ajfand
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2024; 24(3): 25825-25850 https://doi.org/10.18697/ajfand.128.24320

Date	Submitted	Accepted	Published
	7th August 2023	5th February 2024	6th April 2024

THE COMMODITY ASSOCIATION TRADERS/TRAINERS EXTENSION APPROACH: SMALLHOLDER PRODUCTIVITY, INPUT AND MARKET LINKAGES IN NIGERIA

Atser GL[1], Oluoch M[2], Gambo A[1], Diso HZ[1], Fadairo OS[3]* and AA Jibrin[1]

Olushola Fadairo

*Corresponding author email: dairom2@gmail.com

[1]Sasakawa Africa Association, 8 Kura Road, off Magajin Rumfa Road, Nassarawa, Kano, Nigeria

[2]Sasakawa Africa Association, Gurd Shola Area, Bole Sub-City, Woreda 06, Addis Ababa, Ethiopia

[3]Department of Agricultural Extension and Rural Development, Faculty of Agriculture, University of Ibadan, Ibadan, Nigeria

ajfand
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

The Commodity Association Traders/Trainers (CATs) extension approach was an initiative of the Sasakawa Africa Association (SAA) to address the challenges of the low margin of agricultural extension agents and farm family ratio in Nigeria. This study, therefore, provides an assessment of the initiative in supporting agricultural extension service delivery in Nigeria. The study was carried out in Kano, Jigawa, Nasarawa and Gombe states, Nigeria being the four major states where the CATs extension approach was tested. The study used a causal research design involving before and after intervention assessment of 396 beneficiary farmers. Data collected using semi-structured questionnaire were analysed using descriptive statistics and linear regression at $\alpha_{0.05.}$ Majority of the farmers were male (71.5%), middle-aged (42.59±10.91 years) and had small to moderate household sizes (63.4%). Maize (77.6%) and Rice (57.3%) were the foremost crops grown. The farmers received extension service support from CATs in a broad area, including innovation dissemination, training on Good Agricultural Practices, linkage to agro-input dealers, market and credit. About 63.0-86.0% were positive about most aspects of engagement with the CATs except for payment of fees for services received and connecting farmers to credit. The number of farmers that practiced market-oriented agriculture doubled. The number of agribusiness enterprises established and the number of farmers successfully linked to off-takers for their produce also rose from an average of 3 to 8 persons; and 4 to 14 persons per group, respectively. The volume of maize crop marketed through cooperative efforts increased from 7.64±5.15 Kg to 15.66±6.94 Kg per person in each group. Farmers' size of land cultivated, their total produce harvested and productivity for maize and paddy increased after being members of the CATs group. Being male, young, educated, having ease of access to CATs master trainers and farmers' motivation enhanced the performance of the CATs extension approach. The commodity association trainers/traders have enhanced extension services in the project states. The initiative is recommended for up-scaling to cover other regions of Nigeria.

Key words: Agricultural extension, Farmers' group, Sasakawa Nigeria, Market-oriented agriculture

ajfand
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

INTRODUCTION

Agricultural extension plays an important role in the lives and livelihood of the rural people where agriculture dominates as the economic mainstay. This is because a functional extension system enhances the capacity of stakeholders in the farming system and contributes to increased productivity. Extension provides critical support for the farmers to enable them to cope with any emerging challenges and achieve transformation in the global food and agricultural system [1]. The impact of extension has been argued to go beyond rural and agricultural transformation as it is also regarded as a policy tool for promoting the safety and quality of agricultural products [2]. The impacts of agricultural extension are intricately linked to most countries' economic growth and development [3]. This is because agriculture which serves as the mainstay of many countries, providing income, employment and foreign exchange has witnessed several changes as a result of technological revolutions after World War II. The extension system has been the vehicle through which information on these technological advances has been efficiently transferred to the farmers.

However, extension systems in Africa face numerous challenges, which, in turn, limit their effectiveness in promoting smallholder farmers' productivity. These challenges were identified as including poor job satisfaction, weak capacity to mainstream the use of Information and Communication Technologies (ICTs) in the current era of technological sophistication, use of old extension methods and strategies and poor training for extension workers. It is arguable that the neglect of the public extension system by the governments of most African countries paved the way for the aforementioned challenges, especially the low margin of extension agents and farm-family ratio.

In Nigeria, extension services have not been effective as they ought to be due to a low margin of extension agents and farm family ratio, including poor access linking road infrastructure to remote areas where a lot of farming work is being done [4]. On average and across Nigeria, the Agricultural Development Programmes' extension agents: farm families ratio oscillated from 1:1,700; 1:2,132; 1:3,385; 1:2,950 and 1: 3,011 between the years 2008 and 2012 [5]. Similar gaps are observed in many other developing countries, especially in Africa. The understanding of the fact that the biggest improvement for rural farmers comes from getting adequate and timely information on regenerative farming, nutrition-sensitive agriculture and market-oriented agriculture, therefore, calls for a paradigm shift from the conventional extension approaches to a more effective and efficient method. This point was emphasized by Msuya *et al.* [1] who called for re-thinking the reformation of extension by re-positioning extension in the field such that it serves as a neutral facilitator of development across sectors. Some authors

https://doi.org/10.18697/ajfand.128.24320

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

have also made the case for the privatization of extension services and an introduction to pluralistic concepts of extension involving a variety of service providers [6, 7].

To this end, the idea of Commodity Association Traders/Trainers (CATs) by the Sasakawa Africa Association (SAA) gives a lot of hope for addressing the challenge of manpower deficit, especially the subject matter specialists and extension workers who play vital roles in successful agriculture. The use of commodity association traders/trainers has leveraged the advantage of social networking for revolutionizing agriculture. This is increasingly becoming important, especially in the current era of poor coverage of farmers by extension services due to a shortage of manpower. This is in line with pillar 3 of the SAA Strategic Plan (2021-2025) which focuses on market-oriented agriculture with the aim of developing farming as a business enterprise to ensure food security and improve livelihoods. Therefore, the SAA-Nigeria has developed the Private and Extension Service Provision (PESP) approach, supporting Commodity Association Traders/Trainers (CATs) who provide services for a fee to farmers at the local level.

The CATs extension approach as a peculiar private extension strategy, however, requires empirical information on its performance so as to guide future actions and policies for repositioning extension service. This study, therefore, provides an unbiased assessment of the Sasakawa Nigeria project in supporting extension service delivery. Specifically, the study investigated the farmers' experience of partnership with the CATs under the SAA Nigeria on market-oriented agriculture, the influence of CATs on extension service delivery, farmers' perception of the CATs extension approach, and the associated challenges faced in the approach. The outputs and outcomes give the necessary feedback on the performance of the project and the associated intervention in the coverage states to the concerned stakeholders, especially the Sasakawa Africa Association (SAA). This should provide useful lessons for the scale up of efforts in its promotion of regenerative agriculture and marketing of nutritious crops (biofortified and nutrient-dense) in Nigeria. It will also guide future investments and give indications on the kinds of incentives needed for more efficient project delivery.

LITERATURE REVIEW

The Sasakawa CATs Extension Approach

The CATs extension approach is one of the strategies of the SAA for achieving its target of promoting market-oriented agriculture among farmers. The SAA is convinced that stable farm incomes can be realized when production plans are based on market trends [8]. The CATs' extension approach is, therefore, imbued

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

with strategies and structure that encourage the entrepreneurial spirit among farmers. In this vein, innovative individuals are trained as CATs (master trainers) to cascade the training to farmers in their localities and also render services in linking farmers to agri-inputs, markets for their produce, and financial support among others. The process started with a collaborative effort between the SAA Nigeria and the Agricultural Development Programmes (ADP) in project states to form farmers into groups and activate/strengthen existing groups. Each group consists of 20-25 farmers that are registered under the SAA project as direct beneficiaries. Each Extension Agent (EA) and CATs are attached to four and 16-20 groups, respectively. The impact of the extension services rendered by CATs to the registered groups of farmers is expected to trigger the interest of more farmers in the CATs extension approach thereby leading to the formation of more groups who are at the beginning termed indirect beneficiaries.

The Sasakawa CATs Extension Approach: Principal-Agent Theory

This study was underpinned by the principal-agent theory. The theory gained popularity in the 1970s when it was first used to explain the interplay of interests (Figure 1) between institutional factors and economics. Ever since, the theory has been widely applied in various fields to explain the challenges and risks of information asymmetry that could arise between two entities bonded in a form of contractual arrangement. The theory explains the conflict of interest that arises between a principal and their agent or the risk involved when a principal hires an agent to negotiate on their behalf [9, 10]. The principal is an individual or entity who contracts another person or entity (agent) to act on their behalf to protect certain interests of the principal. Usually, the agent is assumed to have the required information, time and skills to protect certain interests of the principal. Conflict, however, arises when the agent acts contrary to the interests of the principal, which is usually the case when the agent has multiple principals to service simultaneously. Examples of a principal-agent relationship are seen in the case of an elected political office holder (agent) and the electorates (principal) or the extension workers (agents) and the farmers (principals). In the context of this study, the public extension service (agent) is underperforming and unable to satisfy the current information requirements and demands of most farmers (principal) leading to a conflict of interest and hence, posing a serious threat to agriculture and food security. The risk becomes more severe as the ratio of the agents to farmers especially in the sub-Sahara African countries is unacceptable. The challenges associated with multiple principals were explained by Voorn *et al.* [11]. For this reason, the private sector's involvement in introducing a new principal-agent model in the delivery of extension services becomes paramount. The Sasakawa-led CATs extension approach could be seen as an attempt to create a new principal-agent approach.

ajfand
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

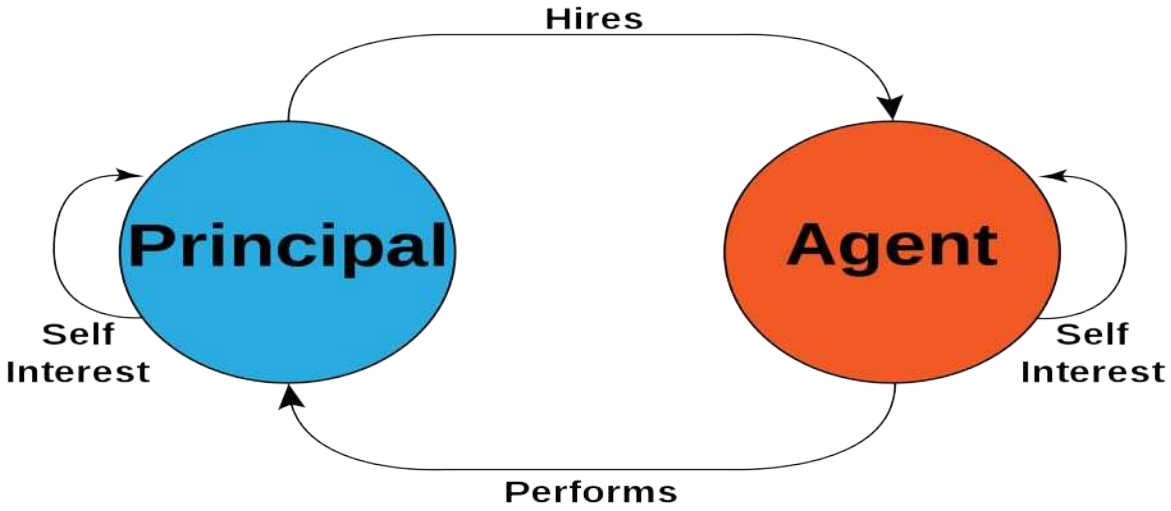

Figure 1: Principal-Agent interrelationship
Source: Gong *et al.* [9].

MATERIALS AND METHODS

The Study Area

This study was carried out in Kano, Jigawa, Nasarawa and Gombe states, Nigeria. These states were selected for preliminary investigation being the four major states where Sasakawa Nigeria has tested the Commodity Association Traders/Trainers extension approach in the region. The states are described as follows: Jigawa State is in the Northwestern part of Nigeria. Jigawa state has latitudes 11.00° N to 13.00° N and longitudes 8.00° E to 10.15° E. The state is originally part of the Kano region and it has Kano and Kastina states to the west, Yobe state to the North, and Bauchi state to the East [12]. Jigawa also shares an international border with the Niger republic. Annually, Jigawa state experiences about 700mm of rainfall between the months of June and September. About 90% of the people in Jigawa state live in rural and semi-urban areas and primarily engage in agriculture as a means of livelihood. The people engage in active cultivation, processing, and marketing of agricultural produce/products within the state and with neighboring states [13]. The state is also characterized by high land areas which are almost 750m high. According to Lawan *et al.* [14], Jigawa has an estimated population of 5,828,200 people.

Kano State is the commercial center of Northern Nigeria and the second largest city in Nigeria. According to Lawan *et al.* [14], Kano has about 9,383,682,000 people. Kano state has boundaries with Kastina state, Jigawa state, Bauchi state, and Kaduna State in the North-West, North-East, South East, and South West, respectively. The state lies between Latitudes 9° 30 and 10° 33 North and Longitudes 7° 34 and 9° 25 East of the Greenwich Meridian [15]. The state has an

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

altitude of 500m to 750m above sea level. Annual rainfall of between 300 -1200mm is experienced between May and early October in variations along Guinea and Sudan savannah areas of the state. The people of Kano state are mostly involved in irrigated Agriculture.

Gombe State has a land mass of 20,265 km2 and lies on a Longitude of 8° 5 and 11° 45 East and Latitudes 9° 30 and 12° North. The state has savanna grasslands and some woody trees. Gombe state's annual rainfall distribution is 880mm between the month of April and October with some distributions of dry spells [16]. The total population of Gombe is 2,364,284 people [14]. Gombe state shares a boundary with Yobe state to the North, Borno and Adamawa states to the East, Bauchi State to the West and Taraba State to the South. Gombe has three distinctive agroecological zones: the Sudan savanna, the Southern Guinea savanna and the Northern Guinea savanna [17].

Nasarawa State is in North-central Nigeria and lies between Latitudes 7° and 9° North, Longitudes 7° and 10° East. The state shares a boundary with Federal Capital Territory (FCT) to the North-west, Kaduna, and Plateau states to the northeast, Kogi state to the west, and Benue state to the South. Agriculture is the dominant occupation of the people in Nasarawa state [18]. The climate and soil conditions of Nasarawa state are suitable for the growth of cereal crops and vegetables, thus, farmers are mainly into arable crop production. The total population in Nasarawa state is 1,863,275 as of 2006 population count [14].

Research Design

The study used causal research design involving a before and after intervention assessment to address the stated objectives. The survey focused on all farmers who were direct beneficiaries of the CATs extension approach of the SAA and used comparative analysis of beneficiaries' experiences before and after involvement in the intervention as a basis for gauging the influence made by the CATs initiative.

Sampling Procedure and Sample Size

The farmers were sampled using a multi-stage sampling procedure. The first stage involved a random selection of 50% of the Local Government Areas (LGAs) in each state where registered farmer groups exist and where the CATs extension approach was prominent. This led to the sampling of Gwarzo, Kura, Warawa, Bankure (Kano); Auyo, Birnin Kudu, Biriniwa, Taura, Yankwashi, Babura (Jigawa); Lafia, Keffi, Akwanga, Doma (Nasarawa); Shomgom, Funakaye, Kaltungo and Yamaltu/Deba (Gombe) LGAs. Figure 2 shows the map of the study areas and the selected sites where respondents were sampled. In the second stage, lists were obtained of CATs beneficiaries in each of the LGAs from the Sasakawa state

ajfand
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

coordinators. Using a simple random sampling technique, a representative proportion of the farmers in each LGAs were sampled. Therefore, 95, 95, 103 and 103 beneficiary farmers from Kano, Jigawa, Nasarawa and Gombe states, respectively were captured in the field survey resulting in a total of 396 farmers.

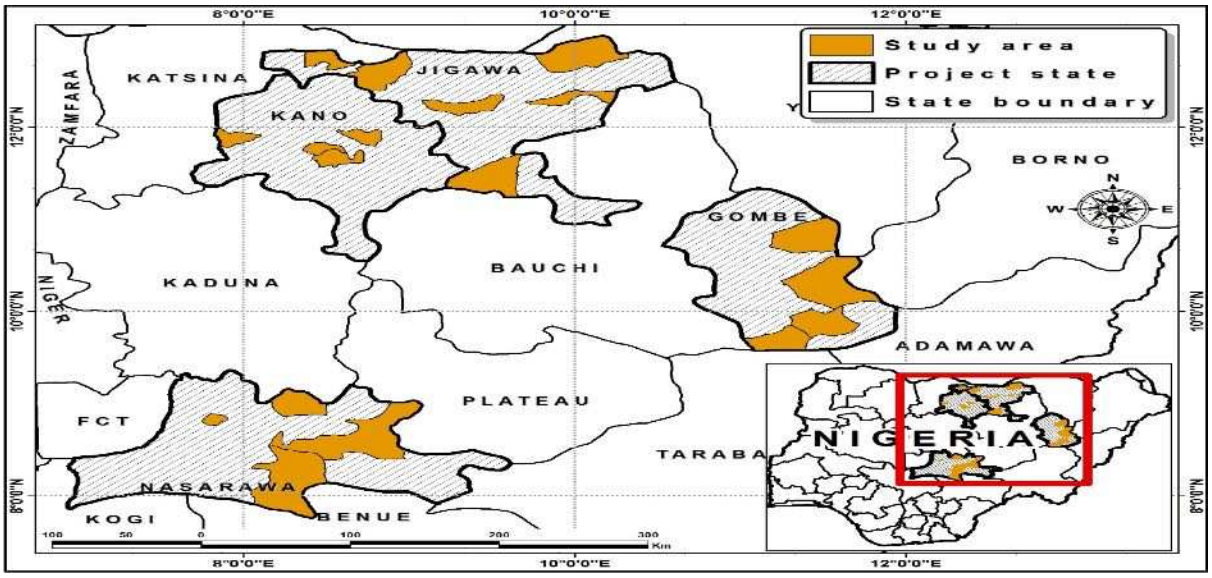

Figure 2: Map showing the study sites

Procedures for Data Collection and Analysis

Quantitative data were collected using structured questionnaire with the aid of computer-assisted personal interview software (Open Data Kit-ODK). Farmers' personal characteristics, experience of partnership with the CATs under the SAA Nigeria on market-oriented agriculture, the influence of CATs on extension service delivery, farmers' perception of the CATs extension approach, and the associated challenges faced in the approach were investigated. Farmers' experience of engagement with commodity association trainers was measured on a three-point scale of positive (2), neutral (1) and negative (0). The statements covered various aspects of engagement such as training, market and credit linkages, and commission for services received. The influence of CATs on extension service delivery was measured using the targeted outcomes of changes in respondents' access to inputs, market access, access to financial support, better income and enhanced productivity. Other indicators used include the number of farmers (direct and indirect beneficiaries) reached with extension support, the number of agribusiness enterprises that were established per farmer group, and the number of farmers per group that practice market-oriented agriculture. Information on these indicators was garnered before and after respondents' involvement in the CATs project and the direction of changes observed, whether positive or negative was used to adjudge the influence of the project on extension service delivery in the study locations. Improvement in each of the indicators was interpreted as a

ajfand
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY
AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

positive influence of CATs while the reverse would mean a negative influence. Farmers' perception of the CATs initiative was determined by presenting respondents with 10 perception items on a three-point scale of agree to disagree. The most positive perception was scored 3, while the most negative perception attracted a score of 1. Respondents were classified as having a favourable or unfavourable perception using the mean perception scores as a benchmark. Challenges faced in the CATs extension approach were identified by asking respondents to identify what they considered as challenges and also rank them as severe or mild by awarding scores of 2 and 1, respectively. Weighted mean values for each of the constraint items were used to discuss the findings. The quantitative data collected were analyzed using descriptive statistics such as frequency counts, percentages, and mean on the Statistical Package for the Social Sciences (SPSS) software. Regression analysis was used to establish the factors influencing change in farmers' productivity before and after the CATs initiative. Figure 2 shows some pictures taken during the field data collection.

Figure 2: Photo shots taken during survey and training of enumerators

RESULTS AND DISCUSSION

Demographic Characteristics of the Respondents

Table 1 shows the demographic characteristics of the sampled farmers registered under the Sasakawa CATs extension approach. The table shows that majority of the farmers (71.5%) were male. The dominance of the male also reflects across the project states as no state had less than 60% of the total sample as male farmers. This distribution suggests the dominance of males among the Sasakawa farmer groups in the project states. The reason for this is not far-fetched as most

https://doi.org/10.18697/ajfand.128.24320

studies on the gender distribution of the farming population in most parts of Africa confirms the dominance of the male folks [19, 20]. However, the sizeable proportion of the female farmers observed in Nasarawa (38.8%) and Gombe (33.0%) states imply that steady efforts are being made by the Sasakawa CATs project to bridge the gender gap in farming populations.

The mean age of 42.59±10.91 years of the farmers indicates that the farmers were mostly young people. This shows that middle-aged persons constitute a significant proportion of the farmers in the study locations. This finding is consistent with the report from research works on the average age of cassava farmers in Nigeria which is indicated to range from 45 to 48 years [21, 22]. Also, Okoye *et al.* [23] opined that the typical farmer in Madagascar is 46.05 years old. The ageof the farming population has a significant influence on productivity, as productive capacity tends to decline with increasing age. Most respondents were married (93.9%) and had small to moderate household sizes (63.4%). About 72% of the farmers had at least primary school-level education, suggesting a moderate level of literacy among the farmers. A positive relationship between education and innovativeness is widely assumed in the literature [24, 25].

Farmers' Experience of Engagement with Commodity Association Trainers (CATs)

Table 2 shows farmers' experience of engagements with the CATs. In Table 2 (a), farmers indicated that they were trained in market-oriented agriculture (97.2%) by CATs through Sasakawa support (94.5%) confirming the trickle-down effects of the "Train the Trainers" effort of the organization. Maize (77.6%), Rice (57.3%) and Groundnut (31.8%) were foremost among the list of crops for which the farmers received extension services from CATs. These crops perhaps play the most significant roles in household economy and food security in the study region. Maize is one of Africa's dominant food crops, rich in carbohydrates and essential minerals as well as 9% protein [26]. Also, the table shows that the farmers received extension service support in a broad area, including innovation dissemination, training on Good Agricultural Practice, linkage to agro-input dealers, market and credit, and support for group formation. The broad coverage of extension services rendered by the CATs to the farmers is expected to bridge the information and practice gaps in the area, leading to improvement in productivity, income and welfare of the farmers and their households. Eighty-two-point six percent of the farmers agreed that receiving private extension services from CATs was neither tedious nor complicated, hence most of the farmers (56.3%) affirmed their willingness to continue receiving extension support from CATs. In a similar vein, about 80% of the farmers expressed the likelihood to recommend the CATs approach to other farmers. Positive reactions observed from the farmers with

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

respect to their views about the CATs extension approach, the willingness to continue with the process, and the likelihood of recommending it to other farmers are strong indications of satisfactory performance of the approach in the study locations, and hence high chances of sustainability likelihood of the CATs initiative.

Table 2 (b) on ratings of farmers' experience of engagement with the CATs processes, however, suggests areas for possible improvement in the approach. The table shows that an overwhelming proportion of the farmers (between 63-86%) were positive about most aspects of engagement with the CATs except for payment of fees for services received and connecting farmers to credit for which most farmers were either negative or neutral (75.8% and 76.2%, respectively). The prevailing mentality that extension services are a public good and as such services rendered in the extension must be free to farmers [27] will take a long time to change; and the process must be gradual. It is expected that the CATs extension approach can achieve this in the long run. A comparative view of the respondent's experience of engagement with the CATs in the project states (Figure 3) shows that most of the farmers in Kano, Jigawa and Gombe states (between 56-95%) were more positive in their experience of CATs than the farmers in Nasarawa where only 33% were more positive. The larger proportion of the farmers in Nasarawa with less positive experience of engagement with CAT could plausibly be explained by the challenge of communal clashes faced in some parts of the region which has reduced their opportunities of engagement with the CATs. Participants mentioned during the focus group discussions that many group meetings were halted due to communal conflicts. Many farmlands in the state were also affected by the recent flooding that ravaged most places in Nigeria around October/November 2022.

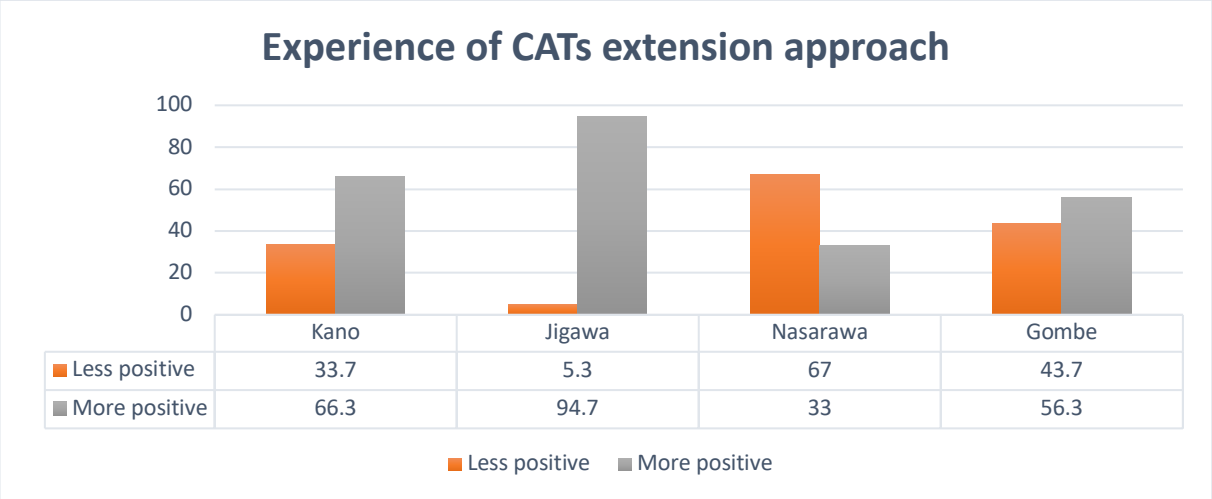

Figure 3: Farmers' summary of the experience of engagement with CATs in project states

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Influence of CATs in Supporting Extension Services

Table 3 shows the influence of the CATs on the various aspects of the extension service needs of the farmers in the project states. Comparing the mean values of the number of farmers reached by CATs for each area of extension service with the average number of farmers that were covered for the same service before the era of CATs shows a major improvement in all areas of the services as a result of the CATs initiative. As an example, the number of female farmers assisted with extension services improved (the number of adult female farmers reached rose from about 8 to 32 persons; youth female farmers rose from about 6 to 17 persons) since the introduction of the CATs initiative. Similarly, the number of farmers in each group that practiced market-oriented agriculture doubled (from 7 to about 15 persons per group). The number of agribusiness enterprises established and the number of farmers successfully linked to off-takers for their produce also rose from an average of 3 to 8 persons and 4 to 14 persons per group, respectively. The volume of crops (maize) marketed through cooperative efforts also increased from 7.64±5.15 Kg to 15.66±6.94 Kg per person in each group.

Influence of the CATs on Farmers' Enterprise Scale and Productivity (maize)

Table 4 shows that the farmers' size of land cultivated for maize increased from 2.01±1.41 to 3.28±2.06 acres; their total maize harvested increased from 1,073.13±964.05 to 2,555.82±2,264.08 kg while their productivity got boosted from 623.27±520.94 to 954.22±718.03 kg/acre before and after being involved in the CATs extension approach. In 2019, Nigeria produced 1.69 tons per hectare of maize [26] representing 1,690 Kg/hectare or about 684.2kg/acre (About 2.47 acres equal to 1 hectare). However, the CATs farmers have achieved an average of 954 Kg/acre, a massive improvement compared to the achievable value across Nigeria. The result implies that the performance of the farmers as measured by their productivity was better under the CATs extension approach than in their previous period.

Comparative Analysis of Farmers' Maize Productivity in Project States (n=335)

Figure 4 compares the maize productivity of the CATs farmers in study locations using their group average productivity value of 954.22 ± 718.03 kg/acre. The table reveals that most farmers in Kano (65.3%) and Gombe (70.6%) states recorded maize productivity values of more than the average performance of the entire farmers in the CATs network. The below group average productivity amongst most farmers in Nasarawa and Jigawa state is plausibly due to the inability of most farmers in this region to access credit support from financial institutions to support their farming enterprises unlike in Kano where a considerable proportion of the farmers were reported (Focus group discussions) to have accessed microfinance

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

support for their farm business. Also, factors mentioned earlier to explain the less positive experience of most farmers in Nasarawa with regard to their engagements with CATs could have also influenced this trend in both states. These include communal conflict, climate change effects such as flooding and herdsmen attacks.

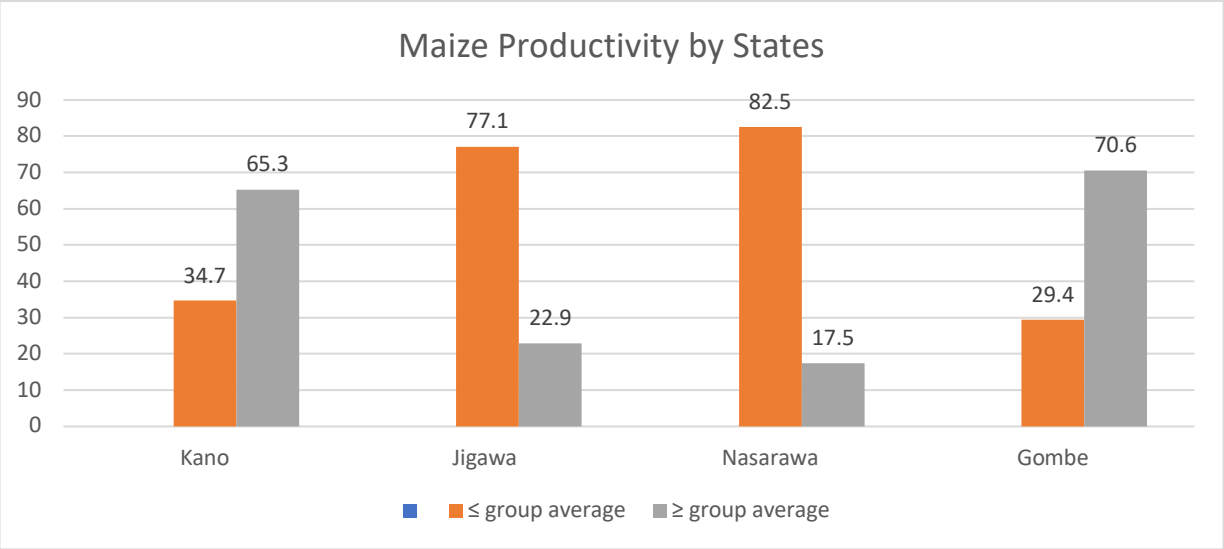

Figure 4: Maize productivity in project states

Influence of the CATs on Farmers' *Paddy Scale of Operation and Productivity

The influence of the CATs on paddy farmers' scale of operation and productivity was measured by estimating changes in land area cultivated, the quantity of paddy harvested, and the productivity of the respondents before and after their involvement in the CATs initiative. There was a general improvement in the CATs farmers' enterprise scale and productivity after involvement in the program (Table 5). The total land area cultivated by the CATs farmers increased from 2.77 ± 4.31 acres to 4.17 ± 5.61 acres, as the maximum acreage cultivated rose from 30 to 40 acres. Also, the average paddy production of the farmers improved from 786.70 ± 661.93 kg before involvement in CATs to 1,973.01 ± 2,077.09 kg after involving in the CATs project, representing more than a doubling of the average yield. In this case, too, the minimum paddy harvested rose from 0 kg to 150 kg and the maximum from 3,900 kg to 22,500 kg in a cycle. Furthermore, the average productivity of the respondents increased from 559.55 ± 533.10 kg/acre to 818.06 ± 800.11 kg/acre.

Comparative Analysis of Farmers' Maize Productivity in Project States

Table 6 shows the comparative analysis of the paddy productivity of the farmers across the project states using the group mean productivity of 818.06 ± 800.11 as a benchmark. The distribution shows that 55.9% of the proportion of farmers from Kano State had paddy productivity above the group average. Less than fifty

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

percent of the farmers from other project-participating states recorded productivity of above the group means. Nasarawa State had the fewest proportion (2.6%) of its farmers scaled above the average productivity value. A similar trend was observed in the comparative analysis of the farmers' maize productivity across the project states. The foregoing, therefore, suggests that while all the project states are faring well under the CATs extension approach, farmers from Nasarawa state occupy the lowest rung of the ladder in terms of maize and paddy productivity. The probable reason for this may be the challenges of herders' attacks and poor accessibility to credit support from financial institutions which came to the fore during a focus group discussion as serious challenges faced in the state.

Influence of CATs on Access to Agri-support Services

Table 7 shows the respondents' access to some essential agri-support services before and after being involved in the CATs project. Generally, the farmers' access to each of the items tested in the study was higher after being involved in the CATs groups. However, while marginal improvements were recorded for some items, some others witnessed a major boost. For instance, the index of access to financial support/loans from credit institutions marginally increased from 1.13 to 1.22. In fact, only 2.5% of the farmers indicated a high level of access to financial support/loans before and after joining the CATs group. This implies no change in the proportion of the farmers who had better access to loans at before and after joining the CATs group. On the other hand, more farmers witnessed increased access to a stable market and better prices for their produce after being part of the CATs project. As an example, only 38.1% of the farmers had a high level of access to a stable market for harvested produce before CATs. This proportion grew to 78.5% during CATs intervention. The highest access was indicated for a stable market ($\bar{x}$=2.70) followed by better prices for produce ($\bar{x}$=2.66) and fertilizers ($\bar{x}$=2.15). The lowest access was observed for financial support/loans.

Farmers' Perception of the Commodity Trainers/Trader's Extension Approach

Table 8 shows the respondents' perception of the CATs extension approach. In Table 8 (a) showing the distribution of responses to the perception statements, it can be inferred that the majority of the respondents had positive opinions about most of the perception statements. As an example, an overwhelming proportion of the farmers (97.2%) agreed that CATs can guarantee increased access to extension services and 87.4% indicated that the approach can imbue a business-like attitude in farmers. The trend of responses was generally positive for most statements except for about 87.9% who opined that the CATs approach takes too much of farmers' time. Table 8 (b) which shows the respondents' summary of responses to the perception scale reveals that slightly above half of the farmers

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

(50.3%) fell within the more favorable category for the CATs extension approach using the mean perception score of 22.58 ± 1.58 as a basis for categorization. The table further revealed that the highest proportion of the farmers from Gombe state (91.3%) followed by Kano (66.3%) fell within the more favorable category of perception than farmers from other participating states.

Factors Influencing Farmers' Change in Maize and Paddy Productivity

It is essential to understand the factors affecting farmers' generally positive change in maize and paddy productivity after involving in the CATs extension approach in order to guide effectively future extension initiatives and scale up of the current intervention. Table 9 shows the contributions of independent variables (such as sex, age, ease of accessing CATs services, experience, and perception of CATs among others) to one of the major performance indicators of the project, which is enhanced productivity. The results show that maize farmers' area of farm location ($\beta = 0.214$; sig < 0.05), their sex ($\beta = 0.125$; sig < 0.05), age ($\beta = 0.144$; sig < 0.05), education ($\beta = 0.164$; sig < 0.05), willingness to continue in CATs group ($\beta = 0.217$; sig < 0.05) and experience of CATs ($\beta = 0.243$; sig < 0.05) significantly and positively influenced their enhanced maize productivity after participating in the CATs project. However, only 22% of the variation in the farmers' boost in maize productivity is accounted for by the explanatory variables tested in this study. Also, respondents' area of farm location [study cites] ($\beta = 0.216$; sig < 0.05), sex ($\beta = 0.326$; sig < 0.05), and ease of accessing CATs extension services ($\beta = 0.306$; sig < 0.05) positively and significantly contributed to improvement in paddy productivity among farmers. About 15% of the variation in the farmers' increase in paddy productivity is accounted for by the explanatory variables tested in this study. Thus, farmers in some locations, especially from Kano and Jigawa states performed better in terms of positive change in maize and paddy productivity after membership in the CATs than others from different areas. This may be due to the longer period of exposure to the CATs initiative enjoyed by participating farmers in Kano and Jigawa states compared to their colleagues. Thus, continued implementation of the CATs extension approach has the prospect of further boosting farmers' productivity and income in the study locations. The CATs intervention started in Kano and later in Jigawa state. Records show that the intervention started in Nasarawa state about two years ago. The male farmers especially the younger and more educated ones (among maize producers) also had a better change in their crop productivity. This suggests that younger age and education among beneficiary farmers granted an impetus to the attainment of the CATs goals. The reason for this is not far-fetched as education and youthfulness have been established as precursors for innovation adoption behavior among the target of any agricultural intervention [28, 29, 30]. Furthermore, paddy farmers' ease of accessing CATs extension services and maize farmers' willingness to

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

continue in CATs groups enhanced the positive changes attained in their crop productivity. This indicates that the accessibility of the CATs master trainers to the farmers and the farmers' interest (motivation) played essential roles in appropriating the benefits of the extension support received. This is consistent with the findings in a study conducted in China which showed that farmers' motivation was significantly contributory to technology adoption among Litchi farmers [31].

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The study concluded that the commodity association trainers/traders have enhanced extension services in the project states. Considerable impacts have been made in facilitating farmers' access to extension support, linking farmers with inputs dealers, and ensuring guaranteed markets and better prices for farmers' produce. These impacts cut across all the participating states. However, not much has been achieved in brokering arrangements for credit between farmers and financial institutions in some participating states. While some states such as Kano have recorded modest success in accessing financial support for farmers from financial institutions, other states have not. Successes achieved and farmers' favorable disposition towards the CATs extension approach give hope for the sustainability likelihood of the system. Continued implementation of the CATs extension approach has the prospect of further boosting farmers' productivity and income in the study locations. Farmers in some locations, especially from Kano and Jigawa states performed better in terms of positive change in maize and paddy productivity after membership of the CATs than others. Being male, young, educated, having ease of accessing CATs master trainers and farmers' motivation enhanced the chances of performance of the CATs extension approach among the farmers.

The commodity association trainers/traders' initiative is recommended for up-scaling to cover other regions of the country where there still exists the problem of low margin of extension agents and farm family ratio. The master trainers should be provided with items such as branded caps and t-shirts for ease of identification, especially by new farmers. The SAA Nigeria should consider how CATs can generate commission for their services rendered to farmers, especially in the areas of facilitating linkage to markets (off-takers) and brokerage of partnerships between farmers and agri-input dealers. Strategies to generate commissions for their efforts should be incorporated into their regular training. This will ensure some modest rewards for their efforts, hence boosting their motivation for more effective services and guaranteeing the sustainability of the approach.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 1: Respondents' demographic characteristics (n=396)

Variable	Response	Kano	Jigawa	Nasarawa	Gombe	All respondents
		F (%)	F (%)	F (%)	F (%)	F (%)
Sex	Male	69 (72.6)	82 (86.3)	63 (61.2)	69 (67.0)	283 (71.5)
	Female	26 (27.4)	13 (13.7)	40 (38.8)	34 (33.0)	113 (28.5)
Age (years)	≤ 30	15 (15.8)	8 (8.4)	23 (22.3)	15 (14.6)	61 (15.4)
(42.59±10.91)	31-40	23 (24.2)	21 (22.1)	48 (46.6)	41 (39.8)	133 (36.6)
	41-50	32 (33.7)	32 (33.7)	25 (24.3)	30 (29.1)	119 (30.1)
	51-60	20 (21.1)	26 (27.4)	7 (6.8)	12 (11.7)	65 (16.4)
	> 60	5 (5.3)	8 (8.4)	0 (0)	5 (4.9)	18 (4.5)
Marital Status	Single	5 (5.3)	2 (2.1)	2 (1.9)	7 (6.8)	16 (4.0)
	Married	86 (90.5)	92 (96.8)	99 (96.1)	95 (92.2)	372 (93.9)
	Divorced	2 (2.1)	0 (0)	1 (1.0)	0 (0)	3 (0.8)
	Separated	0 (0)	1 (1.1)	0 (0)	1 (1.0)	2 (0.5)
	Widowed	2 (2.1)	0 (0)	1 (1.0)	0 (0)	3 (0.8)
Household Size (persons)	≤ 5 (Small)	22 (23.2)	14 (14.7)	53 (51.5)	22 (21.4)	111 (28.0)
(10.27±7.52)	6-10 (Moderate)	28 (29.5)	17 (17.9)	43 (41.7)	52 (50.5)	140 (35.4)
	11-15 (Fairly Large)	21 (22.1)	36 (37.9)	5 (4.9)	21 (20.4)	83 (21.0)
	16-20 (Large)	11 (11.6)	15 (15.8)	1 (1.0)	4 (3.9)	31 (7.8)
	> 20 (Extra Large)	13 (13.7)	13 (13.7)	1 (1.0)	4 (3.9)	31 (7.8)
Highest Education	Non-formal	3 (3.2)	0 (0)	11 (10.7)	4 (3.9)	18 (4.5)
	Quranic	27 (28.4)	27 (28.4)	7 (6.8)	21 (20.4)	82 (20.7)
	Adult Education	1 (1.1)	4 (4.2)	4 (3.9)	5 (4.9)	14 (3.5)
	Primary School	17 (17.9)	17 (17.9)	23 (22.3)	16 (15.5)	73 (18.4)
	Secondary School	21 (22.1)	21 (22.1)	46 (44.7)	42 (40.8)	130 (32.8)
	Tertiary	26 (27.4)	26 (27.4)	12 (11.7)	15 (14.6)	79 (19.9)

*Figures in parentheses are the percentage

https://doi.org/10.18697/ajfand.128.24320

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 2 (a): Farmers' experience of engagement with CATs

Variable	Response	F	%
Have received training on market-oriented agriculture before	Yes	385	97.2
	No	11	2.8
Organiser of the training on market-oriented agriculture	Sasakawa/CATs	374	94.5
	ADP	22	5.6
Commodities of focus for the extension service received*	Rice	227	57.3
	Maize	307	77.6
	Cassava	65	16.5
	Sorghum	94	23.7
	Millet	121	30.7
	Soyabean	92	23.3
	Groundnut	126	31.8
	Cowpea	99	25.0
	Vegetables	34	8.7
Areas of extension services received from CATs*	Information/innovation dissemination	322	81.5
	GAP	323	81.6
	Input supply/Linkage	321	81.8
	Agro-processing support	290	73.2
	Market linkage	326	82.3
	Credit linkage	203	51.3
	Group formation	307	77.5
View about receiving private extension services from CATs	Very easy	268	67.7
	Somewhat easy	59	14.9
	Tedious	67	16.9
	Complicated	2	0.5
Willingness to continue receiving extension service from CATs	No	61	15.4
	Probably Yes	112	28.3
	Affirmative	223	56.3
Likelihood to recommend CATs approach to other farmers	Not likely	2	0.5
	Probably	79	19.9
	Affirmative	315	79.5

*Multiple responses

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 2 (b): Farmers' experience of engagement with CATs

Statements	Negative %	Neutral %	Positive %	Mean ±SD
General attitudinal disposition of farmers to private extension provision	8.3	22.7	68.9	2.61±0.64
Experience of receiving support from Sasakawa Africa Association Nigeria on market-oriented agriculture	7.6	6,6	85.9	2.78±0.57
Provision of training to farmers on good agricultural practices	7.6	16.4	76.0	2.68±0.61
Provision of services for a fee to farmers	38.4	37.4	24.2	1.86±0.78
Connecting farmers to input suppliers	9.1	28.3	62.6	2.54±0.66
Connecting farmers to credit	37.6	38.6	23.7	1.86±0.77
Linking farmers to markets off-takers (market)	7.6	8.3	84.1	2.77±0.58

Table 3: Influence of CATs extension coverage within farmers' groups

Indicators	Before CATs	During CATs
Estimated number of adult Male farmers assisted with extension services	16.98±38.43	43.33±80.26
Estimated number of adult female farmers assisted with extension services	8.03±15.23	31.62±61.82
Estimated number of youth male farmers assisted with extension services	13.80±24.33	27.13±34.27
Estimated number of youth female farmers assisted with extension services	6.41±11.27	16.54±21.01
Number of agribusiness enterprises established per group through CATs	2.78±3.33	8.07±6.03
Number of farmers per group that practice market-oriented agriculture through CATs support? i.e., the average number of farmers per group that produces for sale and not just for personal consumption only	7.38±7.61	14.75±8.27
Number of farmers per group that have been successfully linked to off-takers for their produce	3.98±5.16	14.41±8.31
Number of farmers per your group that was able to obtain credit from financial institutions and other market actors through CATs	1.41±2.69	5.46±6.67
Number of farmers per group that was able to obtain agri-inputs from suppliers	6.01±7.18	14.71±8.46
Number of farmers per group that were linked with repair and maintenance technicians	1.39±2.06	3.14±2.76
Volume of crops sale marketed through cooperatives in tones in last season (using maize as a focal crop; 1 bag = 100kg; 10 bags [1000kg] = 1 tons) per group	7.64±5.15 Kg	15.66±6.94 Kg

https://doi.org/10.18697/ajfand.128.24320

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 4: Influence of CATs on farmers' maize scale and productivity (n=335)

Variable	Period	Minimum	Maximum	Mean±SD
Land cultivated (Acres)	Before CATs	0	10	2.01±1.41
	During CATs	1	12	3.28±2.06
Total maize harvest (kg)	Before CATs	0	7000	1,073.13±964.05
	During CATs	100	17,000	2,555.82±2,264.08
Productivity (Kg/Acre)	Before CATs	40	5000	623.27±520.94
	During CATs	80	4000	954.22±718.03

Table 5: Influence of CATs on farmers' paddy productivity (n=282)

Variable	Period	Minimum	Maximum	Mean±SD
Land cultivated	Before CATs	0	30	2.77±4.31
(Acres)	During CATs	0	40	4.17±5.61
Total paddy harvest	Before CATs	0	3,900	786.70±661.93
(kg)	During CATs	150	22,500	1,973.01±2,077.09
Productivity	Before CATs	5	3,750	559.55±533.10
(Kg/Acre)	During CATs	50	4,500	818.06±800.11

Table 6: Paddy's productivity in project states

Productivity	Kano F (%)	Jigawa F (%)	Nasarawa F (%)	Gombe F (%)	All Respondents	Mean± SD
≤ group average	30 (44.1)	39 (68.4)	75 (87.4)	60 (75.0)	204 (72.3)	818.06 ± 800.11
> group average	38 (55.9)	18 (31.6)	2 (2.6)	20 (25.0)	78 (27.7)	

https://doi.org/10.18697/ajfand.128.24320

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 7: Farmers' access to agri-support services before and after membership of CATs group

	Before CATs		After CATs		Index of access before CATs	Index of access after CATs
	High %	Moderate / Low %	High %	Moderate / Low %		
Financial support/loans	2.5	97.5	2.5	97.5	1.13	1.22
Improved crop seedlings/stem	0.8	99.3	0.8	99.2	1.32	1.41
Fertilisers	33.1	66.9	33.1	66.9	2.10	2.15
Pesticides/herbicides	6.6	93.4	6.6	93.5	1.22	1.27
Stable market for harvested produce	38.1	61.9	78.5	21.4	2.16	2.70
Better price offer for produce	52.0	48.0	76.5	23.5	2.35	2.66

Table 8 (a): Farmers' perception of the commodity trainers/trader's extension approach

Statements	Agree %	Uncertain %	Disagree %
The Commodity Association Traders/Training (CATs) approach can guarantee increased access to extension services at the community level	97.2	2.8	0
Use of the CATs approach cannot guarantee adequate and effective extension information dissemination	95.7	2.8	1.5
The CATs approach is the right step to make extension delivery more efficient and effective	89.1	2.0	8.8
The CATs approach can encourage the co-creation of knowledge among farmers	33.6	14.1	52.3
The CATs approach is too costly to be affordable by smallholder farmers	0	12.1	87.9
The CATs approach can imbue a business-like attitude in farmers	87.4	10.6	2.0
The CATs approach assures quick and timely response to farmers' challenges	0	98.0	2.0
The CATs approach takes too much of farmers' time	87.9	9.1	3.0
The CATs approach enables improved access to extension services for youth and women farmers	0.3	99.2	0.5
The CATs approach builds the capacity of farmers as both producers and trainers	39.1	33.8	27.0

ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 8 (b): Summary of farmers' perception of the commodity trainers/trader's extension approach

Perception of CATs extension approach	Kano F (%)	Jigawa F (%)	Nasarawa F (%)	Gombe F (%)	All Respondents	Mean± SD
Less favourable	32 (33.7)	44 (46.3)	74 (71.8)	9 (8.7)	197 (49.7)	22.58 ± 1.58
More favourable	63 (66.3)	51 (53.7)	29 (28.2)	94 (91.3)	199 (50.3)	

Table 9: Factors influencing farmers' change in maize and paddy productivity before and during the CATs initiative

	Changes in maize productivity			Changes in Paddy productivity		
	Standardized coefficients (β)	t-value	p-value	Standardized coefficients (β)	t-value	p-value
(constant)		0.787	0.432		-0.988	0.324
Study sites (state)	0.214	0.354	0.000*	0.216	3.087	0.002*
Sex	0.125	2.101	0.036*	0.326	5.262	0.000*
Age	0.144	2.188	0.029*	0.080	1.137	0.257
Marital status	0.015	0.274	0.785	0.078	1.340	0.182
Household size	0,000	0.005	0.996	0.008	0.127	0.899
Education	0.164	2.761	0.006*	0.122	1.913	0.057
Ease of accessing CATs extension services	0.127	1.343	0.180	0.306	3.098	0.002*
Willingness to continue in CATs groups	0.217	2.189	0.029*	0.156	1.599	0.120
Likelihood to recommend CATs	0.026	0.439	0.661	0.059	0.937	0.350
Experience of CATs	0.243	3.683	0.000*	0.047	0.671	0.503
Perception of CATs support	0.117	1.847	0.066	0.029	0.405	0.686
	R=0.38, R^2=0.219, Adjusted R^2= 0.188, Standard error= 428.4, $\alpha_{0.05}$			R=0.47, R^2=0.146, Adjusted R^2= 0.117, Standard error= 721.3, $\alpha_{0.05}$		

REFERENCES

1. **Msuya CP, Annor-Frempong FK, Magheni MN, Agunga R, Igodan C, Ladele AA and A Ndiaye** The role of agricultural extension in Africa's development, the importance of extension workers and the need for change. *International Journal of Agricultural Extension.* 2017; **5(1):** 51-58.

2. **Danso-Abbeam G, Ehiakpor DS and R Aidoo** Agricultural extension and its effects on farm productivity and income: insight from Northern Ghana. *Agric and Food Security*. 2018; **7(74):**1-10.

3. **Birkhaeuser D, Evenson RE and G Feder** The economic impact of agricultural extension: A review. *Economic Development and Cultural Change.* 1991; **39(3):** 607-650.

4. **Ladele AA, Igodan CO, Agunga R and OS Fadairo** Agricultural extension in Nigeria's transformation agenda: key recommendations based on a field study. *International Journal of Agricultural Extension.* 2016; **3(3):**173-185.

5. **Haruna SK and YMG Abdullahi** Training of public extension agents in Nigeria and the implications for government's agricultural transformation agenda. *Journal of Agricultural Extension.* 2013; **17(2):** 98-104.

6. **Feder G, Birner R and JR Anderson** The private sector's role in agricultural extension systems: potential and limitations. *Journal of Agribusiness in Developing and Emerging Economies.* 2011; **1(1):** 31-54.

7. **Umali-Deininger D and LA Schwartz** Public and private agricultural extension: Beyond traditional frontiers (**Vol. 236**). World Bank Publications, 1994.

8. **Sasakawa Africa Association-SAA.** Strategic Plan 2021-2025. 2021. https://www.saa-safe.org/wwd/ *Accessed November 2022.*

9. **Gong D, Tang M, Liu S and Q Li** Reconsidering production coordination: A principal-agent theory-based analysis. *Advances in Production Engineering & Management.* 2017; **12(1):** 51-61.

10. **Bernhold T and N Wiesweg** Principal-agent theory: Perspectives and practices for effective workplace solutions. A Handbook of Management Theories and Models for Office Environments and Services. 2021, 117-128.

11. **Voorn B, Van Genugten M and S Van** Thiel Multiple principals, multiple problems: Implications for effective governance and a research agenda for joint service delivery. *Public Administration*. 2019; **97(3):** 671-685.

12. **Tundunwada IY and A Abbas** Flood vulnerability mapping and prediction for early warning in Jigawa State, Northern Nigeria, using geospatial techniques. *International Journal of Disaster Risk Reduction.* 2022; **79:** 103156.

13. **Musa S** Problems associated with Date Palm Fruit marketing in Jigawa State, Nigeria. *FUOYE Journal of Agriculture and Human Ecology.* 2021; **5(1):** 48 – 58.

14. **Lawan UM, Abubakar IS, Jibo AM and A Rufai** Pattern, awareness and perceptions of health hazards associated with self-medication among adult residents of Kano metropolis, North-western Nigeria. *Indian Journal of Community Medicine.* 2013; **38(3):** 144-151.

15. **Irohibe IJ and AE Agwu** Assessment of food security situation among farming households in rural areas of Kano State, Nigeria. *Journal of Central European Agriculture.* 2014; **15(1):** 94 -107.

16. **Sani AA, Sanni SA, Damisa MA and YU Oladimeji** Assessment of household food security among sorghum Farmers under Agricultural Transformation Agenda in Gombe State, Nigeria. *Journal of Sustainable Development in Africa. 2017*; **19(4):** 1 – 12.

17. **Bello Y, Adebayo AA and B Abubakar** Analysis of rainfall and temperature changes in Gombe State, Nigeria. *FUDMA Journal of Sciences*. 2020; **4(1):** 632 – 646.

18. **Salau ES and AJ Attah** A socio-economic Analysis of Urban Agriculture in Nasarawa State, Nigeria. *Production Agriculture and Technology*. 2012; **8(1):** 17 – 29.

19. **De Brauw A** Gender, control, and crop choice in northern Mozambique. *Agricultural Economics.* 2015; **46(3):** 435-448.

20. **Lu JL** Gender differentiation among farmers in the agricultural sector in Benguet, Philippines. *Journal of International Women's Studies*. 2007; **9(1):** 176-199.

21. **Atser GL, Dixon A, Ekeleme F, Hauser S, Fadairo O, Adekoya A and B Vanlauwe** The effect of communication media on the uptake of agricultural innovations in selected states of Nigeria. *Agricultural Education and Extension*. 2022; **29(5):** 583-604.

22. **Omolehin RA, Akogun EO and SO Oyewole** Analysis of factors influencing adoption of Good Agronomic Practices (GAP) among cassava farmers under Nigeria Agricultural Transformation Agenda. *Journal of Agriculture and Ecology Research International*. 2020; **21(6):** 11-20.

23. **Okoye BC, Abass A, Bachwenkizi B, Asumugha G, Alenkhe B, Ranaivoson R and I Ralimanana** Differentials in technical efficiency among smallholder cassava farmers in Central Madagascar: A Cobb Douglas stochastic frontier production approach. *Cogent Economics & Finance.* 2016; **4(1):** 1143345.

24. **Weir S and J Knight** Externality effects of education: dynamics of the adoption and diffusion of an innovation in rural Ethiopia. *Economic development and cultural change*. 2004, **53(1):** 93-113.

25. **Makate C, Makate M, Mango N and S Siziba** Increasing resilience of smallholder farmers to climate change through multiple adoption of proven climate-smart agriculture innovations. Lessons from Southern Africa. *Journal of Environmental Management.* 2019; **231:** 858-868.

26. **IITA.** IITA-BIP sets record for maize production per hectare in Nigeria. 2020. https://www.iita.org/news-item/iita-bip-sets-record-for-maize-production-per-hectare-in-nigeria/ *Accessed December 2022.*

27. **Collins CS** Land-Grant Extension: defining public good and identifying pitfalls in evaluation. *Higher Education Outreach and Engagement*. 2015; **19(2):** 37-64.

28. **Acevedo M, Pixley K, Zinyengere N, Meng S, Tufan H, Cichy K and J Porciello** A Scoping review of adoption of climate-resilient crops by small-scale producers in low-and middle-income countries. *Nature Plants*. 2020; **6(10):** 1231-1241.

29. **Dhakal A, Cockfield G and TN Maraseni** Deriving an index of adoption rate and assessing factors affecting adoption of an agroforestry-based farming system in Dhanusha District, Nepal. *Agroforestry systems.* 2015; **89(4):** 645-661.

ajfand
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 3
March 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

30. **Coffman M, Bernstein P and S Wee** Electric vehicles revisited: a review of factors that affect adoption. *Transport Reviews*. 2017; **37(1):** 79-93.

31. **Li H, Huang D, Ma Q, Qi W and H Li** Factors influencing the technology adoption behaviours of litchi farmers in China. *Sustainability.* 2019; **12(1):** 1-13.