AGRIBUSINESS AND AGRICULTURAL FINANCE

Effect of Cassava Value Web Participation on the Livelihood of Farming Households in Saki ADP Zone of Oyo State, Nigeria

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Abstract

This study investigates the impact of cassava value web participation on the livelihoods of farming households in the Saki Agricultural Development Programme (ADP) zone of Oyo State, Nigeria. Utilizing a multistage sampling technique, data were collected from 296 cassava farmers through structured questionnaires. The analysis reveals that about 54.70% of the respondents were male, about 38.4% fall between the ages of 51 to 60 years, a significant proportion of respondents are engaged primarily in farming, with limited formal education impacting their adoption of innovative agricultural practices. The most common cropping pattern among the cassava-based farmers was cassava/yam/ Maize mixture with 33.1% concentration of the sampled. The findings indicate that participation in the cassava value web enhances household income and promotes sustainable agricultural practices through resource efficiency and waste reduction. However, challenges such as inadequate processing technology and environmental pollution from cassava waste remain critical concerns. The study underscores the necessity for integrated approaches that enhance value addition and promote sustainable practices within the cassava sector. In conclusion cassava value web presents a significant opportunity for improving the livelihoods of farming households in the Saki ADP zone. The study therefore recommends that implementing training programs that will focus on modern agricultural practices and technologies to improve farmers' skills and knowledge and promote higher productivity should be considered

Keywords: Cassava; value web; livelihood; farming households; value addition; Oyo State

1 Introduction

Cassava (*Manihot esculenta*) has long been recognized as a crucial crop in many tropical and subtropical regions. Smith et al. (2018) and Dixon et al. (2020) highlighted cassava adaptability to diverse environmental conditions and its resilience to climatic stress, contributing significantly to the agricultural landscape of various countries. Cassava (*Manihot esculenta*) is a versatile crop with significant biomass potential. Its tubers are rich in carbohydrates, while its leaves, stems, and peels can be utilized as valuable biomass resources. Cassava biomass can be processed into various products, such as animal feed, biofuels, biodegradable plastics, and organic fertilizers (Nassar et al., 2019; Nweke et al., 2019). The abundance and accessibility of cassava biomass make it an attractive and sustainable resource for rural communities, contributing to their livelihoods and promoting environmental sustainability. Sustainable agriculture practices are essential for promoting rural development and improving livelihoods. The cassava value web can contribute to sustainable agriculture through

various means, including resource efficiency, waste reduction, and environmental conservation (Wakhungu et al., 2018). Sustainable agricultural practices, such as intercropping, organic farming, and integrated pest management, can be integrated into cassava cultivation and processing, leading to enhanced productivity, profitability, and environmental sustainability (Tittonell et al., 2016).

The value web concept is derived from business models; where businesses have opted for effective resource management through full oversight of critical functions within the system. In a typical business value web, processes that were formally outsourced are brought into the core of the business, so that productive resources can be optimally used without wastages, leading to a reduction in total costs of production, and increase in business profit. Now, bringing this to agricultural systems, value webs mean the use of available resources within a system to link available product chains in such a way as to maximize outputs and minimize wastes. Cassava (*Manihot esculenta*) has long been recognized as a crucial crop in many tropical and subtropical regions. Smith et al. (2018) and Dixon et al. (2020) highlighted cassava adaptability to diverse environmental conditions and its resilience to climatic stress, contributing significantly to the agricultural landscape of various countries. The value web is an approach created by Virchow et al. (2016) as a multidimensional proposal for the bioeconomy. It is a non-linear approach that allows the analysis of the different value chains originating from a single resource and the connections between them. The value web considers as its starting point the complete resource (i.e. roots, trunk, leaves, flowers and fruits, and their components) and seeks to identify its different current and potential uses. These uses include human consumption (food) and animal consumption (animal feed), fuels (energy) and industrial materials. Virchow et al. (2016) also propose to identify uses related to ecological functions or carbon markets. This more systemic view also seeks to include the concept of circular economy through the identification of uses of by-products or residues (e.g. shells, chemical components) and their reuse.

Livelihoods can comprise a range of on-farm and off-farm activities which in combination provides a variety of procurement strategies for food and income for rural households (Frankenberger and McCaston, 1998). Livelihoods depend heavily on the cassava value web, which encompasses the interconnected actors, processes, and resources involved in cassava production, processing, and marketing (Fregene et al., 2013). However, limited research has focused specifically on understanding the dynamics and impacts of the cassava value web on rural livelihoods. Value addition is the transformation of raw materials into forms of products with higher value and diversified utilities (Popoola et al., 2015). Already more than 80% of the cassava solid waste is being used productively, primarily as pig and fish feed and also for other innovative purposes in many countries (Lukuyu, 2014). However, in Nigeria where cultivation and processing of cassava tubers is a common livelihood activity only an insignificant proportion is converted to useful products as a large portion are usually thrown along the roadsides. The peels and other wastes such as chaffs are being considered as an "inconvenience" rather than a potential resource (Odediran et al., 2015).

1.1 Statement of the problem

Increase in production invariably implies an increase in the level of waste generated from the processing of cassava tubers into other products. During the processing of cassava tubers into these essential products, an enormous quantity of waste is produced in form of solid waste peelings and pulp sieviates, liquid waste and gaseous emission consisting of moisture and cyanide (Ohimain, Silas-Olu, and Zipamoh, 2013). These wastes contain highly polluting bio-materials which can affect the environment in different ways. For example, waters from cassava processing is particularly toxic and makes surface waters poisonous, while improper disposal of cassava peels and effluents pose serious

threat to the environment and human health (Olukanni and Olatunji, 2018). These wastes (peels, waste water and other solid constituents) are often not properly disposed and usually constitute nuisance to the environment. Residents close to the site where the waste is indiscriminately dumped suffer from problems of unbearable odour, presence of poisonous gases and a general unhealthy environment. The result is discomfort, anxiety, mosquito infestation and frequent illness (Obueh and Odesiri-Eruteyan, 2016). Therefore, there is need for value addition to transform cassava waste into less environmental harmful products that are beneficial.

The primary objective is to investigate the Effect of cassava value web participation on the livelihoods of farming households in Saki ADP zones of Oyo state, Nigeria. The specific research objectives are to identify the socio-economic characteristics of cassava value web in the study area, identify the different food and non-food uses of cassava within the cassava value web, determine the extent of participation of the rural households in the cassava value web on their livelihoods in the study area and analyze the factors affecting the participation of the respondents in cassava value web in the study area.

2 Conceptual framework

Cassava makes up the bulk of dietary energy supply for many households in developing countries (Montagnac et al., 2009). Its versatility in the production of food and non-food commodities has been documented; from the production of staple foods such as fermented cassava flakes, to starch used for domestic and industrial purposes (Poku et al., 2018; Nweke et al., 2004). However, its emergence as a producer of non-food and industrial raw material is still limited in Nigeria. This is because cassava is seen by many smallholders as a reserve crop and a crop for producing some of the most consumed staples across the countries (Nweke et al., 2004; FAO, 2018). With the increasing population and hence demand, cassava production in the country is not sufficient to meet the food needs of its populace. This also stems from the fact that low technology adoption by the cassava smallholders leads to low productivity. In addition, the low technology of processing has been the bane of processing cassava into high valued industrial commodities (Ehinmowo and Ojo, 2014; Aminu et al., 2017).

Cassava is currently utilized for two main purposes: human food and industrial use. Estimates for the percentage of cassava used for industrial utilization range from 5 to 16% while the remaining is directly used for human consumption. Most of cassava's industrial utilization is for animal feed. About 10% of its industrial demand consists of high quality cassava flour used in biscuits and other confectioneries, dextrin, pre-gelled starch for adhesives, and starch for pharmaceuticals and seasonings. Failure to adequately develop postharvest and marketing systems for cassava has, for many years, limited the contribution of the crop in economic growth and poverty reduction. The cassava value web encompasses a diverse range of stakeholders, including smallholder farmers, processors, traders, input suppliers, government agencies, and consumers, each playing a unique role in the value chain. The web perspective concentrates on the numerous alternative uses of raw products, including recycling processes and the cascading effects during the processing phase of biomass utilization (Adeyemo et al., 2019).

The increasing demand for non-food biomass of the agricultural system has brought to the fore the need to ensure that the food need of developing countries are not compromised in the bid to supply biomass for industrial use. According to Virchow et al. (2014), the rising demand for food and non-food uses of agricultural biomass and the recent tendency towards post-harvest losses and waste

reduction to maximize profit in many countries will lead to a merging of value chains of an agricultural biomass. For example, in the cassava value web; the production of starch alone may be profitable on its own; but the demand for animal feed, starch and garri may lead to a synergized production/processing/marketing matrix in which the waste that is generated needs to be drastically reduced. Thus, the smallholder is encouraged to produce garri, from a proportion of the cassava roots available. Because he also wants to produce starch, he uses another proportion of his roots and then processes his garri in such a way as to extract as much starch as he could from the process. He also ensures that the peels and chaff from his activities are maintained in such a way that it can be sold as feedstuff to the livestock industry. The stem and waste water and other solid wastes could also be used to produce organic manure (Omilani et al., 2015). Consequently, the isolated and linear analysis of the value chain becomes insufficient for such a system and the concept of the biomass based value web becomes important. These value webs can be viewed as the linkages between all cassava value chain, the linkage between all channels involves in cassava value chains from the stem suppliers down to the end users is known as the value web of cassava. And also the linkage among and among cassava value chains increased utilization of biomass and/or cascading uses of resources within an agricultural system (Virchow et al., 2014; Batidzirai et al., 2016).

The concept of value web according to Knauf and Lubekke (2007), therefore aims at contributing to food and household livelihood security among poor households by focusing on complex systems of interlinked value chains in which food and fodder, fuels, and other raw materials are produced, processed and traded. The conventional value chain approach analyses the series of activities, profitability, efficiency, and actors involved in the production of a raw product, while the value web approach analyses the interrelation and synergies between several value chains and as such captures the manifold products obtainable from a raw product. Hence, it is no longer sufficient to analyze the system by following the conventional (mainly product-focused) value chain approach. Analytical perspectives are needed which covers the complex pathways of biomass which include but go beyond the concept of value chain analysis. Here the holistic concept of biomass-based value webs becomes very important. Instead of examining the pathway of a single product and thus being in tendency more industry oriented, the web approach captures the manifold products which are and can be derived from one biomass raw product and respectively looks at the whole product mix produced by a household, the different value chains the household participate in and how they could be linked. The biomass web analytical approach can also be used to assess profit and other benefit distributions among the different actors and participants in the whole web. Thus, opportunities can be detected where more value could be captured in poor producing regions, how to ensure equitable distribution of value addition and where income- generating activities can be increased (Kaplinsky, 2000; Bolwig et al., 2010). Biomass based value web concepts are as such needed that can help to improve household food and livelihood security for the poor through increased food production, while at the same time supplying sufficient non-food, processed biomass to offer employment and income opportunities to the poor without one affecting the other negatively. For these concepts to be effective, analytic approaches are required which should cover the increasingly complex ways of biomass from crop production to final consumption. In this regard, conventional value-chain approaches analyzing single value chains are neither sufficient nor effective any longer (Adeyemo et al., 2016; Virchow et al., 2016). This leads to the emergence of a biomass-based value web concept.

A value web is a concept that focuses on the values of both food and non-food biomass of agricultural crops in order to increase returns to the actors (Virchow et al., 2015). The concept of the Biomass Web was advocated to improve food security in Africa through focusing on biomass based value web

using certain pilot crops of cassava, maize, plantain, bamboo and onset at this infant stage of the project. The biomass based value web is a system of interlinked value chain in which food, fodder, fuel, raw materials and even waste from agricultural products are produced, processed and traded (Knauf and Lubekke, 2007). The aim of the biomass web is thus that smallholders can exploit different links within the agricultural system in which they act; diversifying their livelihood bases and hence improving income and food and nutrition security. Central to the focus of the biomass web concept is the rationality of agricultural actors, in which decisions are made based on the best production possibility frontier as perceived by the agricultural household based on the technologies and other resources available to them (Mankiw, 2012).

3 Methodology

3.1 Study area

The Saki Agricultural Development Project (ADP) zone is located in Oyo State, Nigeria, and is known for its rich agricultural potential. This region is characterized by its favorable climate, fertile soils, and diverse agricultural practices, making it a vital area for crop production, particularly cassava, which is a staple food and an important cash crop for many farming households. Saki ADP covers several Local Government Areas (LGAs) known for their agricultural activities, including Saki West, Saki East, and Itesiwaju. The region is situated within the southwestern part of Nigeria, benefiting from a mix of tropical weather patterns that provide adequate rainfall and moderate temperatures, conducive to crop cultivation. The population of Saki is predominantly made up of the Yoruba ethnic group, with a mix of other ethnicities engaged in farming and related activities. The communities in this zone are primarily agrarian, with a significant portion of the populace relying on farming as their main source of livelihood. Cassava is a major crop in the Saki ADP zone, with many farmers involved in its cultivation, processing, and marketing. The region's farmers adopt various production techniques, ranging from traditional methods to more modern agricultural practices, to enhance yield and profitability. The presence of local markets facilitates the sale of cassava and its derivatives, such as garri, fufu, and starch, which are highly demanded both locally and in urban areas. The Saki ADP zone plays a crucial role in the economy of Oyo State and Nigeria at large. The cultivation of cassava not only provides food security but also contributes to income generation and employment for many households. The value-added products from cassava processing create additional income streams, enhancing the overall economic stability of the region. Despite its agricultural potential, the Saki ADP zone faces several challenges that impact cassava production and the broader agricultural sector. Issues such as inadequate infrastructure, limited access to credit, high perishability of cassava, and environmental concerns hinder optimal productivity. Additionally, farmers often encounter market fluctuations that affect their income stability.

3.2 Sampling technique

A multistage sampling procedure was used for the selection of respondents. The first stage involved the random selection of an intensive agrarian local government area out of the thirty-three local government areas in Oyo State of which Iseyin ADP zone was selected, second stage involves the random selection of one Local Government Areas (LGA) in the ADP zone. Olorunsogo and Iseyin (LGAs) were selected. The third stage represents random selection of 30% of the villages/cells from each selected LGAs/Blocks. (Pankoko/Waro and Ojo Aaro were selected from Olorunsogo while Aba Ilero and Iseyin were selected from Iseyin LGA, making a total of four villages) was selected because

of high predominant of farmers participating in cassava value web. Fourth stage involves selection of about 5% of the registered cassava-based food crops farmers who participate in cassava value web from each villages/cells. A total of 296 questionnaires were administered during the survey. The distribution of the sample is shown in Table 1.

Table 1. Distribution of the sample by state, zone, local government area and village.

State	Zone	LGA	Village/cell	Sampled farmers	Total	Percentage
Oyo	Iseyin	Olorunsogo	Pankoko/Waro	120	196	66%
			Ojo Aaro	76		
		Iseyin	Aba Ilero	62	100	34%
			Iseyin	38		
Total	1	2	4	296	190	100

Source: Field survey, 2023.

3.3 Method of data analysis

The following statistical and econometric tools were used to achieve the specific and broad objectives: descriptive statistics, linear regression and a five-point Likert-type scale.

3.3.1 Descriptive statistics

This involves or encompasses the use of mean, frequency distributions, percentages. Descriptive statistics was used to have a summary statistics of data obtained from the field. This was used to achieve specific objectives one (i) and two (ii) which identifies the socio-economic characteristics of respondents and the different food and non-food uses of cassava within the cassava value web and map actors within the cassava value web.

3.3.2 Regression models

According to the regression models, the independent variables predict the dependent variables (Roopa et al., 2019). Regression analysis estimates dependent 'y' variable value due to the range of independent variable values 'x' (Seber et al., 2012). Regression (Kavitha et al., 2016) may either be a simple linear regression or multiple regressions. Regression analysis can be used in some cases to determine causal relations between the independent and dependent variables. Importantly, regressions alone show only relations between a dependent variable and a fixed dataset collection of different variables

Simple Linear Regression is a case model with a single independent variable (Abdulazeez et al., 2020). Simple Linear regression defines the dependence of the variable. The simple linear regression model is:

$$y = \beta_0 + \beta_1 x + \varepsilon \quad (1)$$

Simple regression distinguishes the influence of independent variables from the interaction of dependent variables (Acharya et al., 2019).

Multiple linear regression (MLR). MLR is a statistical technique to predict the result of an answer variable, using a number of explanatory variables. The object of (MLR) is to model the linear

relationship between the independent variables x and dependent variable y that will be analyzed. The basic model for MLR is:

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_m x_m + \varepsilon \quad (2)$$

Multiple linear regression (MLR) was used to determine the extent of participation of the rural households in the cassava Value web on their livelihoods in Oyo state. The implicit equation is given as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, e) \quad (3)$$

where:

- Y = asset index
- X_1 = level of value web participation
- X_2 = age of respondents (years)
- X_3 = marital status
- X_4 = educational qualification
- X_5 = household size
- X_6 = farm experience
- X_7 = credit taken
- X_8 = extension agent
- X_9 = farm size
- X_{10} = cassava cultivation
- X_{11} = access to good road
- X_{12} = distance from farm
- X_{13} = distance from farm to market
- X_{14} = amount spent on non-food
- e = error term, assumed to fulfil all assumptions of the classical linear regression model

3.3.3 *Five-point Likert scale*

3.3.3Five Point Likert- Scale. To determine the extent of participation of the rural households in the cassava value web. A five-point Likert scale was used. To ascertain extent of participation in value web by the rural households in the cassava perceptions, the response options and values assigned were as follows: strongly agree = 5; agree= 4; undecided= 3, disagree = 2, and strongly disagree=1.

4 Results and discussion

4.1 Socio-economic characteristics of respondents

The statistical analysis of the respondents' demographic characteristics in Table 2 showed that about (54.7 %) were males and 45.3 % were females. The domination by male respondents among the farmers could be the result of males having greater access to farm land than females. It could also be the result of the tedious nature of farming. A gender analysis of livelihood patterns which revealed that 55.5% of the respondents were male and 45.5% of the respondents were female. About 38.4% of the respondents are between 51-60 years of age, 27.6% of the respondents are above 60 years of age, 25.9% of the respondents are between 41-50 years of age, 6.4% of the respondents are between

31-40 years of age, while 1.3% of the respondents are below 30 years of age. The mean age of the farmers was 51 years, this shows that the farmers are middle age and better positioned to contribute more to the value web. This justifies the record of Orebiyi and Nzeh (2002) that age influences managerial decision making. About (91.2%) respondents are married 4.7% were widowed while 2.4 % were single and 1.7 % were fully divorced. This implies that the respondents were dominated by married men and women who invariably contributed to increase in household size farm labor (Torimiro, 2005). According to Kulik (2001), singles are more likely than their married counterparts to view unemployment as a personal advantage because it gives them more time to themselves. By implication, married people tend to seek for jobs and work more than singles as they (married people) have more mouths to feed and this responsibility has to be carried out on daily basis. Also, 56.4 % of the respondents are Christian, 38.3 % are Muslim and 5.1 % are of traditional religion. This explained that the role of religion can be described as just a side track or passes by when studying another phenomenon. Furthermore, educational background of the respondents revealed that 67.2 % had never been to school, 21.3% had at least primary education, 10.5% completed secondary school education. In addition, 1.0% completed tertiary education with certificates. This implies on the aggregate that the majority of the farmers had no formal education, and thus had the advantage of adopting innovation, since education helps in adopting improved agricultural technologies as observed by Ozor and Madukwe (2005). Majority (66.9%) of the respondents had large household size of between 6-10 persons. About 27.0% had household size of 10 persons and above while about 6.1 % had household size of between 1-5 persons. The mean size of household was 8 persons. The implication of these large household sizes is that there will be more hands to assist in the activities involved in cassava value web thus having a positive effect not only in reducing the cost of hired labour but also enabling farmers form stronger bond through working in an activity with common goal. This result is supported by Ibekwe and Orebiyi (2012) who asserted that large household size provides most of the labour force for farming households.

Majority (91.2 %) of the respondent's primary occupation were farming while 8.8% of the respondent's primary occupation were non-farming. The results also show that farmers dominate the cassava value web. This implies that farming is predominant among the farming households had they choose farming as a means of livelihood which will improve food productivity. This result is corroborated by the study of Msoo and Goodness (2014), which revealed that, 57.2% of the respondents were engaged in farming activities as their major occupation while 42.8% were engaged in non-farm activities. About 27% have farming experience of between 41-50 years, 24.7% of the respondents have farming experience of between 21-30 years, 21.4% of the respondents have farming experience of between 31-40 years, 14.5% of the respondents have farming experience of between 11-20 years, about 7.2% of the respondents have farming experience of between 10 years or less while 2.6% of the respondents have farming experience of between 51 years and above. The mean year of experience was 37 years. This indicates that the majority of the respondents have acquired some level of experience in production, processing and marketing of cassava which could be very helpful in combating the challenges that come with such activities, which is in line with the observation of Onu and Madukwe (2002); Awotide et al. (2012). About 51.3 percent of the respondents had farm size of between 1.1-1.5 hectares of land, 29.7 percent had farm size of between 6-10 hectare of farm size, 16.74 percent of the respondents had farm size of between 11-15 hectares of land, while 1.0 percent of the respondents had farm size above 15 hectares of land. The finding shows that the mean hectare of farm size used in the study area is 5 hectares; this shows that majority of the farmers cultivated farm holding size of less than 5.0 hectares. This confirmed the findings of Obasi (2005), Anyanwu (2009), who stated that the average land holdings of medium scale farmers were often too large for

efficient land utilization. With direct correlation between farm sizes and gross income, it implies that more the farm sizes the cassava output and productivity of the cassava output.

Table 2. Socio-economic characteristics of respondents in the cassava value web.

Variable	Frequency	Percentage
Sex		
Male	162	54.7
Female	134	45.3
Age (years)		
≤ 30	4	1.3
31-40	19	6.4
41-50	77	25.9
51-60	114	38.4
>60	82	27.6
Mean	54	
Marital status		
Single	7	2.4
Married	270	91.2
Widowed	14	4.7
Divorced	5	1.7
Religion		
Christianity	165	55.7
Islamic	126	42.6
Traditional	5	1.7
Educational background		
No formal education	199	67.2
Primary school	63	21.3
Secondary education	31	10.5
Tertiary education	3	1.0
Household size		
≤ 5	18	6.1
6-10	198	66.9
>10	80	27
Mean	8	
Primary occupation		
Farming	270	91.2
Non-Farming	26	8.8

Variable	Frequency	Percentage
Farming experience		
≤ 10	22	7.2
11-20	44	14.5
21-30	75	24.7
31-40	65	21.4
41-50	82	27.0
>50	8	2.6
Mean	37	
Farm size (ha)		
≤ 5	152	51.3
6-10	88	29.7
>10	56	19.0
Mean	5ha	

Source: Field survey, 2024.

4.2 Cassava-based cropping pattern among respondents

In Nigeria, intercropping is common among farmers majority of the farmers in Nigeria did not only plant cassava, cassava with legumes or tuners, particularly cowpea or yam has gone a long way to improve the already limited fertility status among many farming plots. The various cropping systems adopted by the farmers are shown in Table 3. The most common cropping pattern among the cassava-based farmers was cassava/yam/ Maize mixture with 33.1% concentration of the sampled and this was closely followed by cassava / Maize intercropping system with 29.7% of the respondents. The result also revealed that 14.2% of the sampled Farmers plants Cassava/yam, 6.8% of them intercrop Cassava /yam/sorghum, while 4.7% and 3.4% of the sampled cassava based farmers' intercropped Cassava /sweet potato/rice and Cassava/millet/cowpea/vegetables respectively. It is evident that majority of the farmers intercropping cassava with other crops such as maize, yam, sweet potato, sorghum, rice, cowpea, millet and vegetables while sole cropping was rarely practiced in the study area. Olasunkanmi et al., (2012) identified that most food crop farmers intercrop cassava, maize and vegetables or intercrop cassava and maize nearly in all farms in Ogun state. It further indicated that these types of crop-enterprise combination would not only increase the net farm income per hectare, but it will also ensure flow of income during on and off seasons therefore, increase the utilization of the limiting resources, that is capital base and hectares of land cultivated. Chabi-Olaye et al., (2005b) reported that intercropping cassava with legumes is one of the common cropping systems in Africa. According to Saka et al., (2011), it was found that about 67% of the farmers in Southwestern Nigeria propagated mixed cropping and maize/cassava is widely planted.

From the result derived from the field survey it was observed that majority (81.8%) of the respondents in the study area practiced intercropping or mixed cropping it shows that majority of the respondents plant other crops alongside with cassava while 18.2% of the respondents practiced only sole cropping alone. Majority (54.1%) of the respondents cultivated local and hybrid variety of cassava, 29.1% of the respondents cultivated only local variety while 16.9% of the respondents cultivated only hybrid variety of cassava.

Table 3. Distribution of respondents by cropping pattern and type of cassava.

Cropping pattern	Frequency	Percentage
Cropping combination		
Cassava/yam/maize	98	33.1
Cassava/maize	88	29.7
Cassava/yam	42	14.2
Cassava/millet/cowpea/vegetables	10	3.4
Cassava/sweet potato/rice	14	4.7
Cassava/yam/sorghum	20	6.8
Total	272	91.9
Cropping system		
Sole cropping	54	18.2
Intercropping or mixed cropping	242	81.8
Total	296	100.0
Type of cassava		
Local variety	86	29.1
Hybrid variety	50	16.9
Combination of the two	160	54.1
Total	296	100.0

Source: Field survey, 2024.

4.3 Respondents' involvement in the cassava value web

4.3.1 Food and non-food uses of cassava in the study area

Cassava Usage was estimated by the count and monetary worth of uses, respondents or households put cassava into within the last 30days. Table 4 shows the ranking of cassava usage (multiple responses) among households in the study area. This was captured as multiple responses since household can put cassava into two or more uses at the same time.

Table 4. Food and non-food uses of cassava.

Product	Frequency (%)	Ranking
Garri	262 (88.5)	2nd
Fufu	242 (81.8)	3rd
Abacha	60 (20.3)	9th
Lafun	282 (95.3)	1st
Pupuru	150 (50.7)	6th
Tapioca	105 (35.5)	7th
Starch	92 (31.1)	8th
Animal Feed	240 (81.2)	4th

Product	Frequency (%)	Ranking
Manure/Mulch	188 (63.5)	5th

Source: Data analysis, 2024. Figures in parentheses are percentages of the total sample (296).

Cassava can be processed into various food and non-food uses as shown in Table 4, which can be consumed at the household level or make available for sale in the market to generate additional income for the household. Table 4 shows the nine prominent food and non-food uses of cassava in the study area. As it can be seen in the table, the most common use of cassava in the study area was for 'Lafun, a locally consumed delicacy in the study area with over 95.3% of households using cassava for 'Lafun preparation either for home consumption or for the market, 88.5% of households using cassava for 'Garri preparation either for home consumption or for the market, 81.8% of households using cassava for 'Fufu preparation either for home consumption or for the market, 81.2% of households using cassava for 'Animal feed preparation either for home consumption or for the market, 63.5% of households using cassava for 'Manure/mulch preparation either for home consumption or for the market, 50.7% of households using cassava for 'Pupuru' preparation either for home consumption or for the market, 35.5% of households using cassava for 'Tapioca' preparation either for home consumption or for the market, 31.1% of households using cassava for 'Starch' preparation either for home consumption or for the market. While the least use of cassava in the study area was for 'Abacha' with only 20.3% of households in the study area engaged in its preparation

Figure 1 shows the nine prominent cassava uses in the study area and the actors in the cassava value web.

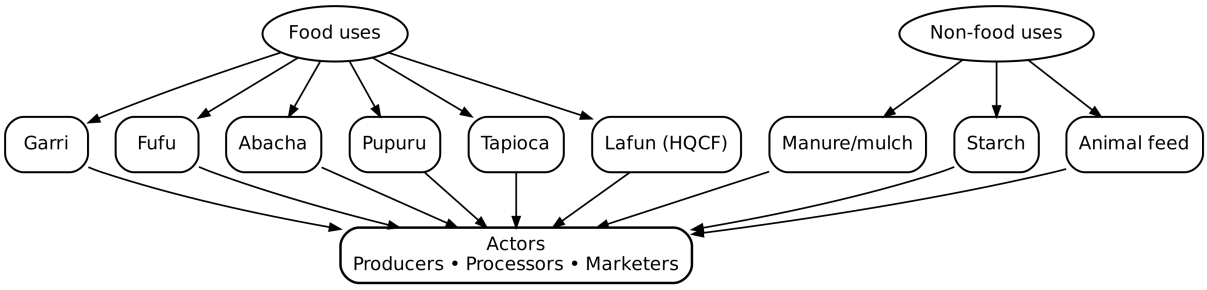


Figure 1. Cascading uses of cassava and actors in the cassava value web (redrawn from the authors' conceptualisation, 2024).

4.3.2 Cassava usage distribution of households

The result in Table 5 shows the distribution of households by cassava usage. It can be deduced from the table that about 50% of the sampled households put cassava into 2 or 3 uses, while only 1.0% put cassava into 9 different uses in the study area. The average usage of cassava in the study area was above 3 uses. This result is similar to the findings of Adeyemo et al. (2016), where they discovered that most of the smallholder farmers in Edo state have more than 3 areas of income generation from the cassava web.

Table 5. Cassava usage distribution of households.

Cassava usage count	Frequency	Percentage
2	43	14.5
3	105	35.5

Cassava usage count	Frequency	Percentage
4	75	25.3
5	38	12.8
6	20	6.8
7	7	2.4
8	5	1.7
9	3	1.0
Total	296	100
Mean cassava usage	2.27	

Source: Field survey, 2024.

4.4 Extent of rural household participation in the cassava value web

4.4.1 Level of participation in the cassava value web by households

The level of involvement of Households in the Cassava value web was classified into the respondents that participated and those that don't participate levels based on the estimated Herfindahl index of Maize usage following the classification model of Crowley et al. (2016).

The distribution of farming households by participation is presented in Table 6.

Table 6. Distribution of farming households by participation in the cassava value web.

Participation	Pankoko/Waro	Ojo Aaro	Aba Ilero	Iseyin	Total
Yes	26 (8.8%)	29 (9.8%)	20 (6.8%)	20 (6.8%)	254 (85.9%)
No	6 (2.0%)	1 (0.3%)	3 (1.0%)	1 (0.3%)	42 (14.1%)

Source: Field survey, 2024.

Table 6 showed that 85.9% of the respondents in the study area participated in the cassava value web, while 14.1% did not participate in cassava value web. Thus, the majority of the sampled households had a high level of involvement in Cassava value web in the study area. This result is supported by Adebayo et al., (2012) in the study the non-farm income per year was categorized into five; majority of households (43%) had an average annual non- farm income of N199,950.45 This is an indication that the respondents have not significantly benefited from the diverse non-farm income generating opportunities in the study area.

4.4.2 Extent of participation in the cassava value web: Linear regression results

The extent of participation measures have shown that there are differences in participation outcomes for the different systems (value adder or participate/non-value adder or participate) in the cassava value web. The results of the linear regression are presented in Table 7.

Table 7. Linear regression estimates of the extent of participation in the cassava value web.

Variable	Coef.	SE	*t*	*p*	95% CI lower	95% CI upper
Level of participation in cassava value web	0.00301	0.00163	0.163	0.066*	-0.002	0.623

Variable	Coef.	SE	*t*	*p*	95% CI lower	95% CI upper
Age of household head	0.03847	0.01138	0.92	0.001***	-0.166	0.456
Marital status	0.05200	0.00103	0.50	0.616	-0.152	0.256
Education qualification	-0.03100	0.0002	-1.59	0.115	-0.07	0.008
Household size	0.00713	0.00131	5.44	0.000***	0.454	0.971
Primary occupation	0.06721	0.02439	0.113	0.006***	0.172	0.028
Farm experience	-0.00043	0.00044	-0.97	0.332	-0.131	0.044
Credit taken	0.00157	0.00267	0.59	0.556	-0.369	0.684
Extension agent	-0.01539	0.00254	-6.05	0.000***	-0.2041	-1.037
Farm size	0.00126	0.00042	3.02	0.003***	0.043	0.208
Cassava cultivation	-0.00043	0.00017	-2.50	0.013**	-0.077	-0.009
Access to good road	-0.00275	0.00282	-0.97	0.332	-0.832	0.282
Distance to farm	-0.00005	0.0008	-0.61	0.545	-0.021	0.011
Distance from farm to market	0.00002	0.0001	0.16	0.875	-0.018	0.021
Amount spent on food	0.00017	0.00130	5.44	0.000***	0.454	0.971
Amount spent on non-food	0.00000	0.000	-2.41	0.017**	0.000	0.000
Constant	0.01022	0.00923	1.11	0.27	-0.8	2.844
Mean dependent var	-0.00304					
R-squared	0.392					
Sd dependent var	1.086					
Prob > f	0.000					
Akaike crit. (aic)	482.390					
Bayesian crit. (bic)	-0.304					

Source: Data analysis of field survey, 2024. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

From the result of linear regression model, it was found that level of participation, Age of household head, Household size, Primary occupation, Extension agent and Farm size were significant factors affecting the level of participation in cassava value web among the respondents in the study area. Level of participation, Age, Household size, Primary occupation, Extension agent, Farm size, Amount spent on food, cassava cultivation and Amount spent on non-food. Age is positively associated with the likelihood of participating in cassava value web. This implies that older farmers are more likely to participate in cassava value web than younger farmers. Household size is positively associated with the likelihood of participating in cassava value web. This means the farmers with more household size are more likely to participate than the farmers with small household size. Primary occupation is positively associated with the likelihood of participating in cassava value web. Extension Agent is positively associated with the likelihood of participating in cassava value web. This implies that the more the extension agent visit the more likely they participate in cassava value web, Farm size is positively associated with the likelihood of participating in cassava value web. This implies that the more the farm size the more likely to participate in cassava value web than those with less farm size.

Level of value web participation is significant at 10%, cassava cultivation and amount spent on non food were significant at 5% level while Age, household size, Primary occupation, extension agent, farm size and Amount spent on food were statistically significant at 1%. This showed that all these variables were important factors that determined the level of participation in cassava value web by the respondents in the study area.

The following variables had a negative coefficient and an inverse relationship with the level of participation in cassava value web by the respondents in the study area: marital status, education qualification, farm experience, credit taken, access to good road, distance to farm and distance from farm were not statistically significant.

Marital status is negatively associated with the level of participating in cassava value web, education qualification, farm experience, credit taken, access to good road, distance to farm and distance from farm were negatively associated with the level of participation in cassava value web. This implies that the less the marital status, education qualification, farm experience, credit taken, access to good road, distance to farm and distance from farm are less likely to affect the level of participation in cassava value web.

5 Conclusion and recommendations

The cassava value web presents a significant opportunity for improving the livelihoods of farming households in the Saki ADP zone. The integration of various stakeholders—from farmers to processors—can enhance productivity and profitability while also contributing to environmental sustainability. The data indicate that while participation in the value web positively influences household income, challenges such as low technological adoption and waste management need urgent attention. Thus, a holistic approach that includes education, improved processing technologies, and better waste management practices is essential for maximizing the benefits of cassava biomass utilization. The study therefore recommends the following:

1. Implement training programs focused on modern agricultural practices and technologies to improve farmers' skills and knowledge, promoting higher productivity.
2. Invest in research and development of efficient cassava processing technologies that can reduce waste and increase the value of by-products.
3. Establish effective waste management systems to handle cassava waste, converting it into useful products like organic fertilizers and animal feed.
4. Encourage the formation of cooperative societies among cassava farmers to enhance collective bargaining power, access to markets, and shared resources.
5. Advocate for supportive government policies that provide financial assistance, subsidies for technology adoption, and infrastructure development to improve the overall cassava value chain.

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