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The Effect of Advanced Agricultural Technology on Members and Non-Members of Cassava Producer Cooperatives in Imo State, Nigeria.

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ABSTRACT

This study was carried out to comparatively determine the effect of advanced agricultural technology on cassava producer co0-operatives and non-cassava producer cooperatives in Imo State. Random sampling procedure was used to select 240 respondents comprising of 120 members and 120 non-members. A structured questionnaire was used to collect data. Data collected were analyzed by using descriptive statistics, Z-test, and adoption rating. The results from the study showed that the most important source of information on cassava production among cassava farmers cooperatives in the study area was extension agents (23.9%) followed by radio (22.5%), other farmers (19.8%), and farm leaders (14.7%). Non-members had radio as the most important source with 22.5% followed by other farmers (17.2%) and farmers' leader (16.7%). This implied that radio, other farmers, extension agent and farmers' leader were the preferred sources of information on cassava production among cassava farmers in the study area. The level of adoption was above 70% in 7 out of the 10 improved cassava production technologies. This included use of improved stem cuttings, minimum tillage, stem dressing, fertilizer application and integrated pest management, and use of crop residues as manure. On an average, 76% of members adopted improved cassava production technologies compared to 57% of non-members. Test of significance showed that adoption of improved cassava production technologies by members was significantly higher than that of non-members in the area. It is recommended that business development support should be given to Cassava Farmers Associations to facilitate access to market information. In addition, researchers and extension specialists should work with cassava farmers using innovative approaches such as Farmers Field School to enhance better up take of improved cassava production technologies.

Keywords:Agricultural Technology, Members, Non-Members, Cassava P Cooperatives

INTRODUCTION

Agriculture occupies a key position in the Nigerian economy judging by its critical role of providing food security, provision of employment, revenue generation and provision of raw materials for industrial development [1,2]. The Nigeria population according to the 2006 census was estimated to be about 140,003,542m. About 75% of this estimated population is directly or indirectly dependent on agriculture for their livelihood [3,4,5]. Due to an ever- increasing demand for food as a result of population growth and a wide variety of nutritional requirements, the existing gap between food and population expansion, cultivable land and labour has significantly increased [6,7,8,9]. Despite these indicators, Nigeria's agricultural performance in recent times remains inadequate and indeed far less than its potentials. Food demand exceeds the supply thus leading to large importations of food, which further erodes the economies foreign exchange [10,11,12]. Between 2020 and 2021, the value of imported agricultural products went up by 140.47 percent. In the first quarter of the year 2021 it spiked by 18.37 percent compared to the last quarter of 2020. Precisely, Nigeria's balance of trade for food products between 2020 and 2021 was N503 billion. [13] and this trend has not

yet changed. At the heart of this inadequacy of the sector lies the foremost problem of low productivity due to the use of crude tools and traditional production techniques [14,15,16,17]. In order to address these challenges, there has been increased effort towards the formation of agricultural cooperatives [18,19,20]. It is envisaged that collective action, through a cooperative would enhance the effectiveness of agricultural production and marketing of farm products [21,22,23]. A major area where agricultural cooperatives are mostly affected is in the use of advanced technologies. Improved crop varieties and animal breeds have the ability to geometrically increase output and farm revenue. Improved farm practices such as artificial insemination, crop rotation, minimum tillage, soil testing and getting suitable inorganic fertilizers and pesticides have led in improving the productivity of farmers cooperatives [24,25]. The development of agricultural technology in Nigeria led to the creation of agricultural technology centres or agricultural research institutes; and the major role is to develop improved seeds of crops that are early maturing, high yielding, resistant to pests and diseases and are adaptable to local environment [26,27,28,29,30,31]. The research gave rise to improved cassava varieties such as TMS 30572, TMS 4(2) 1425, maize (TZESRW) Cowpea (TAR 48) Rice (ITA 150) and Sorghum (KSV 12). However, low adoption rate means that new technologies have been partially successful.

Statement of the Problem

Improved agricultural production technology has been widely recognized as a critical input for increasing food production in the country. In view of this, efforts have been made by the Government of Nigeria to ensure that farmers cooperatives across the country access improved production technology through extension services. Farmers are being encouraged to form cooperative associations to enhance adoption of improved cassava production technology and increased income through better access to extension services and critical farm inputs. On the basis of the above premise, there is a probability that cooperative members adopt more recommended practices and deliver better output with improved access to extension services and credit. On the other hand, it is also possible that there is no difference in the performance of both members and non-members and farmers associations exist in nomenclature only and are not involved in actual delivery of services that add value to their members. As far as cassava production in Imo State is concerned, there is paucity of data validating or rejecting the premise that cooperative members adopt agricultural innovations faster than non-members. It is against this backdrop that the study investigated the effect of advanced agricultural technology on production co-operative programmes in Imo State and the level of adoption for members and non-members of Cassava Farmers Associations in Imo State.

Objectives of the Study

The broad objective of the study is to compare the effect of advanced agricultural technology on cassava producer cooperatives and non-cassava producer cooperatives in Imo State, Nigeria. The specific objectives of the study are to:

I. Examine the extent of adoption of improved cassava production technologies among members

and non-members.

II. Compare the output of cassava per hectare of members and non-members

Research Questions

It is anticipated that the study would provide answers to the following research questions:

I. What is the extent of adoption of improved cassava production technologies among members and non-members?

II. What is the output of cassava per hectare among members and non-members in the study area?

Statement of Hypothesis

HO_1: There is no significant difference in the adoption of improved cassava production technologies by members and non-members of Cassava Farmers Associations.

HO_2: There is no significant difference in the output per hectare among members and non-members of Cassava Farmers Associations.

Significance of the Study

The significance of this study cannot be overemphasized. It will benefit a lot of people as outlined below; Cooperatives: This study will help cooperatives to appreciate the reason for their performance in improving agricultural production. This knowledge will thus help them to put in more effort to align themselves with the principles of cooperatives as the rewards are assured. Cooperative as a socio-economic entity will learn from this study the essence of collective activity which will help them to improve their agricultural activities and standard of living.

General Public: The general public will learn from this study the benefits of joining a cooperative society and the extra benefits they enjoy from the services of the extension workers that educate them on how best to improve their productivity through the adoption of improved technologies.

Government: The study will help the government understand better the contributions of cooperative societies in national development and encourage them in planning far-reaching agricultural programmes through the cooperative societies. Additionally, the government will know the various challenges that cooperatives encounter and aim towards assisting them in ameliorating these challenges.

Researchers: Since this study is expected to provide empirical data that will confirm or invalidate the premise that members of Cassava Farmers Associations in the study area are better than non-members in terms of adoption of improved cassava production technologies, it will act as a base for students carrying out research on similar topics.

Scope of the Study

The study examined the effect of advanced agricultural technology on cassava producer cooperatives and non cassava producer cooperatives in Imo State. The content of the study was narrowed to a comparative analysis of the adoption of agricultural technologies by cooperatives and non-cooperatives and the effect of the technologies on the yield of cooperative farmers and non-cooperative farmers. It sought to ascertain the number of available agricultural technologies such as improved stem cuttings, use of tractors, legume-cassava rotation, organic manure, mulching, etc adopted by cooperative and non-cooperative cassava farmers in the

study area. Also, the study determined the effect of advanced production on the output per hectare of the cassava farmers. The study was limited to the Owerri agricultural zone of Imo State. The study was carried out between September 2021 and February 2022 and analyzed the productive activities of the farmers in the 2020 – 2021 planting periods. The choice of the two planting seasons was borne out of the knowledge that farmers who have not been using advanced agricultural technologies still cultivate cassava as a biennial crop.

Limitations of the Study

The following challenges were encountered in the course of gathering information and data necessary in accomplishing this research work.

i. Some respondents were unwilling to release the necessary information to the researcher. The researcher was able to gather the needed information from the respondents though it actually took him some time to convince them on the ability of the researcher to manage the disclosed information. Some respondents made financial demands before filling out the questionnaire as they thought the researcher was working for the government and thus must have been handed huge sums of money for the information gathering. However, the researcher was able to set the records straight and they cooperated.
ii. The researcher has to battle with role conflicts as sometimes his field activities was affected by vital family and work issues which made him rush back. However, with strenuous and diligent planning, he did achieve the objectives set out.
iii. The study was limited to the Owerri North L.G.A of Imo State. Hence the outcome of the study may not necessarily be a true reflection of what is obtained in the entire South-East region of the country.

REVIEW OF RELATED LITERATURE

Conceptual Review

Improved Cassava Production Technologies

Increase in cassava output, in recent times, has been driven mainly by increase in land area rather than an increase in productivity. A critical issue in achieving self-sufficiency in cassava production is the need to improve farmers' productivity. For example, improved varieties of cassava were specifically developed by NIHORT to solve the problem of low productivity and late maturity in cassava production. In addition, a number of them are resistant to African pests and diseases, such as the devastating Cassava Mosaic Disease to stem borers and termites. The results of a study on adoption of improved cassava varieties among small-holder farmers in South-western Nigeria show that farmers have responded appreciably to intervention programmes that promote the use of improved cassava varieties with an adoption rate of 68.7%. The mean yield of improved cassava varieties (1.60 t ha^{-1}) was significantly higher than the yield of the local varieties (1.15 t ha^{-1}) with a yield advantage of 38.7% [7,8,9].

Cassava Cooperative Farmers Associations

Conceptually, cooperatives are all types of business enterprises or organizations owned and controlled by members in the pursuit of

perceived mutual benefits and need actualization [8]. Farmer cooperatives are regarded as social instruments for making the market environment work for resource poor farmers who are faced with the challenge of limited and uncertain demand for the commodities they produce [12]. Cooperatives can serve as an avenue for the capacity building of farmers andalsohelptoreduceproductioncost sbyorganizingbulkpurchasesfortheir members.For example, Cassava Farmers Association of Nigeria is an umbrella association for cassava farmers across the country with the main objectives of supporting their members on production, processing, and marketing of cassava as well as supplying farm inputs at lower prices. The association has a strong presence among cassava farmers in Imo, Abia, Enugu, Ebonyi, Anambra, Rivers, Cross Rivers as well as the Western State.

Conceptual Framework

Figure.1 below is a diagram of the conceptual framework which identifies the effects of advanced technology on production cooperatives in the study area. In the context of the study the independent variable in the model includes:

i. Socio-economic variables which comprise of age, educational status, marital status, household size and farming experience.
ii. Institutional variables which comprise of contact with extension agents, credit received and membership of a farmer's cooperative society.
iii. Technological variables which comprise affordability, compatibility and complexity.

The dependent variable is the adoption of improved cassava production technologies. Technologies under consideration are the use of farm machines, improved varieties, modern farming methods, soil tests and the use of organic and inorganic fertilizers. The observable effects of adoption of improved cassava production technologies are increase in production output and a resultant increase in the income of the cassava farmers.

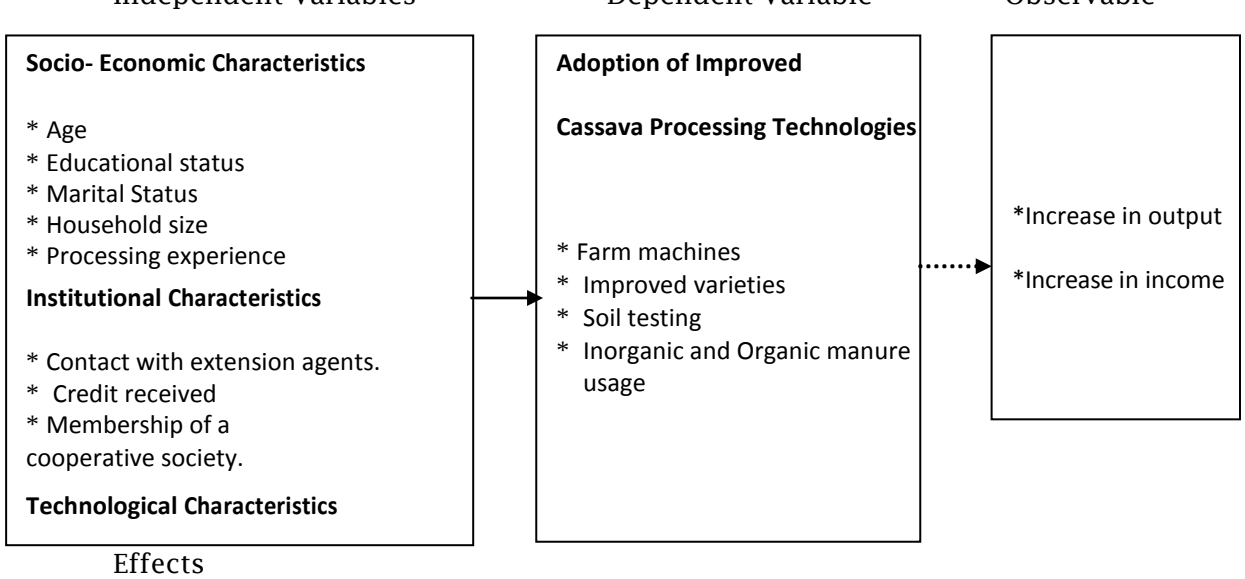

Fig 1:A model of socio-economic, institutional and technological factors influencing adoption of improved cassava production technologies by cooperative and non-cooperative farmers.

Theoretical Framework

Two theories on which this work is anchored on are the financial constraint theory and the group formation theory. As seen below, both theories shed light on the added importance cooperative societies play in the education and training of their members so that they can adopt improved technologies that will increase their productivity.

Financial Constraint Theory

This originated from Howitt Peter in 1973. The financial constraint paradigm is anchored on the theory in which farm households are perceived to be responsible for making decisions as to the type of crops to grow, how much of land area to allocate for the cultivation of each crop, and whether agricultural inputs will be used or not. A distinct feature of the model is the use of a single decision maker and the assumption that there is no divergence of views among household members [9]. A major disadvantage of this theory is that agricultural innovations are rarely adopted, and even if adopted, very late. Non cooperative farmers fit into this theory as they make individual decisions, most times without consultations. Cooperatives seek to address this anomaly. One major principle of cooperatives is continued education of members. Hence cooperatives are always on the lookout for modern innovations and technologies to adopt in their farm business so as to increase production [12]. This is one advantage of cooperative farmers over non-cooperative farmers.

Group Formation and Collective Decision-Making Theories

[8], originated this theory and asserted that all groups pass through 5 stages of development namely Forming, Storming, Norming, Performing and Adjourning. At the Forming stage, interested persons join the group and have a shared understanding of its purpose as a prelude to relationship building. The group enters the Norming stage when members begin to set goals and expectations while roles of leaders and other members are assigned at the Storming stage in preparation for action. The Performing stage is characterized by interdependence and flexibility as members reach a conclusion on issues discussed and carryout necessary actions in the interest of the group. The Adjourning stage is about the completion of agreed tasks and disengagement of members from the task and the group itself. The theory shows one of the advantages of agricultural cooperatives. They organize and sustain cooperation that advances common interest of the group in which they belong [13]. For example, cooperatives source for loans as a unit and on-lend to their members. They also arrange for group labour to help members meet their farming activities.

Empirical Framework

Socioeconomic Factors Affecting Adoption of Improved Cassava Production Technologies

Studies have shown that there is a relationship between socioeconomic characteristics of farmers and adoption of agricultural innovations. In a study on the determinants of sustainable

agricultural technologies, [20], observed that adoption of agricultural innovations is affected by socioeconomic characteristics of farmers. In the case of adoption of innovations in rice production, farmers' socioeconomic characteristic is not different. [15], in a study on factors influencing adoption of cereal crop production innovations in Benue State reported that the most important factors were extension contact, amount and use of credit and cooperative membership. The results obtained in a study on factors influencing adoption of irrigated rice production in North-east Nigeria showed that five factors namely farming experience, household size, gender, market availability and labour availability significantly influenced adoption of irrigated rice production [14].

Awareness of Improved Cassava Production Technologies

Access to information on a particular agricultural innovation is the first step toward the creation of awareness among farmers. Various sources of information are used to disseminate agricultural technologies depending on the type technology and level of education of the farmers. Younger and better educated farmers have more contact with sources of information than uneducated ones [17]. Personal and socio-economic characteristics are related to farmers' use of agricultural information. [19] found a significant relationship between farmers' use of agricultural information and educational qualification, marital status, income and preferred media. On the other hand, social participation, reliance on indigenous knowledge, tenancy status, gender, size of land cultivated, years of farming experience, part- or full-time farming and age did not correlate with agricultural information use. [10], reported a positive significant relationship between utilization of extension information and farmers' awareness, age, social participation, level of education, extension visits, access to radio and farm size. According to [16] information from friends and mass media such as radio and television were found to be most effective among cowpea farmers in Oyo State. In addition, there was a significant relationship between age, household Size, years of experience and effectiveness of information sources.

Cooperatives and Technology Adoption

Cooperatives are useful in overcoming access barriers to assets, information, services, and markets for high value products; they also assist some Nigerian small-scale farmers in solving land, labour and capital problems. Farmers' cooperative associations in Oyo State, Nigeria, function well as agent, medium, and target of change for agricultural extension in their domains [19]. Contrastingly, a survey by Savannah Conservation of [10] in Daudawa and Tafoki Local Government Areas of Katsina State, Nigeria reported that most farmers' groups in the study area were at their embryonic stage of development. They were found to be economically weak with low capacity in resource mobilization and collective action for improved access of members to farm inputs and technical services. However, recent studies are divided over the issue of effects of membership of cooperative associations on adoption of agricultural innovations and farmers' outputs. For example, membership of Farmers Associations was found to have no significant influence on the adoption of chemical pest control among cowpea farmers in Makarfi Local Government Area of Kaduna State, Nigeria [11]. In the words of [15], there was no significant relationship between membership

of social organization and adoption of fertilizer among rice farmers in Bende Local Government Area of Abia State, Nigeria.

Summary of Empirical Review:

Table 1 gives a snapshot of the empirical literature reviewed in this research work.

Table 1: Summary of Empirical Literature Review

S/N	Author(s)	Year	Area of Study	Title	Methodology	Findings
1	Jibowo, Farinde and Lawal	1994	Oyo State	Cooperative Society as an Extension Institution for Sustainable Rural Development	Multiple regression	Farmer's Cooperatives are positively significant in the adoption of innovations.
2	Onumadu,F. W	2002	Katsina State	Determinants of Agro-forestry Practices Among Small-Scale Farmers in Katsina State	Descriptive statistics	Younger and better educated farmers have more contact with sources of information than uneducated ones
3	Peter and David	2003	Honduras Hillsides	The Determinants of Adoption of Sustainable Agricultural Technologies	Tobit regression model	Adoption of farm innovations is affected by socio-economic characteristics of farmers
4	Savannah Conservation of Nigeria	2004	Daudawa and Tafoki, KatsinaState	Savannah Conservation of Nigeria (2004). Review and Evaluation of Group Development and Strategic Planning of Farmer Organisations in Daudawa and Tafoki, Katsina State	Descriptive statistics	Poor adoption of innovations by cooperatives, significantly influenced by their gestation stage of formation.
5	Omolehin, OgunfiditimandAdeniji	2007	MakarfiL.G.AofKadunaState	Factors Influencing Adoption of Chemical Pest Control in Cowpea Production among Rural Farmers in Makarf iL.G.A of KadunaState	Analysis of Variance	No significant relationship between cooperatives and technological adoption
6	Onyenweaku C.E., Okoye, B.C., and Okorie, K.C.	2007	Bende L.G.A. AbiaState	Determinants of Fertilizer Adoption by Rice Farmers in Bende Local Government Area of Abia State, Nigeria	Multiple regression	No significant relationship between cooperatives and fertilizer adoption

7	Fadiji and Atala	2009	Kaduna State	Relationship between Socioeconomic Characteristics of Farmers and Utilization of Agricultural Extension Information in Rural Areas of Nigeria	Pearson's Correlation Matrix and Pearson's Stepwise Regression	Positive significant relationship between socioeconomic characteristics and technological adoption
8	Ayoade A.R.	2010	Oyo State	Effectiveness of Information Sources on Improved Farm Practices among Cowpea Farmers in Oyo State	Multiple regression analysis	Positive significant relationship between socioeconomic characteristics and technological adoption
9	Odoemenem and Obinne	2010	Benue State	Assessing the Factors Influencing the Utilization of Improved Cereal Crop Production Technologies by Small Scale Farmers in Nigeria	Multiple regression analysis	Superior performance of cooperative members over non-cooperative members in terms of adoption of improved technology
10	Opara, U.N	2010	Imo State	Personal and Socio-Economic Determinants of Agricultural Information Use by Farmers in the Agricultural Development Programme Zones of Imo State, Nigeria	Multiple regression	Positive significant relationship between socioeconomic characteristics and technological adoption
11	Jamala, Sheu, and Garba	2011	Jimeta/ Yola	Evaluation of Factors Influencing Adoption of Irrigated Rice Production in Fadama soil of North Eastern Nigeria	Logistic regression model	Socioeconomic characteristics significantly influenced adoption of irrigated rice production

Gap in Empirical Literature

There is no consensus on the socioeconomic factors that affect the adoption of improved agricultural technologies. In relation to the sources of information and awareness of improved production techniques, it appears a comprehensive agricultural extension communication strategy can be built around the use of radio, extension agents and other farmers. It may be important to examine existing local structures among farmers for sharing of information on agricultural production and explore opportunities for making them work better as there exist a positive relationship between sources of information and benefits of services received by farmers. Also, researchers are divided on the role cooperatives play in adoption of agricultural technologies. This research gap in the study area needs to be addressed too.

METHODOLOGY

Research Design:

The object of the research was to assess the impact of cooperative societies on the adoption of advanced agricultural technologies.

A qualitative research design was used since this is an exploratory type of research [8]. A qualitative research is defined as a systematic subjective approach used to describe life experiences and give them meaning. It examines uniqueness of individual's lived situations whereby each person has own reality; reality is subjective [14].

Area of the study

The study is conducted in Owerri Agricultural Zone of Imo State, Nigeria. It is made up of eleven Local Government Areas (L.G.As). Agriculture is the predominant occupation of the people; farmers in the zone are mainly small holder farmers growing crops such as cassava, yam, melon, coco yam, okra, oil palm, vegetables and fruits and raising of poultry, pigs, sheep and goats.

Sources of data

Data used were sourced from both primary and secondary sources. The primary source of data for the study was the use of a structured questionnaire. Secondary sources of data were from published information gathered from libraries, journals and unpublished works of individuals relating to the topic.

Population of the study

The total of cassava cooperative-farmers and non-cooperative cassava farmers make up the population of the study. A list of registered cassava producer cooperatives in the zone was gotten from the Agricultural Development Project Owerri. From the list, there are 8 cassava producer cooperatives with a totality of 177 members. This is the population of cooperative farmers for the study.

Determination of sample size

The sample size of cooperative farmers was determined from the population of the study using Taro Yamane Formula

$$n = \frac{N}{1 + N(e)^2}$$

Where

n = Sample size
N = Population
e = Error of sample (0.05)

Thus to calculate $n = \frac{177}{1 + 177(0.05)^2}$

$$= \frac{177}{1 + 177(0.0025)}$$

$$= \frac{177}{1 + 0.4425}$$

$$= \frac{177}{1.4425}$$

$$= 122.7$$

An approximate 120 cassava cooperative farmers were selected. Also 120 non-cooperative farmers were also selected from the same area for the comparative study.

Sampling techniques

From the sample frame of members of cassava farmers associations in the area, one hundred and twenty respondents were selected using the systematic random sampling. From the areas where the respondents are selected, the same number of non-cooperative cassava farmers were randomly selected using the simple random sampling technique.

Methods of data collection

Data used were sourced from both primary and secondary sources. The primary source of data for the study was the use of a structured questionnaire. It was designed with the objectives and hypothesis of the study in mind. Secondary sources of data were from published information gathered from libraries, journals and unpublished works individuals relating to the topic.

Validity of the instrument:

Almost all measuring instruments contain some degree of error no matter how precise and careful the researcher maybe. Thus, effort should be directed towards ensuring a relatively high level of validation of the research instrument. As a result, the questionnaire was reviewed by the supervisor and two other lecturers in the Department and their inputs were incorporated.

Reliability of the instrument

The Cronbach Alpha method of reliability was carried out to test the instrument's level of reliability on a pilot test in Okigwe agricultural zone of the state. A significant value of 0.841 was recorded, therefore affirming its reliability

Model specification

The model for this research is adopted from Efobi and Osabuohien (2011) and Mafimisebi, *et al.* (2006), and the model is given as

$$Z = \frac{\bar{x} - \mu}{\sigma - \sqrt{n}}$$

where

$\bar{x}$ = sample mean

μ = population mean

σ = population standard deviation

n = sample size

Method of Data Analysis

The objectives were analyzed using descriptive statistics and the adoption ratio. The hypotheses were tested, using the Z-test.

DATA PRESENTATION AND ANALYSIS

Data Presentation

The data collected is presented below in accordance with the objectives and hypothesis of the study. Socioeconomic Characteristics of Members and Non-members of Cassava Farmers Associations. Table 2 presents the socio-economic characteristics of the cooperative and non-cooperative farmers in the study area. The socioeconomic characteristics considered were sex, age, household size, marital status, educational level, farming experience, etc.

Table 2. Distribution of Respondents by Socioeconomic Characteristics

	Cooperative Farmers		Non-Cooperative farmers	
Variables	Frequency (No)	Percentage (%)	Frequency (No)	Percentage (%)
A. Sex				
Male	44	37.7	35	29.2
Female	76	63.3	85	70.8
Total	120	100	120	100
B. Age (years)				
Less than 25	3	2,5	8	6.7
25 - 50	95	79.2	76	63.3
Above 50	22	18.3	36	30
Total	120	100	120	100
C. Marital status				
Single	6	5.0	14	11.6
Married	110	91.7	99	82.5
Divorced/ widow	4	3.3	6	5.0
Total	120	100	120	100
D. Family Size (No.)				
Less than 5	42	35	50	41.7
5-10	73	60.8	59	49.1
Above 10	5	4.2	11	9.2
Total	120	100	120	100
E. Educational Status				
Illiterates	24	20.0	36	30
Primary	55	45.8	49	40.8
Secondary and above	41	34.2	35	29.2
Total	120	100	120	100
F. Farm size (Ha)				
Less than 1.0	42	35	49	40,8
1.0 – 3.0	56.4	47	60	50
Above 3.0	21.6	18	11	13.2
Total	120	100	120	100
G. Farming Experience				
1 – 10 years	27	22.5	24	20.0
11 – 20 years	44	36.7	56	46.7
21 – 30 years	26	21.7	28	23.3
< 30 years	23	19.1	12	10.0
Total	120	100	120	100

Source: Field Survey 2022

From the table above, about 63% of the cooperative farmers were female while 70% of non-cooperative cassava farmers were female. among members and non-members. While 79% of cooperative farmers were between the ages of 25 – 50 years, 63% of non-cooperative farmers fall in the same category. A greater percentage of the cooperative and non-cooperative farmers (91% and 82% respectively) are married. Both categories also boast of a fairly large household size, with the cooperative farmers having 60.8% of the respondents with a household size of 5 – 10 persons while the non-cooperative farmers have 49 percent of the respondents have a household size of the great category. All but 20% of cooperative farmers and 30% of non-cooperative farmers have

some forms of formal education. About half of both respondents cultivate the farm of 1 – 3 hectares with years of experience in the cassava farming.

Average Yield Per Hectare Among Members and Non-members of Cassava Farmers Associations in Imo StateThe average yield of cassava produced per hectare among members and non-members of Cassava Farmers Associations in the study area is presented in Table 3

Table 3:Average cassava output among members and non-members of Cassava Farmers Cooperatives

Yield (Tonnes)	Members		Non-members	
	Frequency	%	Frequency	%
1 – 5	4	3.33	17	14.17
6 – 10	26	21.67	32	26.67
11 – 15	39	32.50	41	34.17
16 – 20	43	35.83	28	23.33
21 – 25	5	4.17	2	1.67
More than 25	3	2.50	-	-
Total	120	100	120	100

Source: Field Survey 2022

The table above shows that the majority of the cooperative farmers produced between 11 – 15 tonnes (32.5%) and 16 – 20 tonnes (35.83%) while the majority of the non-cooperative farmers produced between 6 – 10 tonnes (26.67%) and 11 – 15 tonnes (34.17%). Extent of Adoption of Improved Cassava Production Technologies Among Members and Non-Members.The analysis of the adoption of each improved cassava production technology among members and non-members of cassava farmers' cooperatives in Owerri Agricultural Zone is presented below.

Table 4: Adoption of Improved practices on Cassava Production by Members and Non-members of Cassava Cooperative Farmers

Improved Cassava Production Technology	Frequency and percentage of Adopters		Adoption Score	
	Members	Non-members	Members	Non-members
1. Tractor for land preparation	22(18.33)	24(20.0)	0.18L	0.20L
2. Improved stem cuttings	102(85.8)	86(71.67)	0.86H	0.72H
3. Minimum tillage	94(78.3)	55(45.93)	0.78H	0.46L
4. Stem dressing	87(72.5)	22(18.33)	0.73H	0.18L
5. Herbicide for land clearing	52(43.3)	34(28.33)	0.43L	0.28L
6. Herbicide for weed control after Planting	82(68.33)	49(40.83)	0.68A	0.41L
7. NPK fertilizer application	114(95.0)	89(74.17)	0.95H	0.74H
8. Crop residues as manure	78(65.0)	92(76.67)	0.65A	0.77H
9. Cassava-Legume rotation	69(57.5)	36(30.0)	0.57A	0.30L
10. Integrated Pest Management	86(71.6)	81(0.68)	0.72H	0.68A

Source: Field Survey 2022. Figures in parenthesis are percentages

H = High (71-100), A =Average (50-69),L= Low (49 and below).

Of the10 components or recommendations on improved cassava production technology the adoption index was high in 6, average in 2 and low in 1 among cooperative members and high in 3, average in 2 and low in 6 among non-members.

Data Analysis

Socioeconomic Characteristics of Respondents

Data on sex shows that there are more female cassava farmers in Owerri Agricultural Zone than male cassava farmers. Thus women are not just involved in playing supportive role in certain aspects of cassava production such as processing but areal so active in cassava production. This should be an important consideration in the planning, implementation and evaluation of development interventions in cassava production. In terms of the effect of gender on adoption of improved technologies, [14] found that gender is one of the factors significantly influencing adoption of improved technologies while [8] reported an indirect relationship between gender and adoption and intensity of use of chemical fertilizers. The mean age of the respondents was 44 years among members and 43 years among non-members. The age difference among members and non-members was marginal. The significance of the average age of the respondents in the study area is that the cassava farmers are still within the productive age group and can cope with the energy demand for cassava production. This finding was supported by [19] asserted that farmers within the productive age group of 20-45 years are likely to have the necessary physical stamina required to carry out farm operations. According to [14], farmers who adopted recommended practice on agricultural production were younger in age. Marital status is an important socioeconomic factor affecting adoption of agricultural technology. Farmers who are married are likely to have family labour force that can contribute to farm labour especially when the agricultural technology in question is labour intensive. [20] reported that large

percentage of married respondents among cocoa farmers is an indication of the fact that more members of the farm family will likely be available for crop production. The household size may be related to the number of household members that will be available for farm work. There is a probability that the larger the household size the greater the volume of farm work that will be absorbed by household labour. Mean years of experience in cassava production among members of cooperatives was higher than the number obtained for non-members. Farming experience can have positive or negative effect on adoption. With more experience, cassava farmers can be cautious and unwilling to take risk relating to technology adoption than farmers who have less experience. Similarly, Farmers with formal education are likely to have the capacity to understand and adopt process driven technologies than their counterpart with no formal education. [17], noted that farmers with higher levels of education are likely to be more efficient in the use of inputs than those with little or no education. They observed that the average years of schooling for farmers adopting improved technology was 8 years compared to 7 years for farmers using traditional technology.

Average Yield of Respondents

As seen in Table above the output of cassava cooperative farmers revolved around 11 – 20 tonnes per hectare while that of the non-cooperative farmers concentrate on 6 – 15 tonnes per hectare. It is thus evident that the producer cooperative farmers seem to enjoy higher output than non-producer cooperatives. The reason is not farfetched; producer cooperatives are aware of modern agricultural technologies and use them in their farm. For example, improved cassava cuttings are high yielding and can resist some of the worst cassava diseases and pests [9]. The findings of the study is in line with the research of [18] who reported a positive relationship between adoption of improved technology and output amongst cooperative farmers in rural northern Nigeria.

Extent of Adoption of Improved Cassava Production Technologies Among Members and Non-Members

As seen in Table above, the components of improved cassava production technology with high adoptions core among members included: improved stem cuttings, minimum tillage, stem dressing, fertilizer application and integrated pest management. For non-members adoption index was high for stem cuttings, fertilizer application and use of crop residues as manure. The same components as members apart from sorting of stems and seed dressing with average adoption score While cooperatives recorded low adoption only in two areas, non-cooperatives recorded low adoption in six. [17], lent credence to this result when they found that cooperatives adopted innovations more than non-cooperatives in Niger State.

Hypothesis Testing

Hypothesis 1: Difference in the adoption of improved cassava production technologies

HO: There is no significant difference in the adoption of improved cassava production technologies by members and non-members of Cassava Farmers Associations

HA: There is a significant difference in the adoption of improved cassava production technologies by members and non-members of Cassava Farmers Associations

Decision Rule: Reject Ho if Z-calculated is greater than Z-tabulated, otherwise accept Ho.

Table 5: Z-Test Analysis on Difference in the Adoption of Improved Cassava Production Technologies by Members and Non-Members of Cassava Farmers Associations

	Cooperative Farmers	*Non-Cooperative Farmers*
Mean	6.30	5.15
Variance	1.85	1.67
Observations	120	120
Z	3.048656184	
P(Z<=z) one-tail	2.480596647	
z Critical one-tail	1.644853627	
P(Z<=z) two-tail	3.061193295	
z Critical two-tail	1.959963985	

Conclusion: Since Z-tabulated (1.96) is less than Z-calculated (3.06) we reject the null hypothesis and conclude that there is a significant difference in the adoption of improved cassava production technologies by members and non-members of Cassava Farmers Associations

Hypothesis 2: Difference in the output of cooperative and non-cooperative farmers

HO: There is no significant difference in the output per hectare among members and non-members of Cassava Farmers Association

HA: There is a significant difference in the output per hectare among members and non-members of Cassava Farmers Association

Decision Rule: Reject Ho if Z-calculated is greater than Z-tabulated, otherwise accept Ho.

Table 6: Z-Test Analysis on Difference in the output per hectare by cassava producer cooperative Members and Non-Members

	Cooperative Farmers	*Non-Cooperative Farmers*
Mean	15.95	9.03
Variance	16.8	12.3
Observations	120	120
Z	2.86599	
P(Z<=z) one-tail	1.813968	
z Critical one-tail	1.644853	
P(Z<=z) two-tail	2.179636	
z Critical two-tail	1.959963	

Conclusion: Since Z-tabulated (1.96) is less than Z-calculated (2.87)) we reject the null hypothesis and conclude that there is a significant difference in the output per hectare of members and non-members of cassava producer cooperatives.

Discussion of Findings

Hypothesis 1: Difference in the adoption of improved cassava production technologies

The result of the hypothesis strengthened the position that there is a significant difference in the adoption of innovations by cooperatives and non-cooperatives. This is evident when the important principle of cooperative education is considered. Agricultural cooperatives seek to find better and more productive innovations to facilitate their farm business. The theory of group formation and collective decision making reviewed in Section Two expressed the view that groups propel their members to increased productivity through shared knowledge and ideas. The findings by [9] demonstrated that cooperatives significantly and positively influenced the adoption of innovations in the production of plantain and banana. Several other empirical studies have also supported this development. [16] found a superior performance of cooperative members over non-cooperative members in terms of adoption of improved technology in Benue State. [8] reported that cooperatives help their members overcome barriers to assets, information, services, and markets for high value products; they also assist some Nigerian small scale farmers in solving land, labour and capital problems.

Hypothesis 2: Difference in the output of cooperative and non-cooperative farmers

Hypothesis 2 showed that there was a significant difference between the yield per hectare of cooperative and non-cooperative cassava producers in the study area. Thus, it is evident innovation adoption is key to increasing farm productivity. Also,

it is evident that cooperatives help their members to access and use advanced agricultural technologies. Education of members is one of the key principles of cooperatives. The findings of the study correlates with the findings of [17] who found a significant positive relationship between cooperative groups and farm output.

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

Summary of Findings

The study investigated the adoption of improved cassava production technology among members and non-members of Cassava Farmers Cooperatives in Owerri Agricultural Zone of Imo State. Random sampling procedure was used to select 120 members of Cooperative Cassava Farmers and 120 non-cooperative farmers, making a total of 240 respondents. Data collected were analyzed using descriptive statistics, Z-test, and adoption ratio.

- Socioeconomic characteristics of the respondents showed that about 63% of the cooperative farmers were female while 70% of non-cooperative cassava farmers were female. among members and non-members. Both categories were mainly between the ages of 25 – 50 years, active to engage in the demands improved innovation entails. Similarly, both categories have large household sizes that can help with the demands of farm activities.
- On the extent of adoption on which objective 1 hinged on, out of the 10 components or recommendations on improved cassava production technology, the adoption index was high in 6, average in 2 and low in 1 among cooperative members and high in 3, average in 2 and low in 6 among non-members. The hypothesis on the objective showed that there is a significant difference between the adoption of agricultural technologies by cooperative and non-cooperative farmers at 95% level of significance.
- The findings on the effect of the advanced technology on the output of the farmers reported a mean output of 15.95 tonnes per hectare for cooperative farmers and a mean output of 9.03 for non-cooperative farmers. The hypothesis on the objective showed that there is a significant difference at 95% confidence level in the output of cooperative farmers and non-cooperative farmers.

CONCLUSION

The broad objective of the study is to compare the adoption of improved agricultural technologies by cassava producer cooperative farmers and non-cooperative farmers. As evidenced in the findings, the level of adoption by cooperative farmers was high in 6 out of the 10 improved cassava production technologies as they were adopted by over 70% of the respondents. These included: improved stem cuttings, minimum tillage, stem dressing, fertilizer application and integrated pest management. For non-members adoption index was

high only for stem cuttings, fertilizer application and use of crop residues as manure. The cooperative members also recorded a significant increase in output more than non-cooperative members, largely due to their use of advanced agricultural technologies. The results from the study showed that cooperative members the study area were better than non-members in terms of overall awareness and adoption of improved cassava production technologies. This might be attributed to better access to extension agents and agricultural information by members.

RECOMMENDATIONS

The implications of the major findings from the study are as follows:

(i.) Farmers should be encouraged to organize themselves into cooperatives so that they can enjoy the benefit of adopting improved technologies faster in their farm business.

(ii.) Government and other organizations should be encouraged to grant loans, grants or subsidies on these advanced agricultural technologies to expand their rate of education.

(iii.) There should be increased sensitization and awareness on cooperatives and the benefits of joining agricultural cooperatives (cooperative effects).

(iv.) Government should promote a virile extension service that is empowered and backed with improved agricultural innovations from research institutions so that they can reach the majority of rural farmers and increase their adoption.

Contributions to knowledge

The study established that:

(i) There are more women (85% of cooperative farmers and 71% of non-cooperative farmers) engaged in cassava production than men, which will thus ensure that innovations on improved cassava production are centered on women than it was previously.

(ii) Cassava producer cooperative farmers had significant higher yield per hectare than non-cooperative farmers as a result of their adoption of improved technologies.

(iii) Cooperative farmers have a better record of adopting improved cassava production technologies than non-cooperative farmers.

Suggestions for Further Studies

The following topics have been suggested for further studies;

i. Thefactorsinfluencingtheadoptionofimprovedcassavaproductiontechnologies among cooperative members and non-members in Imo State;

ii. Effect of adoption of improved cassava production technologies on farm income of among members and non-members of cassava producer cooperatives in Imo State

iii. Constraints to the adoption of advanced agricultural technologies by cassava producer-

cooperative members and non-members in the study area.

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