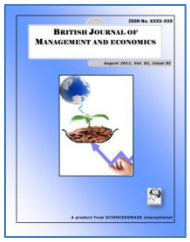

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Strategies for Enhancing Rice Innovation System in Southeast Nigeria

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ABSTRACT

This study examines strategies for enhancing rice innovation system in Southeast Nigeria. Four hundred and ninety six (496) purposively selected actors in rice innovation system were used. Information was collected using questionnaire and interview schedule for illiterate farmers. The data analysis was done using mean statistics. Findings indicated that farmers perceived nursery preparation (2.9), fertilizer/agro-chemical application (2.9), harvesting (2.8), planting (2.7), threshing/winnowing/drying (2.7) and others as the most important production activities performed in rice production. Individual actors vary in their perception of strategies for enhancing rice innovation system. The researchers, policy institutions, marketers and consumers indicated that ban on rice imports, establishment of destoner and mills, and promotion of NGO involvement, set pre-season prices, subsidy on fertilizer, intensifying research and promotion of active extension were perceived as effective strategies for enhancing rice innovation system. The findings point to the fact that enhancing rice innovation system should be a result of interaction of mix of variables and subsequently multiple actors. Also the pivot roles of policy and infrastructure environment are implied. Therefore the study recommends that policies be enacted to stimulate innovative culture in the system, influence the infrastructure /investment environment. Intervention and policy should target building capability of the actors particularly the productive sector (farmers) in critical production activities. In conclusion, strategies for enhancing rice innovation system should be holistic and focused on existing strength, weakness, threat and opportunity in the system.

Keywords: Rice production; strategies; rice; innovation system; actors.

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1. INTRODUCTION

Rice according to WARDA (2004) has established itself as a preferred staple in Nigeria. According to Daramola (2005), Nigeria is the highest rice producer in West Africa, producing an average of 3.2 million tons of paddy and 2 million tons of milled rice. It is also the largest consuming nation in West Africa, with the growing demand amounting to 4.1 million tons in 2002 and only about half of that demand met by domestic production (United state Department of Agriculture and foreign Agricultural services (USDA FAS , 2003). Production rose from 2.4 million metric tons in 1994 to 3.1 million metric tons in 2002, representing 29.2 percent rise in domestic rice production. This is below average Nigerian rice consumption of 24.8 kilogram of rice per year, accounting 9 percent of caloric intake (IRRI, 2001). Apparently the rise in domestic demand/consumption of rice exceeds local production precipitating an increase in rice importation bill to as high as 160 million US dollar in 2003 (FAO, 2003). Consequently, emphasis by government and all stakeholders have been on ways to improve domestic production of rice to meet the increasing demand.

The above is attributed to myriad of intervening variables in the rice industry required to stem the trend of over reliance on importation; to satisfy the increased demand and to bridge the gap in rice production system. According to Emodi and Madukwe (2008), natural phenomenon such as low temperature, water scarcity, biotic losses etc, as well as poor infrastructure, farm management significantly constraint rice production.

Above all, rice production and innovation in many developing countries has largely focused on attaining food security and alleviating poverty, by enhancing crop yields for farmers and improving food availability for consumers with limited market access or purchasing power. Investments in science and technology have featured prominently and consistently in most strategies to promote sustainable agricultural development at the national levels, irrespective of the rapidly changing agricultural context. It is now widely recognized that the value of traditional pattern of agricultural science and technology investments such as research and extension, though necessary is not sufficient to enable agricultural innovation. No doubt, investment in science and technology may increase knowledge, but they are not enough to stimulate high innovative stride/ culture in the whole process. Also changes in agricultural development context which calls for the need for innovation in the agricultural sector are apparent (Bharghonti et al., 2004).

Emerging paradigm to sustainable development, however builds on the concept of innovation as a social process which occurs in a social system referred to as innovation system; involving not only scientific research and research organizations, but also other bodies and non-research tasks. By definition it is a system of all major social actors, affecting the revealing, acknowledgement, generation and diffusion of technical and institutional knowledge over time (Clark, et al., 2003; Hall et al., 2001). Walts et al. (2003) further opined that innovation system also include the interactive learning that occurs when organizations engage in generation, diffusion, adaptation and use of new knowledge; and institution (norms, rules) that govern how this interaction and processes occur. Invariably, rice innovation system comprised a network of economic actors- namely research, education, credit, information, government, public extension, private sectors, NGOs, processors, marketers, input providers and transporters that engage in generation, adaptation, diffusion, and use of technical and institutional knowledge over time; the interaction that exist for knowledge generation and use and the policy environment/infrastructure influencing the interaction. In other words, production of rice takes place along the entire commodity chain and according to Erenstein et al. (2003) different

actors are involved in each step of production. However, the innovative strength of the whole process is a function of interaction, linkages, alliance and knowledge flow. Janssen and Braunschweig (2003) rightly pointed out that technical change and innovation have become much more interactive processes, which can be led by many different types of actors.

Innovations are therefore not solely the product of organized research and development activities undertaken within universities, research and development institutes; and it should not be assumed that the results of formal research or increased investments in research and development in science and technology infrastructure will automatically spur innovation or be put into economic use. It is the enabling environment that encourages continuous learning, creativity and knowledge flows which facilitates innovation for socio-economic development (Mytelka, 2000). Innovation system as a network of organization, enterprise, and individuals focused on bringing new products, new processes and new forms of organizations into social and economic use, together with the institutions and policy that affect their behaviour and performance (World Bank, 2006). Therefore rice innovation system embraces the totality of the component actors, and their interaction and the policy environment. It tends to go beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in useful ways. Innovative performance depends not only on how the individual actors perform in isolation, but also on how they interact with each other as element of a collective system of knowledge creation and use.

In essence innovation in rice commodity chain required for enhanced production demands that institution including the policy and legislative framework and nature of human capital, physical infrastructure, finance, and investment climate and system of facilitating information and knowledge flow among the actors and institution be sufficiently addressed. If the macro processes and sub processes that govern the dynamics are well characterized, their successful operation contributes to achieve the overall objectives. Investing or innovating in isolation which sadly characterized most sectoral innovation systems including rice innovation system is the bane of development efforts and remains a formidable challenge to entire system of research and development. Many relevant actors are not productive and in extreme cases may have ceased to provide any innovative output. Hence identifying strategies to boast the operation and performance of all the component actors is apt.

The widely agreed potential for rice production in Nigeria is highly concentrated in the south eastern geo-political zone. The states provide diverse ecological conditions for rice production. According to USDA/FAS (2003) rice production is wide spread in the country, extending from the northern to southern zones with most rice growth in the eastern and middle belt of the country. Moreover, the technological capability in terms of the number of research institutes, education, infrastructure (rice mills and markets) are relatively concentrated in the zone. Consequently, much rice production activities, researches, infrastructural developments and interventions exist in south eastern states. As discussed earlier, the operations of the actors remain compartmentalized and isolated with little or no policy response to the performance of some actors in the system. Therefore the question is "what strategies should be promoted to evolve efficient and functional system of actors in rice innovation system?

1.1 Purpose of the Study

The study therefore sought to examine actors' perception on the strategies that are essential for enhancing rice innovation system. Specifically, it aimed to:

1) ascertain production activities important for enhancing rice production in southeast Nigeria;
2) identify strategies for enhancing rice innovation system in southeast Nigeria.

2. METHODOLOGY

The area of the study is made up of the four states in the rice cultivation belt in southeast Nigeria (Abia, Anambra, Ebonyi and Enugu). The Southeast Nigeria is situated east of River Niger and covering an area of 29,908 square kilometres with a population of about 16,381,729 (National Population Commission (NPC, 2006) and lying on latitude 5^0 and 7^0 75´ North and longitude 6^0 85´ and 8^0 46´ East. The Southeast Nigeria is one of the six geo-political zones in Nigeria (North-West, North-East, North-Central, South-West, South-East and South-South) and it comprises of five states namely: Abia, Anambra, Ebonyi, Enugu and Imo States. Nigeria encompasses nine major agro-ecological zones; Sahel Savannah, Sudan Savannah, Guinea Savannah, Jos plateau, Montane Region, Derived Savannah, Lowland Rain Forest, Freshwater Swamp, Mangrove Forest, and Coastal Vegetation (Nigeria Forest Resources (NFR, 1998). The study was purposively carried out in four states-Abia, Anambra, Ebonyi and Enugu States of southeasten Nigeria. This is because of the potential and actual involvement in rice production and its geographical spread of research activities on rice production.

The study population constituted all actors in rice innovation system in the four states (Abia, Anambra, Ebonyi and Enugu) of southeast of Nigeria. The actors (market/demand, enterprise, research and training, diffusion and infrastructure) were classified according to their related activities as follows: research agencies, policy agencies, technology transfer agencies, farmers, marketers and consumers. Six research institutes/agencies, three policy agencies, one technology transfer agencies, marketers and consumers in the capital cities, and ADP rice farmers were purposively selected, This was based on their perceived involvement in rice innovation system.

Forty researchers were purposively selected from the six agencies as follows: National Cereals Research Institute (NCRI) (9), International Institute for Tropical Agriculture (IITA) (7), West Africa Rice Development Association (WARDA) (6), Plant Quarantine Service (PQS) (7), International Network for the Generic Evaluation of Rice (INGER- AFRICA) (6) and National centre for Agricultural Mechanization (NCAM) (5).

From seven policy agencies in southeast, three agencies were purposively selected as follows: Federal Ministry of Agriculture (FMA), the National Agency for Food and Drug Administrations and Control (NAFDAC), the Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB). Thirty six administrative and technical staff from FMA, nine from each of the four states; 20 NAFDAC staff, five from each state, and 20 NACRDB workers, five from each state was purposively selected.

Similarly, for technology transfer agencies, ADPs in the states were purposively selected because it is the main public agency with government mandate for extension service. In each state ADP (Abia, Anambra, Ebonyi and Enugu) project manager (1) directors of extension (1), technical services, planning, monitoring and evaluation, three zonal extension officers (ZEO), five subject matter specialists (SMS) and ten block extension supervisors were purposively selected. A total of 88 ADPs respondents were used. One hundred and ninety six farmers were randomly and proportionately selected from the list of farmers accessed in the state ADPs.

Fifteen marketers were purposively selected from the biggest markets in each of the states capitals, giving a total of 60 respondents. In the same vein, twenty consumers (heads of households) were purposively selected from each of the states' capitals and a total of 80 respondents were selected.

Overall, a total sample size of 539 was used. Questionnaire and structured interview schedule (for illiterate farmers) were used for data collection. Trained research assistants helped in the administration of the questionnaire and conducting interview for the illiterate farmers. Four hundred and ninety six (496) questionnaires/interview schedules were retrieved properly completed, and used for analysis.

To ascertain important production activities, farmer respondents were asked to indicate the extent to which 16 production activities were perceived as important for improving rice production on a four point Likert type scale of "very great extent (4) great extent (3), little extent (2) and very little extent (1)". To address objective on strategies for enhancing rice innovation system, respondents indicated the extent to which the listed items could be effective for enhancing rice innovation system using four point Likert type scale of" very effective (4), effective (3), less effective (2) and not effective (1). Mean score was used for data analysis. Responses on the four – point Likert-type scales were later categorized according to the mean scores using the methodology of Anyanwu et al. (2000). Variables with mean scores of 2.5 and above were considered important production activities or effective strategies as the case may be in rice production, while those with mean scores of below 2.5 were regarded less important or less effective for enhancing rice innovation system.

3. RESULTS AND DISCUSSION

3.1 Important Production Activities for Enhancing Rice Production

Data on Table 1 show that 7 items out of the 15 investigated were perceived by farmers as important for improving rice production. These include: nursery preparation (M=2.9), fertilizer/agro-chemical application (M=2.9), planting (M=2.8), harvesting (2.8), threshing, winnowing and drying (M=2.7), pest and disease control (M=2.6), weeding (M=2.5), and storage (M=2.6). Other variables of less important to rice production were land acquisition (M =2.4), land clearing (M=2.4), land stumping (M=2.3), marketing (M= 2.3) ridge/mound making (M=2.1) and water management (M=2.0). The activities are the major determinants of production performance. For instance, uncontrolled weeds' in rice has been estimated to cause as much as 80-100% losses in upland ecologies and 46-84% for lowland ecologies in Nigeria (Akobundu et al., 1986). Also input supplies are not only erratic, but sometimes adulterated and very expensive. Rice farmers need skill, knowledge, access to relevant inputs and information on sustainable ways of carrying out the above functions in order to reduce cost and maximize profit. Nursery preparation though was rated very high compared to other variables, probably because it marks the beginning of success story in production. However, production is a function of the interaction of several factors. Although water management, land clearing, stumping, and marketing were rated less important, neglect of their pivot role in production chain could impair expected yield.

Table 1: Mean scores on perceived important production activities for improving rice production among farmers

Production activities	Farmers	
	Mean (M)	SD
Land acquisition	2.4	0.7
Land clearing	2.4	0.7
Land Stumping	2.3	0.7
Ridge/Mound making	2.1	0.8
Nursery preparation	2.9	0.5
Planting	2.7	0.7
Pest and disease control	2.6	0.5
Weeding	2.5	0.8
Water management	2.0	0.8
Fertilizer/agro-chemical application	2.3	0.7
Trapping rodents/making scarecrows	2.3	0.9
Harvesting	2.8	0.4
Threshing/winnowing/drying	2.7	0.5
Storage	2.6	0.6
Marketing	2.3	0.7

Source: Field survey, 2010

3.2 Strategies for Enhancing Rice Innovation System

Table 2 show that researchers agreed to the strategies of ban on rice imports (M=4.0), establishing destoner mills (M=4.0), subsidy on fertilizer (M=4.0), intensifying research (M=4.0) set pre-season prices (M=3.8), active extension (M=3.2).and promotion of NGO involvement (M=3.2) as effective efforts towards enhancing rice innovation system.

Similarly, policy personnel expressed that effective strategies for enhancing rice innovation system were ban on rice import (M=2.9), establishing destoner mills (M=3.2), promotion of NGO involvement (M=2.8), set pre-season prices (M=2.8), subsidy on fertilizer (M=3.6) and promotion of active extension (M=3.6).

Technology transfer agencies, however rated effective establishing destoner mills (M=4.0), subsidy on fertilizer (M= 3.7), intensifying research (M=3.7) and promotion of active extension (M=3.7) promotion of NGO involvement ($\overline{X}$ =3.00), set pre-season prices (M=3.3). The agencies perceived ban on rice imports (M=2.2) as less effective strategy for enhancing rice innovation system.

Also farmers rated the followings as effective strategies for enhancing rice innovation system: intensifying research (M=3.8), subsidy on fertilizer (M= 3.6), and promotion of active extension (M=3.6), establishing destoner mills (M=3.6), promotion of NGO involvement (M=3.4), set pre-season prices (M=3.1), and ban on rice imports (M=3.1)

Data in Table 2 show that marketers perceived ban on rice imports (M=3.8), establishment of destoner mills (M=3.6), promotion of NGO involvement (M=3.8), set pre-season prices (M=3.6), subsidy on fertilizer (M=3.4), intensifying research (M=3.5) and promotion of active extension (M=3.4) as effective strategies for enhancing rice innovation system.

Table 2: Mean scores on the perceived strategies for enhancing rice innovation system

Sl. No.	Strategies	Researchers	Policy personnel	Technology transfer agencies	Farmers	Marketers	Consumers
		Mean M	Mean M	Mean M	Mean M	Mean M	Mean
1	Ban on rice imports	4.00	2.92	2.18	3.13	3.80	3.67
2	Establishment of destoner mills	4.00	3.22	4.00	3.61	3.62	3.46
3	Promotion of NGO involvement	3.18	2.83	3.00	3.41	3.80	3.83
4	Set pre-season prices	3.83	2.82	3.31	3.06	3.55	2.92
5	Subsidy on fertilizer	4.00	3.57	3.66	3.61	3.35	4.00
6	Intensifying research	4.00	3.57	3.66	3.84	3.47	3.64
7	Promotion of active extension	3.18	3.64	3.67	3.61	3.40	3.72

Source: Field survey, 2010

In the same way consumers perceived that subsidy on fertilizer (M=4.0), ban on rice imports (M=3.7), promotion of NGO involvement (M=3.8) and promotion of active extension (M=3.7), intensifying research (M=3.6), establishment of destoner mills (M=3.5) and a set pre-season prices (M=2.9) were effective strategies.

Overall, individual respondents vary in their perception of strategies for enhancing rice innovation system. The researchers, policy institutions, marketers and consumers agreed to all the seven items: ban on rice imports, establishment of destoner mills, and promotion of NGO involvement, set pre-season prices, subsidy on fertilizer, intensifying research and promotion of active extension as strategies for enhancing rice innovation system. The use of ban on rice will undoubtedly increase rice production costs, increase demand for local rice and enhance rice innovation system (Oyejide et al., 2005).

Specifically, researchers perceived four strategies as very effective for enhancing rice innovation system at the same mean rating namely ban on rice imports, establishment of destoner mills, subsidy on fertilizer and intensifying research, while Policy institutions rated promotion of active extension as the effective strategy in rice innovation system. It is recognized that a policy which provides adequate trained and well-equipped technology transfer agencies has the potential to disseminate information on improved rice technology is very vital in rice innovation system (Erenstein et al., 2003).

Technology transfer agencies perceived establishment of destoner mills as effective enhancing strategy in rice innovation system. Longtau (2003) observed that destoner is important in post-harvesting of rice. The investment in destoners is necessary but it would have a real impact only if the quality issue is tackled holistically at the various stages of the commodity chain to establish an enabling rice innovation system through the emergence of a shared concern among stakeholders (Lancon et al., 2003).

The result further showed that the farmers' most perceived effective strategy was intensifying research. Likewise marketers perceived effective enhancing strategies as ban on rice imports and promotion of NGO involvement. Similarly, the findings showed that consumers perceived subsidy on fertilizer as very effective strategy in rice innovation system. Farmers need adequate amount of fertilizer at the right time to obtain high yields in rice production (Onwuka, 2005). Based on individual respondents, strategies for enhancing rice innovation system could be discussed as follows:

Ban on rice import: Ban on rice import will encourage local rice production; lead to increase in rice production, reduction in foreign exchange expenditure on rice importation, and the country being self sufficient in rice production. Through ban on rice import there will be increase in farmers' rice sale and income earning. Ban on rice imports in 1989 resulted in a rapid increase in rice production, the subsequent relaxation of this ban in recent years without the country achieving self sufficiency in rice production, has led to hardship on rice producers in the country (Fagade, 2001). It is important that governments enact policies to significantly encourage sustainable rice production.

Establishment of destoner mill: There is complete absence of destoners and modern technology of drying and milling of local rice in most developing countries (Basorun, 2010). Hand-threshing on the soil is responsible for the high percentage of stones and foreign matter mixed with rice. Introduction of destoner in rice processing should be a collaborative effort involving all actors particularly policymakers, researchers, technology transfer agencies, farmers (operations), and others in rice innovation system. Certainly this will not

only ensure production of quality produce but more importantly improve market structure of rice.

Promotion of NGOs involvement: NGOs involvement in rice production is crucial as strategy in enhancing performance of rice innovation system. It will entail strong link between the actors, and better coordination, and networking capacity of various NGOs with other actors, ranging from researchers, policy personnel, technology transfer agencies, marketers to consumers. The rationale for NGOs promotion as effective linkage strategy could be to pool resources to more effectively develop research on new technology, building capacity and contributing towards research funding in rice innovation system

Set pre-season prices: Rice innovation system can be promoted through pre-season prices set in rice production, especially among the farmers and marketers. Through set pre-season price, the farmers can easily purchase inputs (seed varieties, fertilizer, and agro-chemical) at the cheapest and stable price available. To cope with fluctuating market prices, there is need to enhance effective pre-season price among the actors in rice innovation system (Bank World, 2006). Without a coordinating body to develop more productive forms of interaction in pre-season prices, rice innovation may well collapse. There is the need for the development of a comprehensive and public price information system in rice innovation system. Langtau (2003) observed that actors in rice innovation system have neither a role in fixing rice prices nor serve as information source on prices. The dissemination of price information may contribute to developing a common base of information for all actors involved in rice innovation system (Akande and Akpokodje, 2003). This suggests the need for regulation of prices of rice inputs and rice produce in rice innovation system.

Subsidy on fertilizer: Fertilizer plays an important role in rice production. Government subsidy on fertilizer, will reduce the risk of farmers use of adulterated and yet very expensive fertilizer in rice production (Langtau, 2003). Also farmers are encouraged to expand production through conversion of marginal lands.

Intensifying research: Research has always been modeled according to western agenda and methods (Fagade, 2001). This has to change in favour of collaborative research with researchers, policy personnel, technology transfer agencies, farmers, marketers, consumers) to stimulate high human resource capability and innovative stride in the system. Effective linkage between actors in rice innovation system through workshops, exchange visits, bulletins and leaflets are the panacea for generation of appropriate technology and utilization by the productive sector. Above all, actors explore advantages of synergy and complimentary; and subsequently, maximize scarce resource use. Different actors are informed of the activities of other actors in rice innovation system.

Promotion of active extension: Active extension system is the key requirement for the dissemination of developed technologies to rice farmers. The transfer of technology model popularly used in the last decade made the farmer only a recipient of technology resulting to supply of inappropriate technology and low adoption by farmers. Extension should be participatory, demand-driven and community- oriented. This calls for enabling environment of favorable policy, sustainable funding, adequate trained personnel and functional linkage among agencies.

4. CONCLUSION

The study indicated that nursery preparation, fertilizer/agrochemical, harvesting, planting, threshing/winnowing/drying and others were the most important production activities for enhancing rice innovation system. Respondents vary in their perception of strategies for enhancing rice innovation system. However researchers, policy institutions, marketers and consumers agreed that ban on rice imports, establishment of destoner mills, and promotion of NGO involvement, set pre-season prices, subsidy on fertilizer, intensifying research and promotion of active extension are effective strategies for enhancing rice innovation system. Enhancing rice innovation system will undoubtedly encourage local rice production; lead to functional system; reduction in foreign exchange expenditure on rice importation, and the country being self sufficient in rice production. However enabling policy environment is an imperative for effective implementation of the strategies and stimulation of the whole innovation process. Intervention and policy should target building capability of the actors particularly the productive sector (farmers) in critical production activities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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