquisition of external knowledge, tacit knowledge, considered essential for the creation of technological competence. The firms are performing poorly in terms of interactions with other stakeholders which calls for urgent intervention by the institutions and government. There are weak interactions with local supplier of technologies, universities, research institutes and foreign firms; while interaction with government is very low.

5.3. Recommendations

Based on the results of this study, the following recommendations are provided:

1. The industry should strive to collaborate with the available stakeholders (URI, Government, Foreign firms etc) in the country. This may serve as a supportive measure in acquiring the needed technologies for rice processing operations in the country.

2. The industry should endeavour to design programmes for staff training in order to manage new technologies and to achieve the objectives of the firms. This will make the firms competitive.

5.4. Significant Contribution of the Study

Studies have shown that the output of rice processing industry in Nigeria is insufficient as such, imported have to make-up for the short fall in the demand of rice. It was also established that actors of industry play prominent roles involving industrial development, technological innovation capability enhancement and improved firms overall performance. Hence, the study therefore has contributed to the existing literature by providing information on the state of technological innovation of rice processing firms and the level of the existing interaction between the firms and actors involved in rice processing operations in Nigeria. This could help to boost the level of technological innovation through collaboration with these actors.

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