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Knowledge and technical competence level of extension agent on climate-smart techniques for rice production in North-Central, Nigeria

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Abstract

The study examined extension agents' knowledge and technical competency level regarding Climate-Smart Agricultural Practices (CSAP) used by rice farmers in Nigeria. The study specifically examined the technical competence level, knowledge of the extension agents, and factors that influence their competency level on CSAPs. The 88 respondents for the study were chosen using a multi-stage sampling procedure. Data were collected from respondents using a structured questionnaire, and descriptive and inferential statistics (probit regression model) were used for analysis The results show that the majority of the extension agents had high-level knowledge on crop (53.4%) and soil smart mechanism (56.8%), but low-level knowledge on water (52.3%) and weather smart mechanism (54.5%). This also hampered their job performance, as more than half (51.1%) of extension agents had low competence level in CSAPs. Factors that significantly influence the competency of extension agents were years of experience ($p>0.089$), educational level ($p>0.002$), and knowledge ($p>0.000$). The study therefore recommends that specific training related to the areas discovered from the research should be incorporated into the extension agents' curriculum activities. Extension agents should also be given opportunities to improve their knowledge and competency by attending seminars and workshops in research institutions.

Keywords: Competence, Knowledge, Climate smart agricultural practices, Extension agents

Introduction

Most individuals in Sub-Saharan Africa, particularly those in West Africa consider rice to be a necessary diet, as the consumption of cereals like millet and sorghum has declined and that of rice has risen due to population growth, changes in consumer priorities, and urbanization (Zalkuwi, 2019) [38]. In Nigeria, rice is also one of the cereal crops, in that it has substantially contributed to the agricultural sector, and gained cash crop status, resulting in up to 80% jobs for residents of the producing area (Bello, Baiyegunhi, & Danso-abbeam, 2020) [8].

However, the country's rice production statistics reveal that the country needs 7,000,000 metric tons more than the 5.8,000,000 metric tons it currently produces (Udemezue, 2018) [36]. This implies that rice production needs to increase to minimize hunger and insecurity of food in the future. Rice production faces numerous obstacles, the most significant of which is climate change, as most production activities are rain-fed. One of the research conducted by Anyaoha *et al*. (2019) [5] pointed out that most rice farmers are faced with the challenges of changes in rainfall patterns, pests and diseases, weed infestation, and flooding which are all attributes of climate change. More so, most farmers lack the information capacity resources needed to minimize climate change's impact on rice production. According to Rahman, (2012) [32], one of the issues experienced by rice farmers was lack of awareness about IPM (integrated pest management) and sufficient training in IPM practice, which may result in reduced yield. Therefore, an increase in rice production can occur by incorporation and utilization of CSAPs into their production activities as this will assist in mitigating the inimical effects of climate change. Tiamiyu, Ugalahi, Fabunmi, Sanusi, Fapojuwo, & Shittu, (2018) stated that food adequacy can be guaranteed despite inadequate weather through Climate-Smart Agricultural (CSA) practices. This is realized through a variety of soil management practices that store carbon in the soil, minimize greenhouse gas emissions, and contribute to the intensification of production (FAO, 2013) [15]. Likewise, providing farmers with greater agricultural loans may result in increased rice harvest (Nwankwo & Chigbo, 2019) [25]. Several studies have shown that farmers are responding to shifting climate situations by adopting certain climate smart agricultural practices such as changing planting season, crop and livestock diversification among others (Danso-abbeam, Ojo, Baiyegunhi, & Ogundeji, 2021; Mukhamedova, & Pomfret, 2019; Asfaw, Suryabhagavan, & Argaw, 2018) [12, 24, 6]. However, the uptake of this possibly advantageous measures is frequently low (Arslan, McCarthy, Lipper, Asfaw, & Cattaneo, 2014; McCarthy, Lipper, Branca, & Security, 2011) [7, 22]. This was further ascertained by a number of researchers who have observed limited climate adaptation practices uptake and utilization (Akinnagbe & Irohibe, 2014; Ali & Erenstein, 2017; Tripathi & Mishra, 2017) [3, 4, 35]. More so, Tiamiyu *et al*., (2018) [34] pointed out that the adoption rate of CSAPs in guinea savannah region is generally very low. The low adoption rate can be ascribed to the knowledge of humans, their flexibility in adapting to the climate change negative consequences (Olorunfemi *et al*., 2019) [30] as well as inadequate information communicated to the farmers through the extension agents. Musafiri *et al*., (2022) concluded that one of the crucial factors that determine the adoption of CSAPs is farmers contact with extension agents. Extension organizations globally are characterized with the problem of professional competencies among their employees (Man *et al*., 2016). Nevertheless, (Issahaku, 2014; Hoffman, 2014; Kshash, 2018) noted that effectiveness of extension service can be determined via the degree of competencies of the extension agents in the technologies they disseminate, as well as the methods of communication used to reach farmers. This implies that there is a need to probe more about the knowledge and the competency level of the extension agents, in order to increase rice production which is in line with the food sufficiency aim of the country coupled with the Sustainable Development Goals (SDGs) of zero hunger and climate action.

Methodology

The study was conducted in North central, Nigeria representing one of the six geopolitical zones in Nigeria. Areas of Nigeria which are generally referred to as belonging to the Northcentral are: Kwara, Benue, Niger, Plateau, Kogi, Nasarawa and (Abuja). It covers latitude 7^0 00'-11^0 30' north of the equator and longitude $4^0$00'-$11^0$00' east of the Greenwich meridian. The economy is mostly agrarian suitable for: growing of crops such as rice, maize, beans, and tomatoes; livestock such as sheep goat and cattle; and fisheries activities. Average annual rainfall ranges between 1,200mm and 1500mm while temperature is high almost throughout the year except during hamattan period which begins in November and ends in February. The weather is cold and dry during the period coupled with hazy atmosphere and dust particles flowing around. The rainfall pattern is predicted with increase of 0.58mm of rainfall per annum from 2013 to 2042. Presently, it has 20 ADPs out of 37 with few extension agents to cover millions of farm families in the agricultural value chain. Ecologically, North Central zone is situated in the Guinea savanna region of the country (National Bureau of Statistics, NBS, 2005), however its vegetation cut across the three savannah belts (Guinea, Sudan and Sahel) and this is one of the reasons why both cereals and roots crops are prominent in this ecological zones.

Sampling procedure

A multistage sampling procedure was employed in selecting the extension agents. The first stage was a random selection of Kwara, Kogi, and Niger States out of the seven states within the area. Stage two involve purposive selection of zone B out of the four ADP strata in Kwara state, zone A out of the three ADP strata in Niger state, and zone D out of the four ADP strata in Kogi state due to their peculiarity in rice production. The third stage was a proportionate sampling of 40% of blocks from each of the selected ADP strata to give a total of 7 blocks (Edu, Patigi, Ibaji, Idah, Lavun, Edati, and Mokwa). The fourth stage was the selection of all the village extension agents, Zonal Extension Officers (ZEOs) and Block Extension Officers (BEOs) to give a total of 88 respondents.

A structured questionnaire divided into three sections was used to collect the data, the first for their socioeconomic characteristics; the second is for the knowledge of extension agents on CSAPs. Respondents were exposed to a list of perceived knowledge of extension agents on CSAPs and this was measured using five point Likert-type scale of strongly agree (5), agree (4), undecided (3) disagree (2) and strongly disagree (1). These values was summed up to 15 and divided by 5 to give a mean score of 3.0 which was used for decision rule. Knowledge statement was categorized as high and low knowledge level. The last section is for the importance and competencies in various CSAPs. Respondents were provided with a list of perceived competencies and were rated on a three-point Likert's scale thus; high (3 points), moderate (2 points), and low (1 point). The possible maximum score for each respondent was 153, while the minimum was 51. A reliability test was measured in the form of internal consistency on knowledge and competence and the Cronbach's alpha was 0.876 and 0.934 respectively.

The Probit regression model was employed to determine the key factors influencing the level of participation of the EAs in disseminating CSAPs. This model is appropriate because the dependent variable to be evaluated is dichotomous. The model is as defined below with 'i' indexed for each EA.

$$y_i^* = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + e_i$$

y* = is the latent variable that defines the level of competence of extension in disseminating CSAPs. y* is linked with the observed level of competence such that y = 1(high competency level) if y*> 0, and y = 0(low competency level) if y*≤ 0. The level of competence was determined using the average mean score such that 1 was assigned to EAs with competence scores above the mean and zero (0) otherwise.

The explanatory variables (Xs) are as defined:

X_1= Age of the agricultural extension agent (years)

X_2= Sex (Dummy 1 if Male, 0 if Female)

X_3= Education qualification (years)

X_4= Years of experience

X_5= No of training

X_6= Knowledge of Extension agents (1 if Knowledge is high, 0 if Knowledge is low)
β_s =parameters to the estimated.
e_i =error term

Results & Discussion

Socio-economic characteristics of the Extension agents

The results in Table 1 shows that majority of the extension agents (E.As) were males (95.5%), which insinuates that there is gender imbalance among staff in Northcentral ADPs as it is male-dominated, and this may be due to unequal distribution during recruitments. This agrees with the report of Adisa, (2015) [2], who also mentioned that extension personnel in north-central, Nigeria are male-dominated. Their mean age was 48 years, with majority being married (95.5%), and had attained one form of tertiary level of education (85.2%). Implying that greater percentage of the extension agents are informed and enlightened, which could enhance their thinking ability and encourage them to have more training in order to be competent in various CSAPs. This agrees with Oladele, (2011) [27] who affirmed that educational qualification influences the skills and knowledge of extension agents as regard climate change and agricultural issues. Also, mean years of experience was 21years. The mean number of farmers/ farm families per extension workers was 1:1936, which is high compare to the 1:1000 number of extension agent to farm families ratio recommended by FAO. This is in line with the findings of Haruna, (2013) [16] who reported that extension to farm families ratio in Kwara and Kogi and Niger state was relatively higher than the FAO standard. Average number of in-service training attended on CSAPs in the last three years was 5. Majority of the E.As had between 1-4 contacts with research agencies which implies that majority of the extension agents had low contact and so limit them from getting adequate training on CSAPs needed by the rice farmers and also financial support to implement the practices.

Table 1: Summary of distribution of respondents' socio-economic characteristics

Characteristics	Category	Frequency	Percentage	Mean
Respondents' age (years)	30 – 37	4	4.5	48±7
	38 – 45	30	34.1	
	46 – 53	33	37.5	
	>53	21	23.9	
Sex	Male	84	95.5	
	Female	4	4.5	
Marital status	Married	84	95.5	
	Single	4	4.5	
Highest level of education	Primary	2	2.2	
	Secondary	11	12.5	
	Tertiary	75	85.2	
Years of Professional Experience	5 – 15	35	35.2	21±9
	16 – 26	18	17	
	27 – 37	29	46.6	
	>37	6	1.1	
Number of in-service training on CSA practice	1 – 6	69	78.4	
	7 – 12	12	13.6	5±5
	13 – 18	5	5.7	
	19 – 25	2	2.3	
Number of Farm Families Per Extension Agents	1 – 6700	82	93.18	
	6701 – 13401	5	5.68	1936±6690
	>13401	1	1.14	
	19 – 25	2	2.3	
Number of contact with agency				
1 – 2	45	51.13		
3 – 4	40	45.45		
>4	3	3.40		2±1

Source: Field survey, 2020

4.1 Knowledge Level of the Extension Agents on Climate Smart Agriculture

Table 2 presents the knowledge level of extension agents across all the climate smart agricultural mechanisms. The table showed that above half of the respondents (53.4%) had high knowledge in soil smart mechanism, while 46.6% had low level knowledge. Similarly for crop smart mechanism, majority of the extension agents (56.8%) knowledge was high and 43.2% fell within those with low knowledge level. 52.3% of the E.As had low knowledge level on water smart mechanism, and 47.7% had high knowledge level. Above half (54.5%) of the extension workers had low level of knowledge on weather smart mechanism and less than half (45.5%) of the extension workers fell within those that have high knowledge. The table finally showed that on knowledge smart mechanism, larger percentage of the E.As (62.5%) fell within those that have high knowledge while 32.5% had low knowledge level. This implies that there were disparities in the level of knowledge in the various CSA components, which could be attributed to inadequate of training in this CSA practice. Therefore there is need for extension organizations to improve and enrich the extension workers' knowledge in the various fields identified by exposing them to seminars and workshops that include practical illustration of the CSAPs, thereby building their capacity and makes them efficient in the course of rendering their extension duties.

Table 2: Distribution of Extension agents by Knowledge Level

Categories /	Frequency	Percentage
Soil smart mechanism		
Low(<40.55)	41	46.6
High(>40.55)	47	53.4
Crop smart mechanism		
Low (<68)	38	43.2
High (>68)	50	56.8
Water smart mechanism		
Low (<31.45)	46	52.3
High (>31.45)	42	47.7
Weather smart mechanism		
Low (<29.43)	48	54.5
High (>29.43)	40	45.5
Knowledge smart mechanism		
Low(<7.4)	33	37.5
High(>7.4)	55	62.5
Total	88	100.0

Source: Field Survey, 2020

Table 3 presents the items for which the extension agents had low or high knowledge based their mean score. In soil smart mechanism, the items for which the extension agents had highest mean score was on planting of cover crops which helps in retaining soil nutrient, increase soil organic matter and controls crop erosion ($\bar{x}$=4.44), Application of manure and compost helps to increases the soil nutrients ($\bar{x}$=4.42), use of urea deep placements helps to reduce nitrogen loss ($\bar{x}$=4.39), Mulching is a CSA management practice that buffers the soil against extreme temperature and therefore maintaining soil nutrients ($\bar{x}$=4.09), minimum tillage practice is a CSA practice used in breaking soil compacts and hardpans, increase water infiltration ($\bar{x}$=3.73). This implies that majority of the rice farmers are aware of the use of compost, minimum tillage among others in adapting to climate change. This conforms to the apriori expectations as (Yakubu, Akpoko, Akinola, & Abdulsalam, 2020) reported that minimum tillage and use of organic manure are the major practices used by rice farmers while planting of tress (agro-forestry) were rarely used in North-west, Nigeria

While the lowest mean score was on agro-forestry as a CSA practice that helps in water purification and water regulation ($\bar{x}$=2.47) and agro-forestry as a CSA practice that helps in fixing nitrogen ($\bar{x}$=2.66). This implies that extension agents had low knowledge in that area. This corroborates with the findings of Olorunfemi *et al*., (2020) who reported that extension agents in south west Nigeria had low competence in Agro-forestry such as Alley Cropping. Similarly, Yakubu *et al*., (2020) stated that planting of tress (agro-forestry) were rarely used in North-west, Nigeria.

Table 3: Knowledge of Extension agents on Soil smart mechanism

	Soil smart mechanism	Mean	Std. Dev.	Rank
a	Planting of cover crops helps in retaining soil nutrient, increase soil organic matter leading to increasing soil structure, stability and controls crop erosion.	4.44	.522	1st
b	Application of manure and compost helps to increases the soil nutrients	4.42	.582	2nd
c	Use of urea deep placement technique, where urea is made into briquettes(solid form) helps to reduce nitrogen loss compare to broadcasting methods of urea application and thus increase rice yield.	4.39	.668	3rd
d	Organic fertilizers application is a CSA practice used in increasing the soil nutrients , thus increase crop yield	4.27	.739	4th
e	In SSNM, fertilizer N management is identified through the use of the leaf color chart (LCC)	4.20	.628	5th
f.	Mulching is a CSA management practice that buffers the soil against extreme temperature and therefore maintaining soil nutrients and boost crop production	4.09	.721	6th
g	Site-Specific Nutrient Management (SSNM) is a technology, plant-need-based approach for optimally applying fertilizers such as nitrogen (N), phosphorous (P), potassium (K) to rice.	3.99	.719	7th
h	Use of compost help in protecting against erosion	3.88	.800	8th
i	Micro-dosing(efficient application of fertilizers in split - small but repeated -dosages based on assessment boost the crop yield	3.82	.917	9th
j.	Minimum tillage practice such as ripping is a CSA practice used in breaking soil compacts and hardpans	3.73	.723	10th
k	Use of compost also add to the soil nutrients	3.48	1.028	11th
l	Agro-forestry (i.e planting of trees) is a CSA practice that helps in controlling soil erosion	3.32	1.228	12th
m	Agro-forestry (i.e planting of trees) is a CSA practice that helps in fixing nitrogen and increase soil fertility by improving water infiltration.	2.66	1.123	13th
n	Agro-forestry (i.e planting890qqwertyiopas of trees) is a CSA practice that helps in water purification and water regulation	2.47	.994	14th

Table 4 present the knowledge statement of extension agents on crop smart mechanisms. The item for which the respondents had the highest mean score was planting of early maturing rice varieties ($\bar{x}$=4.31), Use of healthy young rice seedlings is a CSA approach that aids rice germination and increase rice yield ($\bar{x}$=4.24), Planting of pest and disease-resistant rice varieties ($\bar{x}$=4.07), Primed crops emerge fasters, more completely, produce more vigorous seedlings, flower and mature earlier and yield better than non primed ($\bar{x}$=4.06), Using DSR (direct-seeded rice) method help in reducing labour, energy, preparing field, emission of green house-gasses and transplanting cost ($\bar{x}$=3.99), Crop rotation with legumes serve as a CSA solution for weed management ($\bar{x}$=3.83), and mixed cropping practice help in fixing nutrients ($\bar{x}$=3.76). This implies that farmers in the study area have a good knowledge and practice the use of planting of early maturing rice varieties, pest and disease resistant varieties, mixed cropping among others. This implication of this is that majority of the farmers in the study area are naïve about the use of improved rice variety in adapting to the inimical effect of climate change. This is corroborated by the findings of Mbah & Ezeano, (2016) who stated that rice farmers in North central, Nigeria majorly adopt planting of improved rice variety as a adaptation mechanism to climate change. In another study, Onyegbula & Oladeji, (2017) reported high knowledge on use of mulching, appropriate use of fertilizer, mixed cropping, improved tillage practice and planting of early maturing variety among rice farmers in Ekiti, Ebonyi and Niger state, Nigeria.

Table 4: Knowledge of Extension agents on Crop smart mechanism

	Crop smart mechanism	Mean	Std. Dev.	Rank
a.	Planting of early maturing rice varieties is a CSA practice that increase rice yield	4.31	.650	1st
b.	Use of healthy young rice seedlings is a CSA approach that aids rice germination and increase rice yield.	4.24	.695	2nd
c.	Planting of stress- tolerant rice varieties is a CSA practice that increase rice yield	4.08	.592	3rd
d.	Planting of pest and disease-resistant is a CSA practice that increase rice yield.	4.07	.770	4th
e.	Primed crops emerge fasters, more completely, produce more vigorous seedlings, flower and mature earlier and yield better than non primed.	4.06	.554	5th
f.	Planting of leguminous crops helps in protecting the soil against any kind of erosion	4.00	.743	6th
g.	Using DSR (direct-seeded rice) method help in reducing labour, energy, preparing field, emission of green house-gasses and transplanting cost.	3.99	.869	7th
h.	Retention of crop residues or other surface cover increases water content and reduce runoff by evaporation	3.92	.791	8th
i.	Crop rotation with legumes serve as a CSA solution for weed management	3.83	.805	9th
j.	Mixed cropping help in fixing nutrients like phosphorus, nitrogen and potash into the soil and thus increase yield	3.76	1.017	10th
k.	Construction of terraces that are reinforced with drought tolerant fodder grasses strips are used in increasing soil nutrients	3.67	.723	11th

Source: Field Survey, 2020

Result in Table 5 is for knowledge of extension agents on water smart mechanism, the item for which the respondents had the lowest mean score was on use of Alternate-Wet-and-Dry (AWD) technique aid farmers in monitoring the water level of the crop ($\bar{x}$=1.92), In AWD technique, a field is flooded and allowed to dry alternately instead of remaining flooded continuously throughout season ($\bar{x}$=2.19).
While, highest mean score was on construction of water channels in farm as it helps in reducing effect of flood ($\bar{x}$=4.08), furrow irrigation ($\bar{x}$=3.92), multiple inlet irrigation which reduce water waste due to runoff ($\bar{x}$=3.67) and planting of basins method use for capturing rain water $\bar{x}$=3.40. The implication of this is that majority of the rice farmers use construction of water channels, basins in collecting water as resilience to climate change, but low level of awareness of use of AWD technique in adapting to climate change. This conforms to the findings of Abaje *et al*., (2014) who identified the most significant climate change adaptation strategies used by rice farmers were water harvesting.

Table 5: Knowledge of Extension agents on Water smart mechanism

	Water smart mechanism	Mean	Std. Dev.	Rank
a	Construction of water channels in farm helps in reducing effect of flood as a result of climate change on farm	4.08	.791	1st
b	Furrow irrigation involves pumping water into trenches on furrows dug in between rows of crops	3.92	.761	2nd
c	Multiple inlet irrigation reduce water waste due to runoff, and wear on levee gates due to over pumping	3.67	.867	3rd
d	Planting of basins is method use for capturing rain water and therefore reduce crop failure due to unreliable rainfall	3.40	1.000	4th
e	In AWD technique, shallow flooding is done for the first two weeks after transplanting so as to help the plant in recovering from shock and suppresses weed.	2.83	1.297	5th
f	AWD technique entails maintaining shallow pond from heading to the end of flowering stage time when the crop has high growth rate and when the rice crop is very sensitive to water-deficit stress.	2.75	.925	6th
g	Alternate-Wet-and-Dry (AWD) irrigation technique is a process where rice producers prevent the field from constant flooding by ensuring that it dries intermittently throughout the rice lifecycle.	2.68	.865	7th
h	In AWD, a field is flooded, allowed to dry alternately instead of remaining flooded continuously throughout	2.19	.814	8th
i	Alternate-Wet-and-Dry irrigation technique helps to save water usage and reduce methane emission	2.09	.737	9th
j	Alternate-Wet-and-Dry technique aid farmers in monitoring the water level of the crop	1.92	.485	10th
k	Alternate-Wet-and-Dry technique entails keeping irrigation water applied whenever the perched water table falls to about 15cm below the soil surface during all other periods	1.92	.715	10th

Result on the knowledge of extension agents regarding weather smart mechanism are presented in Table 6, and the items for which they had the highest mean score was on ‘‘Early warning system is a climate information service (CIS) that helps in reducing the effect on climate change on farmers’($\bar{x}$=4.13), and ‘‘CIS such as seasonal forecast is a

CSA practice aimed to improve farmers' access to relevant information on weather and climate'' ($\bar{x}$=4.13)

While, the items for which they have the lowest score was on decision support system (DSS) tools which analyzed, interprets information and finally uses the analysis to recommend the most appropriate action for sustaining maximum yields ($\bar{x}$=2.32), DSS tools are used to copy crop management practices on specific crop yields and subsequently generates climate-smart agro-advisory ($\bar{x}$=2.44) and digital agriculture technology such as yield prediction ($\bar{x}$=2.64). This implies that the extension agents in the study area are not totally abreast with climate/ weather information, digital agriculture and insurance policies that can help farmers to make informed decision. This conforms to the findings of Olorunfemi *et al*., (2019) who reported that extension agents in southwest, Nigeria had low involvement in timely dissemination of weather information, farm insurance initiative. This could be attributed to their low level of knowledge in such initiatives.

Table 6: Knowledge of Extension agents on Weather smart mechanism

	Weather smart mechanism			
a	Climate information services (CIS) such as seasonal forecast is a CSA practice aimed to improve farmers' access to relevant information on weather and climate that help in mitigating climate change	4.13	.675	1st
b	Early warning system is also climate information service that helps in reducing the effect on climate change on farmers.	4.13	.658	1st
c	Climate information services (CIS), develop farm management capabilities in a context of climate change, raise awareness of the practical utility of agro-weather information.	4.00	.695	2nd
d	Financial services such as credit and loans is a CSA practice used in increasing productivity and income	3.92	.937	3rd
e	Digital agriculture technology entails providing integrated and market advisories to farmers which helps farmers to make decisions on what to grow, when to plant, harvest and where to sell their produce.	3.34	1.092	4th
f	Climate information services (CIS) such as seasonal forecast is a CSA practice aimed to improve farmers' access to relevant information on weather and climate that help in mitigating climate change	4.13	.675	1st
g	Despite rising climatic variability, new index-based weather insurance products may boost farmers' ability to invest in agriculture.	3.00	.884	5th
h	Digital agriculture technology such as yield prediction involve the use of internet (remote sensing) to predict crop yields	2.64	.860	6th
I	DSS gathers, arranges, and unifies all forms of information essential for crop production.	2.49	.858	7th
J	Decision Support Systm (DSS) tools are used to copy crop management practices on specific crop yields and subsequently generates climate-smart agro-advisory	2.44	.658	8th
K	DSS analyzes and interprets data and uses the results to recommend the best course of action for maintaining maximum yields.	2.32	.929	9th

Source: Field Survey, 2020

The results of the responses of the extension agents to the two knowledge questions regarding knowledge smart are presented in Table 7 and the items for which they had the highest mean score was on ''farmer to farmer learning is one of the CSAPs'' ($\bar{x}$=3.91), Off-farm risk management kitchen garden is a CSA practice that helps farmers to diversify their resources $\bar{x}$=3.50. This implies that the extension agents had a low to moderate awareness on all the CSAPs. Therefore, this makes them moderately effective in disseminating CSAPs to the farmers. This is in agreement with Ebenehi, Ahmed, & Barnabas, (2018) who reported low to moderate level of awareness on climate change adaptation among farmers, and that 79.25% of farmers had extension worker as their source of information. Oladele & Tekena, (2010) [28] stated that lack of knowledge among extension agents can deterred farmers to adopting OA (organic agriculture) practices. That is, when extension professionals have more information on an expertise and this expertise is shared with organic farmers, the adoption of OA is more likely to increase. Thus, this makes them effective in dissemination of the technology.

Table 7

	Knowledge smart mechanism			
a	Farmer to farmer learning is one of the CSAPs	3.91	.978	1st
b	Off farm risk management kitchen garden is a CSA practice that helps farmers to diversify their resources.	3.50	.897	2nd

4.2 Competencies profile of Extension agents on Climate-smart agricultural practices

Table 8 reveals that a little above half (51.1%) of the respondents had a low level of competence on CSAPs disseminated to rice farmers. Implying that the majority of the extension agents (E.As) tend to have low level of performance that is they are inefficient in delivering CSAPs to the rice farmers. Therefore there is a need to improve their competencies in various Climate-smart agricultural practices, as this will increase their knowledge and skills in the practices, allowing them to effectively perform their extension and advisory roles and at the same time improve farmers' ability to adapt to climate change. This is in consonance with the report of Olorunfemi *et al*.,(2020) [31] who stated that the competence level of extension agents in southwest was very low in several content of the climate-smart agricultural initiatives.

Table 8: Competencies profile of Extension agents on Climate smart agricultural practices

Competency level	Frequency	Percentage
High (>97.5)	43	48.9
Low (<97.5)	45	51 .1
Total	88	100.0

Source: Field survey, 2020

4.3 Factors Influencing the Competencies Level of Extension agents

Table 9 shows the probit regression analysis between selected personal characteristics and competencies of extension agents. The result shows that the extension agents' years of experience (p>0.002), level of education (p>0.089) and knowledge of extension agents (p>0.073) had a positive and significant relationship at 1% and 10 % levels of probability respectively. The remaining variables such as age, sex, number of training had no significant relationship with the extension agents competency level. The years of experience (p>0.002) showing a positive significant relationship with the extension agents competency level suggests that extension agent's job performance on CSAPs used by rice farmers will increase with increase in number of professional years of experience. This is because the E.A's could acquire more knowledge on CSAPs and how to mitigate the effect of climate change as their years in service increase. This is in line with the Nwaogu & Akinbile, (2018) [26] who reported that level of experience has a positive significant effect on the competencies of extension agents in Oyo and Ogun States. More so, level of education (p>0.089) shows a positive and significant relationship with extension agents competency level on CSAPs used by rice farmers, This implies that increase in level of education results in increases in competencies of extension agent. This is due to the fact that increase in level of education could make an individual to be knowledge receptive, thereby building their competencies in their field. This is in line with the findings of Olorunfemi *et al*., (2018) who reported that extension agents with a greater degree of education are more likely to be highly competent than their less educated counterparts, because education has been shown to raise individual levels of innovativeness and expertise. Therefore, extension agents should be encouraged to further their education in order to remain enlightened and improve their competencies. Knowledge of extension agents on CSAPs (p>0.000) had a positive and significant impact on the competency of the extension agents. This implies that increase in knowledge of extension agents on CSAPs, will lead to increase in competence of extension agents. This is because, the knowledge gained through training, will infer to increase in abilities and skills of the extension agents. This will automatically leads to increase in effectiveness/job performance of extension personnel in disseminating CSAPs. This conforms to the findings of Dormita & Bautista, (2016) [13] reported that effectiveness of extension service delivery is highly dependent on the adequacy of extension workers and technical experts on postharvest handling. Also, Oladele & Tekena, (2010) [28] stated that the effectiveness of extension service delivery is heavily reliant on the knowledge of extension agents on the various agricultural innovations they disseminate to farmers. The implication of this is that extension organizations need to strategize their system of training the extension agents so as to increase their knowledge on the CSA practice, thus resulting in increase in their performance.

Table 9: Results of Probit regression on the relationship between selected personal characteristics and competencies of extension agents

Variables	Coef.	Std. Err.	p>z value	Decision
Age	-0.019	0.025	0.443	NS
Sex	-0.107	-0.107	0.868	NS
Education qualification	0.198	0.117	0.089*	S
Years of experience	0.062	0.019	0.002***	S
No of training	-0.0008	0.034	0.816	NS
Knowledge of the Extension agents	0.0.18	0.010	0.073*	S
cons	-3.394	2.180	0.120	
Prob> chi2 = 0.0003				
LR chi2 (4) = 21.15				

Note: ***, * represent statistical significance at 1%, & 10%.
Field survey, 2020

Conclusion& Recommendations

Climate change remains a constant factor influencing agriculture productivity and extension agents remains one of the major source of information to farmers. It therefore becomes pertinent to assess the knowledge and the technical competence of extension agents on CSAPs

Hence, monthly or quarterly in-service training programs should be organized for the extension agents in order to enhance their knowledge and competency thereby ensuring effective dissemination of information. It can also be viewed from our results that competencies level of extension agents is a function of their level of education and years of experience. The policy implication of this for the extension agent organization is that when choosing the best applicant for a certain project, years of experience of the personnel should be considered. However, when designing trainings in the extension organization, newly employed personnel should be considered first. More so, extension agents should be encouraged to further their education in order to remain enlightened and improve their competencies.

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