

Original Research Article

Competitive African Rice Initiative: perceptions, utilisation and effectiveness of its practise among rice farmers in Kebbi State, Nigeria

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Abstract

Agricultural extension service in Nigeria is largely public sector driven. Unfortunately, the sector is not operating at its maximum largely due to weak institutional structure and poor extension to farmers' ratio. As such, smallholder farmers often suffer low productivity and poor product quality. The study therefore examined the perceptions, utilisation and effectiveness of the Competitive African Rice Initiative (CARI) extension practise in Kebbi State, Nigeria. Multi-stage sampling procedure was used to select 120 rice farmers enrolled under the initiative in the study area. The data collected were analysed using descriptive and inferential statistics. The study revealed that the average age of the respondents was 47.8 ± 1.72 years, 76.7% were male and married (73.1%). The study further revealed that the respondents were smallholder farmers (5.6 ± 7.22 acres). Respondent's perception of CARI was favourable at 72.5% (36 ± 2.8), Rice Advice ($\bar{x} = 1.32$) ranked highest at the CARI tool utilised most, while the deployment of CARI extension practise was effective 65.8% (48 ± 3.4). There was a significant association between marital status ($\chi^2 = 3.242$, $p = 0.023$), utilisation of CARI tools, and effectiveness of CARI in extension practise ($r = 0.206$, $p = 0.001$). The study recommends sustained capacity building for enrollees of the initiative to enhance utilisation and ensure optimum effectiveness.

Keywords: Competitive African Rice Initiative; effective extension service; rice farmers

INTRODUCTION

Nigeria is a prominent rice producer in West Africa accounting for over 40% of the region's total production as of 2014 (Nwobiala and Adesope, 2013). The same author asserted that out of 4.6 million hectares available for rice production, only 1.7 million hectares are put to rice cultivation, which is responsible for a huge importation figure that stood at 11.61 million metric tons since 2000. Between 2005 and 2015, Nigeria's monthly import bill on rice was between ₦148b to ₦917b (Odumade, 2016).

Agriculture is strategic to Nigeria's economy and equivocally responsible for food production. Smallholder farmers dominate the bulk of agricultural production and are responsible for producing food the populace needs. Smallholder farmers constitute up to 80% of the farming population and produce 80%–90% of the food produced in the country (Mgbenka and Mbah, 2016). Rice occupies 10% of the total land under cereal production and it represents 15% of the total cereal production in Sub-Saharan Africa (FAO, 2019). Rice together with maize and wheat provide over 50% of calories consumed worldwide (World Atlas,

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2017). In recent years, demand for rice in Africa has been growing faster than anywhere else in the world, and far outstripping the region's population growth (CARI, 2018). This trend is predicted to continue for years due to population increase, urbanisation, and changes (CARI, 2018). Rice is Nigeria's most popular agricultural commodity, resulting in its emergence as the fastest-growing sub-sector (Cervigni et al. 2013). It can be grown in almost all agroecological zones of the country with proper management conditions.

Rice consumption in Nigeria has increased by 4.7%, which is almost four times the global consumption growth, and reached 6.4 million tonnes in 2017. Given the importance of rice as a staple food in Nigeria, boosting its production has been on the front burner of successive governments with significant progress that reached 3.7 million tonnes in 2017 (Statistics: Rice Production in Nigeria, 2023). Despite this improvement, comparatively, Nigeria's rice statistics suggest there is an enormous potential to raise productivity and increase production. Yields have remained at 2 tonnes per hectare, which is about half of the average achieved in Asia. In addition, as the population increases, along with rural-to-urban migration, ensuring food security in key staples becomes critical (Statistics: Rice Production in Nigeria, 2023). However, the farmers lack knowledge of the latest and sustainable farming methods, improved seeds, agrochemicals such as fertilisers, and practises for protecting crops to meet this production need (CARI, 2018a).

In Nigeria, the Competitive African Rice Initiative (CARI) project was launched in 2013 by the Federal Ministry of Agriculture and Rural Development (FMARD) with support from The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)-MOVE Programme. The project duration was from 2013 to 2020. The project focused on empowering smallholder rice farmers through raising the competitiveness of locally produced rice, thereby increasing their earnings beyond the poverty line. The objectives of the initiative were to: Improve productivity and quality of paddy rice based on sustainable and competitive rice production systems; Increase efficiency of local rice sourcing, processing, and marketing through structured value chain linkages; Improve technology and process management; Improve access to financial services for all value chain actors; and Improved enabling environment at national and regional level including policy framework and strengthening of rice sector initiatives. To increase the yield and raise the quality of locally produced rice by farmers participating in the scheme, CARI ensured the farmers were linked to

appropriate support by providing extension services to them. Extension personnel were engaged to provide Good Agricultural Practises (GAP) coupled with Farmer Business School (FBS) training to farmers, which led to the training of over 99,000 farmers in GAP and about 81,000 took part in FBS (CARI, 2018b).

The Federal Government of Nigeria embarked on the rice transformation agenda to boost Nigeria's rice production between 2011 and 2014 (Federal Ministry of Agriculture and Rural Development, 2016). Similarly, in 2019 under the Commercial Agric Credit Scheme for rice and maize production, Edo state obtained five billion naira from the Central Bank of Nigeria (CBN, 2019). Despite so many successes recorded by successive governments in rice production, several factors still limit rice farmers concerning access to a reliable supply of high-quality local paddy, nutrient management, and good farm practices required to meet the expected output/ yield (Totin et al., 2012). The agenda also aimed to encourage domestic production by providing the enabling environment for the development of a vibrant rice sector that attracts local and foreign investments. Significant resources from both the public and private sectors have been devoted to developing the rice sub-sector in the last decade in most rice-growing states of the federation like Niger, Ebonyi, Cross River, and Kebbi States. Though significant progress was made, the local production still is not sufficient to meet the country's demand. This has made it an important issue that needs to be strategically tackled if the nation must attain its self-sufficiency goal.

As part of the response to these challenges, the CARI extension tool provides advisory services to the farmers, such as Rice Advice and Weed Manager (CARI 2018). The Rice Advice is a free Android-based application providing farm-specific advice on rice management practises. It is designed to provide information to rice farmers on nutrient management and general farm practises for a particular agro-ecology at the farm level. Weed Manager is also a phone application that helps service providers generate advice on weed management for small-scale farmers. Against this backdrop, the study assessed the effectiveness of the Competitive African Rice Initiative extension service among rice farmers in Kebbi State, Nigeria. Specifically, the objectives were to:

- describe the personal characteristics of rice farmers under the CARI
- examine the perceptions of the rice farmers under the CARI
- determine rice farmers' utilisation of the tools deployed by CARI

(d) establish the effectiveness of CARI in extension practise.

Hypotheses of the study

H₀1: There is no significant relationship between the personal characteristics of the rice farmers under CARI and effectiveness of CARI in extension practise.

H₀2: There is no significant relationship between the perceptions of the rice farmers under CARI and effectiveness of CARI in extension practise.

H₀3: There is no significant relationship between rice farmer utilisation of the tools deployed by CARI and effectiveness of CARI in extension practise.

MATERIALS AND METHODS

Kebbi State is in north-western Nigeria and has a land area of 36,800 km² with 21 Local Government Areas (LGAs) (<https://www.kebbistate.gov.ng/>, 2023). It is located within latitude 11.6781 degrees north and longitude 4.0695 degrees east. Agriculture is the main occupation of the people of Kebbi State and it is the largest rice-producing state in Nigeria. The study population comprised all rice farmers who benefitted

from the CARI, the initiative adopted the formation of rice farmers into groups. A multi-stage sampling procedure was used to select respondents for this study. The initial stage involved the purposive selection of 4 Local Government Areas (i.e. Arugungu, Birnin Kebbi, Jega, and Suru) based on reports concerning their responsiveness to CARI. This was followed by a proportionate sampling of 10% of benefitting groups in the selected LGAs, making it 12 groups out of the 120 groups available in the selected LGAs. The last stage involved the use of simple random sampling to select 30% of the beneficiaries from each of the 12 groups, each group comprised an average of 30 members, which gave rise to 360 members as the study population. Thereafter, 33.3% was randomly selected from the population to give a total sample size of 120 respondents interviewed. The hypotheses stated were tested using Chi-square and Pearson Product Moment Correlation (PPMC) tools.

RESULTS AND DISCUSSION

Table 1 reveals that the respondents were young ($\bar{x} = 47.8 \pm 2.62$). This is an indication that the bulk of the farmers enrolled under the CARI initiative are still

Table 1. Personal characteristics of the respondents

Variables	Category	f (%)	Mean ± SD
Age (Years)	<30	29 (24.2)	47.8 ± 1.72
	30–49	61 (50.8)	
	50–59	19 (15.8)	
	60 and above	11 (9.2)	
Sex	Male	92 (76.7)	
	Female	28 (23.3)	
Marital status	Single	23 (19.2)	
	Married	87 (72.5)	
	Widowed	10 (8.3)	
Household size (persons)	1–4	15 (12.5)	8.2 ± 2.62
	5–8	31 (25.8)	
	9–12	29 (24.2)	
	13 and above	45 (37.5)	
Educational attainment	No formal education	20 (16.7)	
	Primary education	47 (39.1)	
	Secondary education	41 (34.2)	
	Tertiary education	12 (10.4)	
Farm size (acres)	1–2	22 (18.3)	5.6 ± 7.22
	3–4	38 (31.7)	
	5–6	36 (30.0)	
	7 and above	24 (20.0)	
Farming experience (Years)	1–4	12 (10.0)	9.4 ± 3.43
	5–8	36 (30.0)	
	9–12	44 (36.7)	
	13 and above	28 (23.3)	

Source: Fiel survey, 2021; SD: Standard Deviation; f: frequency; %: percentage

active and possess the strength needed to cope with the demands of the range of activities associated with rice farming. This can further be used as a proxy to attest to the farmers' mental alertness under the CARI initiative and acknowledge that they will be prone to embrace the technology introduced to them under the initiative. The data establish a preponderance of male rice farmers (76.7%) to females (23.3%). This trend is partly due to the physical demands of its production activities, acknowledging that most of the production activities are human labour-dependent. The majority (72.5%) of the farmers were married, this status can offer the farmers the opportunity to harness productive resources for their activities. Table 1 also reveals that the respondents have a fairly large ($\bar{x} = 8.2 \pm 1.72$) household size; considering present economic indices and family upkeep, however, this household size can be a strong indication of their proneness to deploy family farming as a productive strategy.

Further details in Table 1 reveal that the respondents were literate having attained varying levels of education, 10.4%, 34.2%, and 39.1% representing respondents that have tertiary, secondary, and primary education, respectively. Their level of education can positively influence their decision to adopt the innovation introduced under the CARI initiative and further

enhance its effectiveness. The average farm size cultivated was ($\bar{x} = 5.6 \pm 7.22$ acres). This figure suggests that they are smallholder farmers. This finding is corroborated by CARI (2018) that small-scale farmers produce 90% of the total quantity of rice cultivation in Nigeria. This is consistent with Mauki et al. (2023) in a study of smallholder rice farmers' profitability in Agricultural Marketing Co-operative Societies in Tanzania: A case of Mvomero and Mbarali districts. Table 1 also reveals that the respondents have considerable years of experience ($\bar{x} = 9.4 \pm 3.43$) in this venture. With this in perspective, it is established that they have ample experience and can compare the output of deploying the tools provided by the CARI initiative to practises they are used to and make informed decisions.

Rice farmers' perceptions of CARI

Data in Table 2a show details of the respondents' perception of CARI. It is revealed that adopting CARI will help improve the linkage between research and extension ($\bar{x} = 4.80$), CARI tools can help improve the linkage between advisory services and rice farmers ($\bar{x} = 4.49$) and CARI could lead to the disengagement of government extension staff ($\bar{x} = 3.97$) ranked highest under the indices used to assess the perceptions of the

Table 2a. Perceptions of CARI

Statements	SA f (%)	A f (%)	U f (%)	D f (%)	SD f (%)	Weighted Mean
Adopting of CARI will help improve linkage between research and extension services.	96 (80.0)	24 (20.0)	0.0	0.0	0.0	4.80
The CARI is very stressful and boring initiative to deploy.	12 (10.0)	58 (48.4)	28 (23.3)	22 (18.3)	0.0	3.51
CARI can help to improve the efficiency of extension services.	18 (15.0)	56 (46.7)	21 (17.5)	20 (16.6)	5 (4.2)	3.51
CARI could lead to the disengagement of a chunk of government extension personnel.	24 (20.0)	16 (13.3)	50 (14.7)	24 (20.0)	6 (5.0)	3.94
CARI tools can help to improve the linkage between advisory services and rice farmers.	(65.0)	28 (23.3)	7 (5.8)	7 (5.8)	0.0	4.49
The tools deployed by the CARI are complex to understand and use.	12 (10.0)	30 (25.0)	36 (30.0)	34 (28.3)	8 (6.7)	3.05
The use of e-resources associated with CARI is not necessarily associated with the illiteracy level of the farmers.	27 (22.5)	21 (17.5)	44 (36.6)	15 (12.4)	13 (11.0)	3.29
Though it may be helpful, it has more inconveniences than I can bear as a smallholder farmer.	17 (14.2)	43 (35.8)	23 (19.2)	19 (15.8)	18 (15.0)	3.17
Skeptical of the internet due to the widespread deception carried out there	21 (17.5)	41 (34.20)	24(20.0)	25 (20.8)	9 (7.5)	3.22

Source: Field survey, 2021; SD: Standard Deviation; f: frequency; %: percentage

Table 2b. Categorization of perceptions of CARI

Perception	Percentage	Minimum	Maximum	Mean	±SD
Favourable	72.5	12	42	36	2.8
Unfavourable	27.5				

Source: Field survey, 2021; SD: Standard Deviation

initiative by the rice farmers. It is appreciated that the bureaucracies created between the transfer of research deliverables from institutions and organisations conducting research to extension service providers and eventually to farmers are huge. Deploying this initiative, the linkage between these stakeholders is perceived to be enhanced and prompt delivery of research deliverables is assured. This further shows that the rice farmers are optimistic that through this initiative services will be delivered to them when due. Owing to this initiative, the traditional physical visit by extension personnel will gradually be phased out because of redundancy.

Conversely, the following indices ranked lowest considering the perceptions of the initiative by the rice farmers. Though it may be helpful, it has more inconveniences than I can bear as a smallholder farmer ($\bar{x} = 3.17$) and the tools deployed by the CARI initiative are complex to understand and use ($\bar{x} = 3.05$). This further shows that farmers acknowledged that the technology came with some inconveniences and initial complexities, they had to adjust to enable them to put the technology to productive use. Furthermore, this affirms that the initiative's benefits far outweigh its costs. Hence these hitches as observed in the indices were not pronounced enough to overshadow the good intentions, more importantly because the farmers were sufficiently trained on using the initiative. This notion is in tandem with CARI (2018b) that an increase in productivity, as well as improvement in the quality of rice, are to be achieved largely by communicating good agricultural practices (GAP) to rice farmers and organising Farmer Business School (FBS) training for them (CARI, 2018a).

Results in Table 2b give the summary of respondents' perception of CARI. Overall, the farmers had a favourable perception (72.5%) of the initiative. The favourable perceptions as shown can be associated with the benefits derived from the initiative by the farmers. In a related study of a scoping review on incentives for the adoption of sustainable agricultural practices and their outcomes, Piñeiro et al. (2020) asserted that independent of the incentive type, programmes linked to short-term economic benefit

have a higher adoption rate than those aimed solely at providing an ecological service. In the long run, one of the strongest motivations for farmers to adopt sustainable practices is perceived benefits for either their farms, the environment, or both. With the favourable perceptions established, the aim of the initiative (to significantly improve the livelihoods of smallholder rice farmers and their families by increasing the quantity and quality of domestic rice) was attained. Furthermore, the favorable perceptions of the initiative would ultimately enhance their ability to put the deliverable of the initiative to productive use despite any of its associated risks.

Utilisation of the tools deployed by CARI

Results in Table 3 reveal that farmers utilised the tools deployed under CARI with 45.5% and 38.9% representing active utilisation and passive utilisation of Rice Advise by rice farmers, respectively. It is also shown that 48.1% and 32.2% represented active and passive utilisation of Weed Manager, respectively, by the rice farmers. This distribution establishes that the farmers put the CARI tools to productive use. Their utilisation of these tools may be attributed to the training received on the utilisation of these tools and the benefits derived from their use. This notion corroborates the findings of Chhachhar et al. (2014), who asserted that mobile phone applications are a very important communication tool in agriculture that is used for providing knowledge and information to farmers.

It is established that the Rice Advise application helps farmers identify the best combination of fertilisers to buy, based on nutrient requirements and fertiliser prices, and helps the farmers make better-informed decisions through specifically trained extension agents (EAs) or service providers (SPs). Also, the Weed Manager application assists EAs or SPs in generating farm-specific advice for weed management for smallholder rice farmers. The Weed Manager reduces reliance on hand weeding by contributing to sustainable and affordable productivity enhancement. This is in tandem with the study of Lee and Christian (2017), who affirmed that weed control is one of the greatest impediments to successful crop production

Table 3. Utilisation of the tools deployed under the CARI

CARI tools	Active utilisation f (%)	Passive utilisation f (%)	Not utilised f (%)	Weighted mean
Rice Advice	55 (45.8)	47 (39.2)	18 (15.0)	1.31
Weed Manager	23 (48.3)	39 (32.5)	23 (19.2)	1.29

Source: Field survey, 2021; f: frequency; %: percentage

Table 4. Effectiveness of CARI in extension practise

Effectiveness	Frequency	Percentage	Minimum	Maximum	Mean	±SD
Effective	79	65.8	56	66	48	3.4
Not effective	41	34.2				

Source: Field survey, 2021; SD: Standard Deviation

in Africa. Farmers therefore need to be supported to adopt proper weed management strategies, such as preventing weeds from setting seeds, ensuring that crop residue cover is retained, and systematically using locally adapted weed management practices to improve production.

Effectiveness of CARI in extension practice

Table 3 reveals rice farmers’ assessment of the effectiveness of CARI extension practice. About two-thirds (65.8%) of them viewed the programme to be effective, while 34.2% considered it ineffective. The effectiveness established may be hinged on the ability of the initiative to sufficiently provide information on their enterprise that will ordinarily have been only provided by government extension agents. Given its effectiveness as claimed by rice farmers, one can attest that the initiative has increased their knowledge of good agricultural practices, increased information flow availability, increased the quality of the information received, increased their access to agricultural output, and increased their information-seeking behaviour. These are all principal functions of extension, which works as a borderline establishment between science produced by research and farmers resident in local communities (Prokopy et al., 2015). Furthermore, the CARI initiative can form a viable complement for public extension practice that has been constrained mainly by dwindling budgetary allocation and a declining number of extension personnel, which has widened farmers’ extension ratio and consequently overstretching the extension personnel oversight functions. Danso-Abbeam et al. (2018) in extension services delivered by the Association

of Church-based Development NGOs (ACDEP) reiterated that in agricultural-dependent economies, extension programmes have been the main conduit for disseminating information on farm technologies, supporting rural adult learning and assisting farmers in developing their farm technical and managerial skills. It is expected that extension programmes will help increase farm productivity, and farm revenue, reduce poverty and minimise food insecurity.

Relationship between selected independent variables and effectiveness of CARI in extension practice

Table 5 reveals a significant association ($\chi^2 = 23.242$, $p = 0.023$) between respondents’ marital status and the effectiveness of CARI as an extension service. The probable reason for this relationship could be that married couples will complement each other’s drive towards the utilisation of the tools, leading to the observed effectiveness. There was no significant relationship ($r = 0.166$, $p = 0.140$) between respondents’ perception of CARI and the effectiveness of CARI as an extension agent. This establishes that effectiveness was ascertained irrespective of the respondents’ inclination toward the initiative. The documented effectiveness of the services shows that the effort was well-considered. Furthermore, there was a significant relationship between the utilisation of the CARI initiative ($r = 0.206$, $p = 0.001$) and the effectiveness of CARI as an extension service. This gives credence that the effectiveness of CARI as an extension service was felt by the respondents when put to use. The findings suggested that effective extension services can provide information on new technologies for farming communities which when

Table 5. Relationship between selected independent variables and effectiveness of CARI as extension practice

Variables	χ^2	r	p
Marital status	23.242		0.023*
Household size		0.173	0.152
Educational attainment	27.331		0.734
Farm size		0.621	0.634
Farming Experience		0.143	0.551
Perceptions of CARI		0.166	0.140
Utilisation of CARI		0.206	0.001*

Source: Field survey, 2021; *Significant variables

adopted can improve production, incomes, and standards of living (Bonye et al. (2012).

CONCLUSION AND RECOMMENDATIONS

The study concludes that enrollees under CARI in the study area are middle-aged, the majority of them are male and are married. They are literate, and a notable proportion have undergone primary and secondary education. Their farm size is very large, hence, they do not qualify as smallholder farmers. They have been engaged in farming for a considerable length of time. Hence, they have an ample wealth of experience in this venture. Most of the respondents had a favourable disposition toward the initiative. The tools under the initiative (Rice Advise and Weed Manager) were utilised and CARI was rated effective in extension practise. Acknowledging that the adoption of CARI will help improve linkages between research recipients and extension services, thus improving the efficacy of extension services. The study further reveals that the respondents are utilising the initiative, hence the dividends of its utilisation felt. Because of the foregoing CARI is considered effective in extension practice. The hypotheses tested establish a relationship between respondents' marital status and utilisation of CARI in an effective extension practice. Furthermore, a relationship was also established between utilisation of CARI and the effectiveness of CARI in extension practice. This further shows that as they use this practice, its effectiveness is further revealed to them. Given the preceding, the study recommends sustained capacity building for enrollees of the initiative to enhance utilisation and further drive optimum effectiveness. Furthermore, the training template should recognise and adopt the family farming model across its components, this is in a bid to pull collective strength, ownership and sustained utilisation of CARI at the home level. This will further drive its replication among the households and at the community level.

CONFLICT OF INTEREST

The authors declared no conflicts of interest with respect to the research, authorship, and publication of this article.

ETHICAL COMPLIANCE

The authors have followed ethical standards in conducting the research and preparing the manuscript.

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