

Welfare Implications of Adoption of Post-Harvest Technologies: The Case of Rural Farming Households in Ido Local Government Area of Oyo State, Nigeria

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Abstract

The study assessed the welfare implications of adoption of post-harvest technologies among farming households in Ido Local Government Area of Oyo State, Nigeria. Data were collected with structured questionnaires from one hundred and sixty (160) farmers who were selected through random sampling technique. Descriptive statistics, likert scale and linear regression analysis were used in data analysis. From the findings, the crib, multipurpose dryer, hermetic storage and yam barn were the four major technologies disseminated to farmers. Yam barn ranked first (54%) because it was found to be the easiest to use followed by the multipurpose dryer and cribs. Hermetic storage was not popular because it was not adopted by the farmers. Results on the effect of the NSPRI post-harvest technologies on expenditure (as a proxy for welfare) of farmers showed that the use of cribs increased expenditure by ₦ 49,222, multipurpose dryers by ₦ 27,717 and yam barns by ₦ 10,552 per annum. The contributions of cribs and multipurpose dryers were significant at 1% and 10% respectively. More use of NSPRI technologies, especially cribs and multipurpose dryers, will increase income and consequently the welfare of the farmers positively and significantly.

Keywords: Adoption, Farming households, Post-harvest technologies, Welfare.

Introduction

Non-availability of post-harvest technologies has been a major problem of Nigerian agriculture. This has resulted in colossal waste of agricultural output and hence considerable loss to the economy (Adejumo and Raji, 2007). According to Abba and Atiku (2013), the losses were mainly in maize, rice, sorghum, millet, cowpea, groundnuts, soya beans, yam, cassava, plantain and fruits. In monetary terms, Nigeria loses a total of ₦ 48 billion annually to post-harvest losses (Atibioko *et al.*, 2012). Post-harvest losses therefore tend to prevent adequate supply of and accessibility to fresh agricultural produce thereby causing an increase in the price of such produce (Karim and Hawlader, 2005). Common existing local storage structures in Nigeria are the mud rhombus, thatched rhombus, underground pits, earthen pots

and warehouse storage. Most of these structures have defects and as such, there is the need for some technical improvement on construction materials, elevation and loading/unloading facilities (Adejumo and Raji, 2007). In line with the need to provide the required technical improvement in storage infrastructures, the Nigerian Stored Products Research Institute (NSPRI) introduced some post-harvest technologies. NSPRI is an institute under the Ministry of Agriculture of the Federal Government of Nigeria which is saddled with the responsibility of reducing post-harvest losses in food crops through research and development of appropriate technologies (NSPRI Guide, 2000).

The technologies disseminated to farmers by NSPRI include the hermetic storage (for household storage of grains), maize crib for the storage of maize cobs

(unshelled maize), improved warehouse storage and inert atmosphere storage among others (NSPRI Guide, 2000). Maize is stored in cribs where drying is done by the natural movement of air in the crib while hermetic storage involves the use of air tight containers to store grains. Multipurpose dryer is used for the drying of peeled cassava flakes and yam barn is a rectangular structure made of wood and usually net-roofed to protect the yams stored from sun.

The implementation of efficient post-harvest system in any community must provide equitable benefits to all those involved in the system. In Kwara State, Falola *et al.* (2017) found that the higher the level of yam storage technique used by the farmers, the higher the level of income of such farmers. Also, Ijatuyi *et al.* (2017) found positive significance between the adoption of chemical use in yam storage and the welfare of farmers in Oriire local government area of Oyo State. Elemasho *et al.* (2017) posited that available post-harvest technologies should be made known to all farmers and there is need to increase smallholder farmers' access to effective storage technologies to improve income and food security (Abdoulaye *et al.*, 2015). It is important that post-harvest procedures be given as much attention as production practices. The stages from planting until the product reaches the final consumers must be a mutual undertaking between the farmers and those who will handle the products after harvest as this will promote value addition and higher income thereby improving general welfare (Asfaw *et al.*, 2012).

Farmers' welfare refers to anything that aids or promotes the well-being of the farmer. The indicators of welfare include

consumption levels, access to assets and human capital (Agboola, 2011). Consumption, as a measure of welfare, includes basic food consumption and non-food consumption such as education, housing, health care and so on. Therefore, this study assesses the welfare implications of adoption of post-harvest technologies introduced by NSPRI among farming households in Ido Local Government Area of Oyo State, Nigeria. The specific objectives are to:

- (i) examine the post-harvest technologies disseminated to farmers
- (ii) analyse farmers' perceptions of the use of post-harvest technologies and
- (iii) estimate the effect of adoption of post-harvest technologies on farmers' welfare

Materials and Methods

The study was carried out in Ido Local Government Area of Oyo State, Nigeria where NSPRI had previously disseminated its post-harvest technologies. A random sampling technique was used to select 160 farming households from ten villages in the study area. The selection of farmers was done based on size i.e. respondents were selected based on the population of farmers in each village. The selected villages were Akufo, Onipepeye and Budo Lagun (30 respondents each). Others were Dada, Olowofela, Apooyin, Ogunweide, Olowofela, Oderemi and Alagbaa (10 respondents each). Descriptive statistics was used to examine the post-harvest technologies disseminated to farmers, the perception of farmers about the post-harvest technologies were analysed using the likert scale while multiple regression analysis was

used to estimate the effect of adoption of post-harvest technologies on consumption expenditure (welfare) of the farmers.

Likert Scale

The perception of farmers about the use of post-harvest technologies was assessed in two categories: ease of use and improvement in income. The respondents were to disagree, agree or strongly agree with the statements in the questionnaire. The attached weights to the responses are disagreed = 1, agreed = 2 and strongly agreed=3.

Calculations

The weight of each response category was multiplied by the frequency, summed up and divided by sample size.

$$\text{Likert rating} = \frac{\text{Weight X frequency}}{\text{Number of respondents}}$$

$$= \frac{WF}{N}$$

Where W = Attache weight to each response category.

F = Frequency of the response,

N = Number of respondents.

Decision Rule: Any value greater than or equal to 2 shows that the agreement of the respondents to the statement is statistically significant (Alawode *et al.*, 2015).

Multiple linear regressions

In estimating the effect of adoption of post-harvest technologies on farmers' welfare, multiple linear regression was used:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \dots + b_9X_9 + U$$

Y= Consumption Expenditure (proxy for welfare)

X₁= Maize crib (yes=1. no=0)

X₂=Multi-Purpose drier (yes=1. no=0)

X₃= Yam barn (yes=1. no=0)

X₄= Sex (male=1, female=0)

X₅= Age (years)

X₆= Household size (number)

X₇ = Ownership of farmland (owner = 1, otherwise=0)

X₈= Membership of farmers' group (yes=1, no=0)

X₉= Marital Status (married=1. Otherwise

U = Random error

Results and Discussions

Socio-economic characteristics of the farmers

The socio-economic characteristics of the farmers are presented in Table 1. The mean age of the respondents was 31.5 years (±24.4), 70% were male, 80% were married, the mean household size was 6 people (±4.37), and the mean years of education was 12.5(±5.78), indicating that on the average, the farmers had secondary education. Also, 63% of the respondents were natives, 64% belonged to farmers' groups, and 77% owned farmland, which can help the farmers to get financial or material help for adoption of the technologies. The average farm size of the respondents was 3.44ha, indicating small scale farming.

Table 1: Socio-economic Characteristics of Respondents

Variable	Frequency n=160	Percentage
Age		
31-40	30	19
41-50	60	38
51-60	47	29
>60	23	14
Mean	31.5± (24.4)	
Sex		
Male	112	70
Female	48	30
Marital Status		
Married	128	80
Single	14	9
Widowed	14	9
Divorced	4	2
Household size		
1-5	21	13
6-10	94	59
11-15	35	22
>16	10	6
Mean	6± (4.37)	
Years of Education		
0	10	6
1-6	63	39
7-12	63	39
=13	24	16
Mean	12.5±(5.78)	
Nativity		
Yes	101	63
No	59	37
Membership of farmers' groups		
Yes	102	64
No	58	36
Ownership of farmland		
Yes	128	77
No	32	23
Farm size		
0.5-2.5	90	56
2.51-5.0	70	44
Mean	3.44±(0.71)	

Source: Field Survey, 2016

Post-harvest technologies disseminated to farmers

The post-harvest technologies disseminated to farmers in the rural area by NSPRI include crib, hermetic storage, multipurpose drier, and yam barn. The results on the post-harvest technologies are presented in Table 2. From the results, it was observed that respondents were engaged in using more than one post-harvest technologies. High proportions of the farmers were only aware of multipurpose drier (61%), crib technology (60%) and yam barn (40%) technologies, but just one-tenth (10%) of the farmers were only aware of hermetic storage without adopting them. All the technologies were adopted at different levels except hermetic storage which was not used by the farmers. Also, there was a high level of unawareness (90%) with respect to hermetic storage. Yam barn had the highest level of adoption (54%), followed by cribs (40%), while multipurpose drier had the lowest level of adoption. The results also indicate that hermetic storage method was not popular among the post-harvest technologies introduced to the farmers. On the other hand, method of storage in yam barn was the most popular probably because

majority of the farmers plant tuber crops.

Farmers' perception of the use of post-harvest technologies

The analysis in this section was based on two perception variables; ease of use and economic benefits (improvement in income) of each of the three post-harvest technologies adopted by the farmers. The results are presented in Table 3. The Likert scores were obtained and they were ranked to show their levels of significance. The decision rule is that any Likert score =2 is statistically significant.

From the results in Table 3, all the responses of farmers with respect to the 3 adopted technologies were significant, that is >2 . Nevertheless, on the basis, of ease of use, yam barn ranked first (2.71), followed by multi-purpose drier (2.37), and cribs (2.28). This implies that farmers would likely continue the use of these technologies considering the levels of significance.

On the basis of improvement in income, all the responses, with respect to the 3 technologies, were significant. In the same vein, from results in Table 3, yam barn ranked first (2.74), followed by multi-purpose drier (2.58), and cribs (2.22). This implies that farmers had preference for yam barn post-harvest technology based on the

Table 2: Post-harvest Technology Disseminated to Farmers

Post-harvest technology	Aware		Adopted		Unaware	
	Freq.	%	Freq.	%	Freq.	%
Cribs	96	60	64	40	0	0
Hermetic storage	16	10	0	0	144	90
Multipurpose drier	97	61	38	24	25	15
Yam barn	64	40	86	54	10	6

Source: Field Survey, 2016

*Multiple Responses

perception variables and likert scores. This is in line with the fact that farmers adopted yam barn technology the most (54%) as reflected in Table 2.

Effect of adoption of Post-harvest technologies on farmers' expenditure

Table 4 shows that adoption of crib, multipurpose drier and yam barn post-harvest technologies positively affect farmers' household expenditure. Specifically, adoption of crib significantly increased household expenditure by ₦49,222.35 at 1%. Likewise, adoption of the multipurpose drier technology increased household expenditure by ₦27,717.47 at 10%. However, even though adoption of yam barn technology increased household expenditure by ₦10,552.12, the effect was not significant. The indication from these results is that adoption of the three storage technologies positively affect household expenditure and by implication, the welfare of the farming households.

Also, results show that age, household size, ownership of farmland and membership of farmers' groups had significant effect on farmers' expenditure.

Specifically, one year increase in the age of the farmer significantly reduces the expenditure by ? 1,747 at 10%. On the other hand, an increase in the size of the household by one person significantly increases the farmers' expenditure by ? 10,363 at 1%. Likewise, ownership of farmland and membership of farmers' group significantly increase farmers' expenditure by ? 38,338 and ? 30,100 respectively at 5% level.

Conclusion

From the findings of this study, farmers adopted crib, multipurpose dryer and yam barn technologies and they significantly found the adopted technologies easy to use and income improving. Also, the adoption of these technologies increased the expenditure of the farmers; showing that adoption of the NSPRI technologies are significantly welfare-improving. Even though farmers adopted yam barn technology the most, the use of crib technology improved farmers' welfare more significantly than the multipurpose dryer and yam barn. From the empirical evidence emanating from this study, NSPRI

Table 3: Farmers' Perception of the Use of Post-harvest Technologies

Perception variable	Response options			Mean score	Rank
	Disagreed	Agreed	Strongly agreed		
Ease of use					
Cribs	8	20	36	2.28	3 rd
Multi-purpose dryer	8	8	22	2.37	2 nd
Yam barn	4	17	65	2.71	1 st
Improvement in income					
Cribs	13	24	27	2.22	3 rd
Multipurpose drier	0	16	22	2.58	2 nd
Yam barn	4	14	68	2.74	1 st

Source: Field Survey, 2016

Table 4: OLS Estimates of Effect of Adoption on Expenditure

Variable	Coefficient	p-value
Crib	49222.35*** (13725.93)	0.001
Multipurpose drier	27717.47* (15944.61)	0.085
Yam barn	10552.12 (17623.81)	0.551
Sex	15289.75 (14995.39)	0.311
Age	-1747.52* (911.203)	0.058
Household size	10363.98*** (2101.313)	0.000
Ownership of farmland	38338.98** (16008.97)	0.019
Membership of farmers' group	30100.79** (14378.21)	0.039
Marital status	5152.143 (9734.428)	0.598

Source: Data Analysis, 2016

Figures in parenthesis are the standard errors

***, ** and * implies that variables are significant at 1%, 5% and 10% respectively

technologies contributed positively to welfare of farmers. More farmers should be encouraged to adopt post-harvest technologies promoted under NSPRI and NSPRI officers should be effective in carrying out their extension programmes so as to educate farmers on the effective use of the technologies.

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