Adoption and the Perceived Impact of Food Crops Technologies along the Value Chain by the Nigerian Farmers

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Introduction

Food crops travel along the food value chain from input supply to consumption. The level of adoption of improved technologies is expected to affect the level of food productivity, rates of post-harvest food losses and food security status of a country. Different types of crop technologies used by farmers and processors need to be identified and certain attributes such as availability, affordability, durability, effectiveness and gender friendliness from the farmers that use them, and the perceived impact of these technologies need to be assessed. This is necessary as valuable traditional methods may be neglected due to the introduction of modern technologies. Besides, it can help to assist the manufacturer on the need to take the users of the technologies into consideration at the stage of designing the technologies. Hence, the significance of this research study to assess the level of awareness, adoption and their perceived impact of some selected food crops (cassava, maize, rice and tomato) farmers along the food value chain (production and processing) in Nigeria. The study distinguishes itself from most previous studies in Nigeria such as: Adewumi *et al.,* (2009); Olayemi *et al.,* (2010); Babalola *et al.,* (2010) and Folayan (2013) that focused mainly on a single crop or on a particular actor along the food value chain or on a specific location. This study adopts a system approach in which producers and processors activities along the value chain are adequately captured for grains and tubers. The geographic scope also extends to the entire country.

Material and Methods

Nature and Sources of Data

Primary data used in the study were obtained mainly from a sample survey. Thus, two sets of structured questionnaires were used. One to elicit information institutions involved in Agricultural Research Systems (NARS) and technologies and the second from farm households who are either involved in production, processing and storage of the selected food crops. The first part of the survey was a cross-sectional survey of the existing production, processing and storage technologies developed and disseminated to farmers by Universities, research institutes and

public as well as private institutions in the six selected states across the geopolitical zones of the federation.

Table 1: Selected States for Farm Household and Technology Use Survey

Geo-political zone	Selected State	Agro-ecological zone
North Central	Benue	Guinea Savannah
North East	Taraba	Guinea Savannah
North West	Sokoto	Sudan Savannah
South East	Ebonyi	Humid Forest
South-South	Cross-river	Mangrove forest
South West	Ogun	Rain Forest and Derived Savannah

Source: Field survey, 2012

The second part of the survey was the cross-sectional household survey, which followed the food value chain analysis approach, in which data production, processing and/or storage of cassava, maize, rice and tomato were collected from the producers and processors. Qualitative and quantitative information were also obtained from relevant government officials and representative of farmers', marketers' and processors' associations in the selected states and Abuja. The selected crops for the study were from the basic food crops that are strategic to meeting the food security objective of the country and the growth enhancement scheme (GES) of the agricultural transformation agenda in Nigeria.

Sampling Procedure

The sampling approach followed a multi-stage sampling procedure. The first stage was the purposive selection of a state in each of the geopolitical zones in Nigeria to ensure equal representation of the entire six geo-political zones, putting into consideration the agro-ecological divisions (Table 1). The second stage was the purposive selection of locations noted for the production of the selected food crops while the third stage involved the selection of 1,800 farm households (300 per selected state) .

Statistical Analysis

The analytical tools employed in this study were both descriptive and inferential statistics. The descriptive statistical tools used were frequency counts, percentages and means, while the inferential statistical tools used include: the analysis of variance and perception index. Farmers were at four different adoption stages. That is "Not aware of", "Aware but never tried", "tried but not yet adopted" and "Adopted". The first three classes make up the non adopters while the last constitute the adopters.

Negative impact was rated (1), normal (2) and positive (3). The score for each impact factor was further used to generate the index. Values greater than the average score (0.5) indicate positive impact while values below 0.5 is rated as having a negative impact on the concerned factor and those of 0.5 indicate that the technology is assessed as normal

Results and Discussion

Evidence from the NARS survey shows that at least 57 cassava, 54 maize, 65 rice, and 11 tomato varieties have been released by the relevant local and international research institutes in Nigeria. Beside these are other technologies (equipment, innovative management practices) for the cultivation and value addition of these crops. Technologies with the highest level of unawareness are D7 Bulldozer for bush clearing (36%), Seed broadcaster (33%), Cassava harvester (57%), Grain harvester (52%), pest scaring devices (39%) for seed maintenance, rotary dryer (44%) for rice and homogenizer (53%) for cassava processing. Tractor pulled implement (31%), Stem cutting for Hybrid Cassava (60%), use of inorganic fertilizers (76%) are the most widely adopted technologies by the respondents. However, the high level of unawareness associated with most of these technologies and the general low level of adoption of the technologies among the respondents suggest inadequate and poor exposure of farmers to improved agricultural technologies. Table 2 reveals a very low adoption index of these technologies in all the selected states. The average adoption index of 0.190 implies that only 19% of the entire technologies are adopted in Nigeria. The results of analysis of variance (ANOVA) to test the difference in technology adoption across the states show that adoption indices are significantly different across the states with the exception of Cross River and Sokoto.

Table 2: Technology Adoption Index by selected States in Nigeria

State	Minimum	Maximum	Mean	Std. Error of Mean
Benue	0.020	0.612	0.153	0.008
Cross River	0.020	0.796	0.176	0.012
Ebonyi	0.020	0.816	0.237	0.009
Ogun	0.020	0.510	0.086	0.006
Sokoto	0.020	0.980	0.193	0.009
Taraba	0.020	0.633	0.272	0.007
Average	**0.020**	**0.980**	**0.190**	**0.004**

Source : Computed from the field Survey data, 2012

Farmers' Assessment and their Perceived Impact of the Available Technologies in Nigeria

The results from the study indicate that all the crop production technologies such as: tractor pulled implement, herbicide, knapsack sprayer, improved seed and inorganic fertilizer are effective (0.74), appropriate (0.81), readily available in the localities (0.70), affordable (0.70), durable (0.80), user friendly (0.74) and gender friendly (0.70) and the farmers also have the requisite skills to use them (0.72). Similarly, the users of the available crop production technologies adjudged them as having positive impact on product quality, farmer's health, the environment and yield. The use of cabinet dryer in cassava processing is not affordable (0.33), durable (0.33), users friendly (0.33) and gender friendly (0.00) with a lot of requisite skill required (0.33). Packaging and washing machines also have similar attributes. All the processing technologies have positive impact on product quality, farmer's health, the environment and yield. Grain processing technologies such as De-stoner are not available (0.43) and not affordable (0.46). Grading machines are likewise not available locally (0.48), not easy to operate as requisite skills are needed (0.48) and not available (0.43). Respondents have similar assessment of both packaging and grading machines. Rice cleaners are not affordable (0.41) and par boilers are not gender friendly (0.43). The available grain processing technologies such as milling, shelling machines, and rice cleaners in the study area except par-boilers have positive impact on product quality, farmer's health, the environment and yield. The only tomato processing technology in use in the country is the grinding machine and the result of its assessment indicates that it is 100% effective, appropriate, available, easy to operate as the requisite skill for operating

3

it is readily available and affordable. The impact assessment of tomato grinding machine reveals it has 100% positive impact on quality (1.00) of the processed tomato, farmer's health (1.00) and yield (1.00) but it has a negative effect on the environment (0.33).

Conclusions and Outlook

The findings of this study revealed very low food crop technologies adoption index in all the states in Nigeria. The major relevant technologies disseminated are 57 cassava, 54 maize, 65 rice, and 11 tomato varieties besides other production and processing equipment. A greater proportion of the respondents are not aware of D7 bulldozer for bush clearing (36%), cassava harvester (57%), homogenizer (53%), cabinet dryer (47%), shelling machine (38%), improved pest scaring devices (39%) and seed broadcaster (33%). All the crop production technologies used by farmers are effective, appropriate, and readily available in the localities, affordable, durable, user and gender friendly, and the farmers also have the requisite skill to use them. However, processing technologies such as cabinet dryer are unaffordable, not durable and not gender or users friendly. Also, packaging machines are not users or gender friendly, washing machine not affordable, durable and gender friendly. Grain processing technologies like De-stoner, grading, and packaging machines in Nigeria are still not locally available and affordable. Parboilers have a negative impact on product quality, farmers' health and the environment. Grinding machine is the only tomato processing machines have positive impact on quality of the processed tomato, health and yield but have a negative effect on the environment. Farmers and marketers use chemicals to store grains but there are no storage technologies for tomato and cassava tuber.

 On the basis of these findings, the following recommendations are suggested:
1. The Nigerian government should improve the adoption of food crop technologies by intensifying their promotional activities;
2. Manufacturers/suppliers of the technologies must involve the users of such technologies at the designing stage for correct specification of devices that will be environmentally friendly improve yield with quality product without affecting the farmers health.

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