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The Influence of Social Networking on Food Security Status of Cassava Farming Households in Nigeria

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Abstract: Food security, at national and household levels, is on the decline because traditional capital (physical, natural, human and financial) has not fully led to its improvement. There is an increasing shift of attention to social capital as an element that explains household food security, but there is a lack of adequately documented information on this. Therefore, this study investigates the effects of social capital on food security, using data collected on a cross-section of 775 cassava farming households from four zones of Nigeria. About 58% of the respondents (cassava farming households) fall under the intermediate category in terms of the benefits received from belonging in social groups. Age and educational level increased the probability to receive benefit from group activities ($p < 0.05$), while membership density, labor contribution and decision making significantly affected the level of benefit received ($p < 0.10$). Based on the estimated food security line, 41% of the cassava households were food secure, while 59% were food insecure. Membership density, cash and labor contribution significantly affected food security. Membership density ($p < 0.10$) and cash contribution ($p < 0.05$) increased the probability of being food secure. It was recommended that cassava farming households should be encouraged or aided to form cooperatives or farmers' groups, participate in the activities, and make financial contributions to investments that reduce manual labor-input in the farming activities to enhance household food security.

Keywords: social capital; food security; cassava farmers; composite score; Nigeria

1. Introduction

Food is a basic necessity of life, and is regarded as the indispensable means of energy sustenance and nutrition wholeness. Adequate food intake, in terms of quantity and quality is vital for both a healthy and productive life. The need for food is topmost in the hierarchy of life's essential needs, and is imperative for one to maintain healthy living. Thus, the achievement of food security is essential in any given country. Food security related issues have been receiving attention in many developing nations. The intense rise in food prices prompts this revitalization all over the world, due to increasing rate in demand for food, declining global food reserves and unfavorable weather patterns, Metu et al. [1]. Food security is not merely having enough and a sufficient quantity of our various staple foodstuffs,

but it also involves access to these food items at affordable prices. On the other hand, food insecurity represents a lack of access to enough food and can be either chronic or temporary. According to Ojo and Adebayo [2], in chronic food insecurity, which arises from a lack of resources to produce or acquire food, the diet is persistently inadequate.

The current global food crisis and insecurity has been attributed to factors such as climate change, population growth, increased demand for biofuels, failure to improve crop yield, high oil prices, leading to increased input loss for producers and traders, as well as structural problems like under-investment in the agricultural sector. A decrease in a household's access to food may be due to seasonality of agricultural production, crop failures or unemployment among the healthy members of households.

In effect, food security does not include a "standalone" concept. The above-enumerated factors are attributable to global food crises and insecurity. Thus, they dovetail into food production problems and their food security consequences. In Nigeria, some of the main consequences of inadequate food production leading to food security challenges are (i) the agricultural sector has remained underdeveloped and depended too much on primary agriculture system with degraded low fertile soils, (ii) less external farm inputs utilization and significant loss of food crops both before and after harvest, and (iii) lack of facilities for storage and preservation of food all of which have cumulatively contributed to price fluctuation of agricultural products (Ilaboya et al.) [3]. These lead to reduced food production (IITA Blogs, 2020) [4], and a resultant problem of availability and access to these food items at affordable prices. From there, the "dreaded" food insecurity surfaces.

The government had made concerted efforts at different levels through the formulation of several agricultural policies to restrict food security challenges. Unfortunately, these policies are not yielding the expected outcome of increasing food production. Hence, a new national Rural Development Strategy (RDS) was prepared and adopted in 2001 by the federal government. It aimed to improve livelihoods and food security through a process of community-based agriculture and rural development. As stated by Eme and Onyishi [5], the strategy advocates a community-driven development (CDD) approach, which ensures the active participation of the beneficiaries and Local Governments at all levels of decision-making. It encourages the organization of the social group, through which the voice of the stakeholders can be heard, and the necessary action taken. This social group formation fosters social connectivity or networking among the participants, and this enhances and promotes social capital. Hence, social capital is seen as an element that ensures food security and sustainable development, Lawal et al. [6]. Social capital is a resource that facilitates cooperation within or between groups of people. It can emerge in relationships in many areas of life, such as those involving friends and families, school communities, ethnic, religious and community groups, occupational groupings, firms, governments and other institutions. The term social capital is used to refer to connections which exist among people and organizations. These social networks have important implications for social identity, emotional support, as well as the exchange of goods, services, and information. Views differ about what constitutes social capital, how it operates, to whom and what the concept applies, and how to delineate between its sources, manifestations and effects. However, there seems to be a broader agreement in the literature about what social capital does more than what it is. In particular, it is widely agreed that social capital facilitates mutually beneficial collective action. This is expected to facilitate and enhance production output and welfare outcomes especially among subsistent farmers which dominate the agricultural sector in Nigeria (Since it permits reliance on each other for individual capabilities, e.g., technological skills, for their own benefit).

A couple of studies have observed that social capital has increasingly gained recognition in many aspects of agriculture, natural resource management and rural development in developing countries. Among others, the prominent of these studies include food insecurity (FAO) [7], Kirori [8], Rudd [9]; Iyanda [10], and Lawal et al. [6]. This is as a result of its perceived positive consequences for development, and opportunity for those who lack possession of and access to financial, human or natural capital [10]. Most of the farmers have severely limited access to, and control over critical assets, including land physical and human capital. They lack production and labor market endowments,

resulting in low income and consumption. This can be attributed to the fact that they depend on subsistence agriculture as their main source of livelihood, where returns to labor and capital are generally low. Adepoju et al. [11], asserted that these factors, coupled with lack of access to the local institutions that shape policies, weaken the decision environment and prevent the rural poor from acquiring the capabilities for decent living, hence, being food secured.

One of the major food crops grown in Nigeria is cassava (*Manihot esculenta*). This is because it is an important staple food of an average household, particularly for the poor rural household. Cassava or its derivatives form part of daily food both for poor and non-poor households. Therefore, this makes it an essential factor in food security, poverty alleviation and employment generation, among others. It was observed by Nweke et al. [12], that cassava has the potential for bridging the food gap, because it has been discovered from research that famine rarely exists where cassava is widely grown. This is because cassava can grow in poor marginal soil where most crops cannot grow, Okpukpara [13]. Since its debut in the late 1600s on Portuguese trade ships from Brazil into Nigeria, cassava has gone from minor crop to a major crop and accounts for between 40–50% of all calories consumed in southern and central Nigeria. Therefore, cassava has played and continues to play a remarkable role in the agricultural sector of Nigeria, particularly on food security. It is of great interest to note that Nigeria is the world's largest producer of cassava in the world. Its current production was estimated in 2009 to be 36.8 million metric tons and the total area harvested in 2009 was 3.13 million ha, with an average yield of 11.7 tons/ha Idrisa et al. [14]. It is produced predominantly (99%) by small farmers with 1–5 ha of land intercropped with yams, maize, or legumes in the rainforest and savanna agro-ecologies of southern, central, and lately northern Nigeria.

In order to tackle the challenges associated with food security, cassava production has gotten international attention, and currently, different organizations and foundations are involved in its research and development activities. Several studies have been carried out on food security in Nigeria. Some of these include Omonona and Agoi [15], Idrisa et al. [14], Adeyemo and Kuhlmann [16], and Fakayode et al. [17]. Most of these studies focused on measuring food security among rural or urban poor households, suggesting ways of solving the food problem. However, there is a gap in the literature on the role of root and tuber crops on ensuring food security particularly cassava which has been highly recognized as one of the crops that possess the potential for higher yield per unit area relative to other crops such as cereals, pulses fruits, vegetables, etc., Gezhagne et al. [18]. Also, in spite of the influence of social networking on food security, no appreciable studies have tried to link the two together in Nigeria. Hence, this research was designed to fill this gap and provide empirical information concerning the nexus between social capital and food security. This study, therefore, identifies the various social capital dimensions available in the study area and the benefits that farmers derived from participating in social networking. It also profiled the farmers based on their food security status and examined the effects of social networking on farmers household food security.

In what follows; however, we summarize the concept of "food sovereignty", make a distinction between it and food security and clarify why our study is on food security and could not be based on food sovereignty concept.

Food sovereignty can be defined as the right every nation has to maintain and develop its own capacity to produce its basic food needs regarding cultural and productive diversity. It emphasizes the right to grow one's food in one's territory, as well as define one's food and agriculture policies, which consequently protect and regulate domestic agricultural production and trade. This is to attain sustainable development through autonomy production, thereby limiting the dumping of foreign products on the local markets Via Campesina [19]. According to Via Campesina [20], food sovereignty is a precondition to genuine food security. In contrast to food security, food sovereignty focuses on food for people, value food providers, emphasizes and localizes food systems and advocates its local control. The concept of food sovereignty emerged as a significant alternative to the prevailing neoliberal globalization policies for agriculture and trade. The emergence was during a conference of peasant and farm leaders in 1996 where they agreed that the potential in the concept of food

security to ensure local access to culturally appropriate and nutritious food was considered invalid [19]. In their view, the pillars of food security lay more emphasis on food-related policies in terms of food production and enhancing food access opportunities, without taking into cognizance how, where and by whom food is produced. Food security, in actual fact, does not differentiate where food comes from (nor consider) under what conditions they are produced or distributed. It is known to be supported by subsidies and policies which damage local food producers but benefit agribusiness corporations. Therefore, it is criticized based on this. On the other hand, food sovereignty considers the food producer, distributors and consumer at the center of food systems and policies relatively than the demands of markets and corporations. It also prioritizes local and national economies and markets, which consequently give power to smallholder and commercial-driven agriculture (Change for Children, https://changeforchildren.org/learn-teach/food-security/) [21].

In Africa, however, the concept of food sovereignty as a phenomenon has not been commonly used in discussion with regards to food production among African leaders. In contrast, the principles of food sovereignty, such as agrarian reform, food production, natural resources protection, reorganization of food trade, and putting an end to the globalization of hunger, all indicate that some of the food sovereignty concepts are already embedded in the principles expressed by African agencies. Conversely, the expression of food security is not new among African political and agricultural agencies and leaders. In this wise, what may be lacking in this instance is a common definition for food security, (Tambi et al.) [22].

The emphasis in this paper is to fill some identified gaps, which will lead to addressing the issue of food security in Africans perspective using social networking. Moreover, Nigeria, before late 2019, is well known for massive importation of food which does not advocate food sovereignty's core principle of stopping neoliberal trade. For this reason, this study is within the context of food security in an aggregated macro-level vis-à-vis social networking. This indicates the motive of why the concept used for the study is different from food sovereignty. Food sovereignty fully embodies the right to food because it adds a human dimension to food security, acknowledging individuals, households, communities and nations have a say in their relationship with food. This distinction is being emphasized in order to reiterate the difference between food security and food sovereignty concepts and that this present study clearly focuses on food security. The social networking identified is hinged on the cooperation ensued to combat risk faced in their livelihood activities and other related risks. Also, data collected are to capture social capital and food security variables as well.

2. Conceptual and Empirical Review

2.1. Conceptualization of Social Capital and Empirical Review

The central idea of social capital is that networks and the associated norms of reciprocity have value for the people who are in them, and at least, in some instances, demonstrable externalities, so that there are both public and private aspects of social capital. There are many different definitions of social capital, and different theoretical approaches underpinning these definitions. Putnam [23] defines social capital as the networks, norms, and trust that enable participants of a group to act together more effectively to pursue common objectives and describes some of its benefits as mutual support, cooperation, trust, institutional effectiveness.

Social capital is an intangible form of capital that is accumulated by individuals when they engage in social relationships. This investment can be intentional or not, but enables an individual to engage in certain actions and to raise certain benefits otherwise impossible to reach. It, therefore, provides for participants to secure benefits by virtue of membership in social networks or other social structures, Aker [24]. Indeed, research evidence shows that high levels of social capital are associated with a range of positive outcomes for individuals and/or communities, including better health and wellbeing, lower crime rates and higher educational achievement.

Some forms of social capital are highly formal with the organized chairperson or a president and membership dues. Other forms of social capital, such as a group of people who gather at a newspaper stand every day, are highly informal. Both forms constitute networks in which reciprocity can easily develop, and in which there can be gains. The capacity for coordination within a group and the attainment of some common objectives are potentially conducive to some individual and social benefit. But, the number of benefits and the distribution will ultimately depend on the nature of the relationships, the group, and the objectives pursued by its members. Moreover, apart from the nature of the group, also the institutional setting in which formal and informal organizations evolve will influence the conduct and outcomes of in-group cooperation [24].

While social capital is usually discussed within the context of communities, which something relies on the existence of links, networks and trust between people, it is arguably the case that some kinds of social capital, such as willingness to trust other people or perceptions of the local area are also attributes of individuals. In practice, attributes associated with individuals, groups of people and places may all contribute to forming social capital. According to Adepoju and Olawuyi [25], the essence of this concept is to facilitate interactions that exist among people based on institutions and network that they establish among themselves or that they mutually belong. The identified critical elements of social capital include: (a) Social resources which are informal arrangements between neighbors or within a community; (b) collective resources which include the establishment of self-help groups, credit unions, community safety schemes; (c) economic resources these are based on the levels of employment; access to green, open spaces; and lastly (d) cultural resources such as libraries, art centers, local schools.

Social capital at a neighborhood level, as reported by Stone et al. [26], can be categorized into three, namely; informal ties which exist among members of household, family and family-in-law, friends, neighbors, and workmates. Secondly, is the generalized relationships which are community-based, and or societal ties that is a relationship existing between people who do not know each other personally, including local people, and people in civic groups. The third type of social network is institutional relationships, which are the ties individuals have with institutions, including the legal system, the police, the media, unions, governments, political parties, universities, and the corporate world. These identified categories of social capital can further be grouped into different dimensions on which social capital can be measured.

Social capital (SC) can be conceptualized under two broad approaches. These include social cohesion and social networking, although the distinction between these theoretical approaches is gloomy.

1. Social cohesion: This originated from Coleman [27], and is considered to be a level of trust and reciprocity that exist among community members. Coleman [27] opined that SC affects social structures and can exist on the same level (horizontal) and between individuals, group and institutions (vertical). The dimensions include: (i) Structural, where individuals have formal opportunities to develop social ties; (ii) cognitive, which is hinged on perceptions of trust and reciprocity; and (iii) relational which emphasizes relationships and identification with others. Features of social capital identified in the literature under this category are:

(a) Social cohesion and inclusion: This reveals a lack of conflict in society through the presence of strong social bonds which bridge divisions in a community, measured by a strong feeling of togetherness within the community. This method has been used by Ehsan et al. [28], Sakurai [29], Ekanayake [30], Ogunrinola [31], and Misselhorn [32].

(b) Trust and solidarity, measured by perceptions about whether people in the community can be trusted and provision of social support by group members for each other in times of hardship. This approach was used by [29], Moazami [33], Diawara et al. [34], and Ogunrinola [31]. Other studies which made use of the approach are Sseguya [32,35] and Hung and Lau [36].

(c) Collective action, measured by community contributing resources towards common developmental goals. This is an indication that people in the community work together to solve common problems. The method was applied by Daud [33,37], Ali [30,32,34,36,38].

2. Social networking: In support of [23,27] revealed that social trust and civic commitment are correlated based on the success of local administration with an emphasis on social networking. The presence of local administration facilitates cohesion and overall cooperation between individual and groups. Therefore, a social network is the structure of social ties that link different individuals together either personally or through groups or organizations. This social link can be formal or informal. The dimensions include: (i) Binding, an enduring, complex, and extremely emotional relationships; (ii) bonding, this focus on resources accessed within networks with similar characteristics; (iii) bridging, the existence of social assets accessed across diverse groups with different socio-economic status; and (iv) linking, a trust network connecting individuals and groups across different classes often in relation to organizational power. The aspects of SC identified here are:

(i) Groups and networks: Measured by membership in a formal or informal organization; ability to secure support from other non-family members and relatives in times of hardship; ability to learn from one's group, access to markets information through the group. These have been used by Sakurai [30,38,39], Thamizoli [31,34,40]. Others who used it are Sseguya [35], Islam and Al Mamun [36,41], Grootaert [42], Grootaert et al. [43], Kuroki [44], Narayan and Pritchett [45], Adepoju et al. [11], Yusuf [46], Okunmadewa et al. [6,47], Kirori [8] among others.

(ii) Group cooperation: Measured through member's willingness to contribute time and money towards group and individual advancement. This, as used can be found in [6,8,35,40,42,43,45–47], among others.

(iii) Information and communication: This is measured by Incidence of reading or listening to news sources, such as radio, newspapers, and television, as well as sharing useful information among group members. Previous studies which used this are Thamizoli [40], Kuroki [44], Martín-Alcázar [46,48].

(iv) Empowerment and governance: Measured by acquiring control in decision making, affecting daily activities. It also connotes involvement in local elections, such as voting and being voted for. This method was adopted by Kuku and Liverpool [6,29,30,42–49].

The concept of SC can be a combination of different methods highlighted above. SC was conceptualized in this study using the combinations of all social networking measures as applied by [42–48]. The choice of this was based on the use of primary data that extensively capture different areas of measuring household capital unlike the use of secondary data which may limit the number of SC available to three or less.

2.2. Concept, Basic Dimensions of Household Food Security and Empirical Review

Concepts of food security have evolved in the last thirty years to reflect changes in official policy thinking, Heidhues et al. [50]. The term first originated in the mid-1970s, when the World Food Conference in 1974 according to Shaw [51] defined food security in terms of food supply—assuring the availability and price stability of basic foodstuffs at the international and national level. The definition was revised to include the individual and household level, in addition to the zonal and national level of aggregation, in food security analysis. World Food Summit (WFS) [52], definition of food security existence as when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The widely accepted definition reinforces the multidimensional nature of food security to include food access, availability, food use and stability. It has enabled policy responses focused on the promotion and recovery of livelihood options.

According to Pinstrup-Andersen [53], the concept of food security has been used extensively at the household level as a measure of welfare and attempts have been made to make the concept

operationally useful in the design, implementation, and evaluation of programs, projects and policies. A household is considered food secure if it can acquire the food needed by its members to be food secure. There are two reasons why household food security may not assure food security for all its members. First, the ability to acquire enough food may not be converted into actual food acquisition. Household preferences may not prioritize food acquisition over the acquisition of other goods and services, such as school fees and housing. Second, the intra-household allocation of the food may not be based on the needs of each individual member. The existence of a large number of households with both undernourished and obese members is a case in point. Rao [54], reported that at the individual level, the definition of food security is much more straightforward. An individual is food-secure if his or her food consumption is always greater than need, as defined by physiological requirement. Consumption is determined by the claim the individual has on household food resources. This may be affected by individual earnings and assets, or by the individual's position in the household. It is certainly unusual for an individual's share of household food consumption to be determined solely by need. It is clear that food security at one level does not imply food security at a lower level of aggregation. Food security at the household level does not imply that all members of the household are food secure. A food-insecure household may equally contain food secure members. The nature and extent of food insecurity are dependent on the time factor. Food security analysts have defined two general types of FAO [55] as (i) Transitory Food Insecurity and (ii) Chronic food Insecurity.

Different methods have been used in literature to measure food security. These among others include:

1. Coping strategies index: As adopted by [49]. The coping strategies can be defined as a response to adverse events or shocks. These strategies range in intensity from activities like food rationing or drawing down savings, to more permanent strategies like the sale of assets.
2. Use of money metric: Where food security status is measured based on the proportion of household income or expenditure expended on food. This method has been extensively used by [15], Irohibe and Agwu [56], Amaza et al. [57], Abdullahi et al. [58], Oni et al. [59], Salman and Ekong [60].
3. Cost of caloric (COC) intake: Here, the cost of buying the recommended minimum calorie intake is used to determine the food insecurity line. The method was used in the following studies: Sultana and Kiani [61], Fawehinmi and Adeniyi [62] and Olagunju et al., 2012 [63].
4. Daily calorie intake per adult: This is measured at the household level where a seven days memory recall method is put to use to classify households into food secure and food insecure. The method was adopted by Zemedu and Mesfin [64], among others.
5. Household Hunger Scale (HHS): This was developed by the "Food and Nutrition Technical Assistance (FANTA)" project and adopted by Digo et al. [65]. The method categories households into three based on the level of hunger experienced.
6. House Food Insecurity Access Scale (HFIAS): This utilizes nine occurrence questions that ask whether a particular condition related to the experience of food insecurity has happened during the past four weeks or 30 days, with responses coded as 1 for yes and 0. This has been used by Malual [66], Obayelu [67], and Ibrahim et al. [68].

The money metric approach is without specific assumptions about preferences. While it can be seen as conceptually less complete relative to a few methods mentioned above, it has the advantage of requiring substantially fewer data. On this basis, this study adopted the use of expenditure on food (money metric approach) to categorize the household into food security status. This is because, when we consider the advantage of less required data, the fact that getting the actual calories intake by households through memory recall may not be possible. The approach has been extensively used in various similar studies, such as References [15,56–60].

2.3. The Nexus between Social Capital and Food Security

Social capital is expected to influence household food security in two possible ways, either through an increase in the resource base of the household or by increasing the dependency ratio. A large dependency ratio can aggravate household food insecurity by directly creating additional mouths, thereby increasing the pressure on available resources. On the other hand, it improves food insecurity status indirectly when more household members earn incomes for households with other resources or engage in family labor (Liverpool-Tasie et al. [69]. Social capital can cushion the effect of food insecurity through the benefit that households derive from belonging to a social group. These benefits may include information sharing about market opportunities, sources of credit and subsidized input, price movement, among others.

The household income, in addition to remittances, received determines the household assets base, which directly influences the level of food consumption within the households. These with other socio-economic factors, further influence the type of social network that the household engages in, either formal or informal groups. Conversely, social network directly affects income and the food security strategies adopted at the household level, as well as household expectations from these social groups. The food security problems (such as poverty, vulnerability to risk, lack or inadequacy in information, lack of farm inputs, price and income fluctuations, and market failures) will prescribe the strategies that the household will use in order to improve its food insecurity status.

Sseguya [35], reported that availability, accessibility and utilization of food by households could be enhanced by collectively sharing information and resources. Further, during times of stress or shock, social capital manifested through relationship, community solidarity and access to external networks potentially plays a role in facilitating access to food for the affected households and/or communities. Access to information and resources from informal and formal networks is mediated by norms of reciprocity and mutual trust and solidarity at both household and community levels. The household general characteristics are expected to directly determine the level of income which will consequently affect various expenditures undertaken at the household level—the instability or fluctuation of income influences household expenditure and hence, food security status.

3. Materials and Methods

3.1. Study Area and Sampling

This study was carried out in four geographical zones of Nigeria. They are the northcentral, south-east, south-south and south-west zones. Nigeria is bordered to the west by the Republic of Benin, to the south by the Atlantic Ocean, to the east by Cameroon and to the north by Chad and Niger Republic. The survey which was carried out during the implementation of the IITA/IFAD project was accomplished by the International Institute of Tropical Agriculture during the first quarter of 2015 under the sub-project "Enhancing the competitiveness of High Quality Cassava Flour (HQCF) in Nigeria". A Multi-stage sampling technique had earlier been adopted in selecting respondents for this study. The sampling resulted in the following: (i) One state in the north-central (FCT), two states in the south-east (Abia and Enugu), one state from the south-south (rivers) and two states from the south-west (Oyo and Ogun); (ii) random selection of local governments areas (LGAs); (iii) random selection of villages and localities/enumeration areas (EAs); (iv) in the final stage, the cassava producing households were randomly selected by way of proportionate and representative sampling. A total sample of 775 cassava producers had earlier been pre-determined through a confidence interval approach.

3.2. Data Collection and Variables

Primary data were collected with the use of a structured questionnaire containing both open and close-ended items. The questionnaire administration was cross-sectional. Secondary data were extracted from IITA database and other documented reports, such as journals, bulletins, as well as other books on related issues. Data and variables which included demographic characteristics (age,

gender, household size, marital status, education, farming experience), the benefit derived from social groups, household food expenditure, among others, were collected. The demographic, social capital and food security variables used in the analysis are described in Tables A1 and A2 in Appendix A. The abridged questionnaires containing the questions asked to gather the information on the variables used in this paper are shown on Tables A6–A9 in Appendix B.

3.3. Statistical and Econometric Tools and Models Used in the Analysis

3.3.1. Descriptive Statistics

Descriptive statistical tools included frequencies and percentages, mean, standard deviation, minimum and maximum parameters used to describe the social capital dimensions.

3.3.2. Composite Score

Arising from the consideration of the social capital concepts adapted and used by previous studies described in Section 2.1 above, it was expedient to compute a composite score. A composite score was employed to measure the level of benefit derived by farmers who engaged in social group activities. Respondents' claim of benefits received from membership in the social group was estimated on a binary scale. A score of 1 was allotted to 'Yes' and 0 to 'No' responses on highlighted benefits. With ten (10) statements, a respondent can score a maximum of 10 points and a minimum of 0 points. The categorization into high, intermediate and low benefit was then achieved using a composite score as used by Sirkin [70] and adopted by Adepoju and Olawuyi [25]:

High category = Between Mean + S.D and 10 points
Medium (intermediate) = between lower and upper categories
Low Category = Between 0 and Mean − S.D.

3.3.3. Factors Influencing Benefit Derived from Social Capital

1. Use of Ordered probit: This model, as adapted from the studies of Adepoju et al. [11]; Jerry et al. [71], and Kawakatsuy and Largeyz [72] was used to identify the factors influencing benefit received by farmers. The fractional regression (non-heteroskedastic probit) model was, however, run to determine the factors influencing the benefits received by the farmers on the geographical zonal basis. The actual index of the derived social capital benefits was proxied as the rate of benefits and used as the dependent variable. An ordered probit model is used to model relationships between a polytomous response variable which has an ordered structure and a set of regressor variables. Using the composite score (as computed in Section 3.3.2) from the level of benefit received from social capital, farmers were categorized into high, intermediate and low benefit recipients. The standard ordered probit model is widely used to analyze discrete data of this variety, and it is built around a latent regression of the following form:

$$y^* = x' \beta + \varepsilon \quad (1)$$

where x and β are standard variable and parameter matrices, respectively, and ε is a vector matrix of normally distributed error terms. Predicted grades (y^*) are unobserved. We do, however, observe the following:

$$y = 0 \text{ if } y^* \leq 0 \quad (2)$$

$$y = 1 \text{ if } 0 < y^* \leq \mu_1 \quad (3)$$

$$y = 2 \text{ if } \mu_1 < y^* \leq \mu_2 \quad (4)$$

where μ_1 and μ_2, are the cut-off points, i.e., the threshold variables in the probit model. The threshold variables are unknown, and they indicate the discrete category that the latent variable falls into. They are determined in the maximum likelihood estimation procedure for the ordered probit.

When normalized σ to 1,

$$\Pr(y_i = 0) = \Pr(y* < 0) \tag{5}$$

$$\Pr X_i\beta + \varepsilon < 0,$$

$$\Pr(\varepsilon < 0 - X_i\beta)$$

$$\Phi(0 - X_i\beta)$$

$$\Pr(y_i = 1) = \Pr(0 \le y* < \mu_1) \tag{6}$$

$$\Pr(0 \le X_i\beta + \varepsilon < \mu_1)$$

$$\Pr(\varepsilon < \mu_i - X_i\beta) - \Pr(\varepsilon < 0 - X_i\beta)$$

$$\Phi(\mu_1 - X_i\beta) - \Phi(0 - X_i\beta)$$

$$\Pr(y_i = 2) = \Pr(y_i* \ge \mu_1) \tag{7}$$

$$\Pr(X_i\beta + \varepsilon \ge \mu_1)$$

$$\Pr(\varepsilon \ge \mu_1 - X_i\beta)$$

$$1 - \Pr(\varepsilon \le \mu_1 - X_i\beta)$$

$$1 - \Phi(\mu_1 - X_i\beta)$$

Note that $0 < \mu_1$ in that order for the benefits received from being a member of a social group. The likelihood for a benefit received by an individual is

$$L = [\Phi(0 - X_i\beta)]^{z_{i1}}[\Phi(\mu_1 - X_i\beta) - \Phi(0 - X_i\beta)]^{z_{i2}}[1 - \Phi(X_i\beta - \mu_1)]^{z_{i3}} \tag{8}$$

$$Z_{ij} = 1 \text{ if } y_i = j;\ 0 \text{ otherwise for } j = 0.1 \text{ and } 2 \tag{9}$$

where for the i^{th} individual, y_i is the observed outcome and X_i is a vector of explanatory variables. The unknown parameters β_j are typically estimated by maximum likelihood.

Y = level of benefit received, (0 = low benefit, 1 = intermediate benefit, 2 = high benefit).
X_1 = age (years), X_2 = gender (male = 0, female = 1), X_3 = level of education (years),
X_4 = Household size (number), X_5 = Meeting attendance/(frequency of interaction) index,
X_6 = Farming experience (years), X_7 = Labor contribution index, X_8 = Decision making index
X_9 = Cash contribution (₦), X_{10} = Membership density.

2. Use of Fractional Probit: Another model which was used to identify the factors influencing the benefits received by farmers (on the geographical zonal basis) was the *Fractional regression* (non-heteroskedastic probit) model. The actual index of the derived social capital benefits was proxied as the rate of benefits and used as the dependent variable. The variants of the model are often used for such outcomes as rates, proportions, and fractional data. The fractional probit regression was used because it was the model that captured all the independent variables as a result of *interaction* during the disaggregation of the sample into the zonal basis. Details of this model can be found in Papke and Wooldridge [73] and Wooldridge [74]. The model, adapted from [73] is presented as follows:

Assuming the availability of an independent (though not necessarily identically distributed) sequence of observations $\{(X_i, y_i) : i = 1, 2, \ldots, N\}$, where $0 \le y_i \le 1$ and N is the sample size. The asymptomatic analysis is carried out as $N \to \infty$. A maintained assumption is that, for all i,

$$E(y_i|X_i) = G(X_i\beta) \tag{10}$$

where $G(\cdot)$ is a known function satisfying $0 < G(z) < 1$ for all z ∈ R. This ensures that the predicted values of y lie in the interval (0, 1).

3.3.4. Food Security Index

Food security can be measured using varying methods among which are: Dietary Energy Consumption, FAO [55] and Otemuyiwa and Adewusi [75] which is closely related to Dietary diversity Score, Hoddinott [76] and Maxwell et al. [77]. This categorized household into food security status based on estimated energy composition of food intake. Cost of Calorie is another method which classifies households to different status based on the total cost of daily calorie intake from food consumed by each household [57,63]. Another method related to Cost of Calorie Intake is *Household calorie Acquisition* [76]. Also, there is a food security index (FSI) which differentiates household using their level of food expenditure [15,53,56,77]. In addition to these, we have the Food Insecurity Multidimensional index (FIMI), this makes use of different dimensions to food security to categorize household based on food availability, affordability, sustainability and utilization, Marion [78].

The food security index approach to measuring food security uses imputed monetary flows without specific assumptions about preferences and is in a sense shortcut version of the other approaches. While they can, therefore, be considered conceptually less complete, they do have the advantage of requiring substantially fewer data. On this basis, this study adopted a food security index to categorize the households in the study area, considering the advantage of less required data. The approach has been extensively used in various similar studies.

The households were classified into food secure and food insecure using food security index as earlier used by [15,25]. This was used to establish the food security status of various households. It is given by:

Fi = Per capita food expenditure for the i^{th} household
2/3 mean per capita food expenditure of all households

Where Fi = food security index. When Fi $\geq$ 1, the i^{th} household is food secure, and Fi $\leq$ 1, the i^{th} household is food insecure. A food-secure household is, therefore, that household with per capita monthly food expenditure falling above or equaling to two-third of the mean per capita food expenditure. On the other hand, a food-insecure household is that household with per capita food expenditure falling below two-third of the mean monthly per capita food expenditure.

3.3.5. Empirical Determinants of Food Security

The logit model: A Logit model was used to examine the determinants of household food insecurity. This is specified as:

$$Y_i = g(I_i) \tag{11}$$

$$I_i = b_0 = \sum_{j=1}^{n} b_j X_{ji} \tag{12}$$

where: Y_i is the observed response for the i^{th} observation (i.e., the binary variable, $Y_i = 1$ for food-secure household and $Y_i = 0$ for a food-insecure household); I_i is an underlying and unobserved stimulus index for the i^{th} observation (conceptually, there is a critical threshold $\left(I_i^*\right)$ for each household; if $I_i < I_i^*$ the household is observed to be food secure if $I_i \geq I_i^*$ the household is observed to be food insecure). Also, g (in Equation (11)) is the functional relationship between the field observations (Y_i) and the stimulus index $\left(I_i\right)$ which determines the probability of being food insecure. The logit model assumes that the underlying stimulus index $\left(I_i^*\right)$ is a random variable, which predicts the probability of being food insecure. Therefore, for the i^{th} observation (a household):

$$I = I_n \frac{P}{1 - p_i} = b_0 + \sum_{j=1}^{n} b_j x_{ji} \tag{13}$$

The relative effect of each explanatory variable (X_{ji}) on the probability of being food secure is measured by differentiating with respect to X_{ji}, using the quotient rule, we have:

$$\frac{dp_i}{dX_{ji}} = \left(\frac{e^{I_i}}{1+e^{I_i}}\right)\left(\frac{I_j}{X_{ji}}\right) \tag{14}$$

where *Pi* is the probability of an i^{th} household being food secure; *Xi* = vector of explanatory variables. The logit model as used in this paper has been applied by Amaza et al. [57], and Olagunju et al. [63] in their studies on determinants and measurement of food insecurity in Nigeria and determinants of food insecurity in Ogbomoso metropolis, respectively.

3.3.6. Variable Descriptions/Definitions and Their Apriori Expectations

The descriptions and or definitions of the variables (The questions which have been used to elicit the data/variables are presented in the abridged sections of the household questionnaire on Tables A6–A9 in Appendix B. The particular questions were asked because they were amenable to the methodology of the study. Households' heads or their representatives were interviewed through a household survey) used in the analyses are presented in Tables A1 and A2 in Appendix A (with their expected signs).

4. Results and Discussion

4.1. Dimensions of Social Capital of the Sampled Households

The dimensions of the social capital of the sampled households are presented in Table 1. The mean value of membership density (DM) for Nigeria is 1.63 (1.29%), which is approximately 2. This is an indication that an average household participated in about two social groups. This result is low relative to the findings of [11,46] where membership density in the social group was about five. However, in another study by [6] where the effects of social capital on credit access among cocoa farming households in Osun State was analyzed, the overall membership density was found to be about 48. In effect, we can imply that participation in social groups will depend much on the perception that household members have about the quantum and quality of the benefits they can derive from participating in such social groups. This also depends on the set up of the social groups and the environment where they operate. It is worthy of note that the south-west zone recorded the highest mean value of 1.83 (1.41%), while the least in that category was the south-east zone with 1.63 (1.19%). In our study, the results of the zone membership density imply that though the four zones had very low DM figures, households in the south-west zone enjoyed better and more benefits than their counterparts in the other three zones. Participation in decision making within a group reveals a good level of activity with a 59.40 (23.17%) decision score. Only the north-central zone recorded below average in decision making score 46.00 (20.85%) relative to other zones. In the study of [6], the decision-making indexes were low across the zones considered. It has been asserted that active and robust decision making involvement by members of an association improves the benefits derived from such associations [43,46,47]. In terms of meeting attendance, the result shows an average of 81.47 (21.07%) attendance for the sampled respondents (cassava farming households). All the zones had above 80.00 meeting attendance except the south-west zone, which had 78.37. This is an indication that cassava farmers are fairly committed to social group activities, suggesting that regularity at meetings and interaction among members and between groups or association was reasonable. Studies, such as Maluccio et al. [79] and Aker [24], reported an increase in benefits that members derived from their association as the meeting attendance and interactions at different levels increased. The mean value for labor contribution was very low (5 person-days). This shows that only an average of 5 person-day labor was contributed every month. The reason for this may be the use of modern implements for agricultural activities that is encouraged for cassava cultivation both at the zonal and national levels. This is contrary to the findings of [11], where labor

contribution was almost 20 person-days. The highest mean value for labor contribution, 8.18 (6.26%), was observed in the north-central zone, while the least, 3.43 (4.68%), was in the south-south zone of Nigeria. Finally, on the social capital dimensions, a mean value of ₦5733.08 was estimated as contribution by an average cassava farmer in their various social groups. Cassava farming households from the south-west zone made the highest average contributions of ₦8999.10, while households from the north-central made an average contribution of ₦1840.00. Generally on dimensions of social capital, participation in decision making by households in our study was high enough, and this implies that farming households were actively involved in decision making within the associations they belonged. This is in agreement with the findings of Grootaert [80]. Also, cash contributions or cash commitments by the cassava farming households to the associations were much lower than contributions made by fish farming households involved in a recent study by Adepoju [83] where the fish farming households contributed as much as ₦43,887.52.

Table 1. Distribution of social capital dimensions in Nigeria.

Socio-Economic Variables	North-Central Freq (%)	South-East Freq (%)	South-South Freq (%)	South-West Freq (%)	Pooled Freq (%)
Membership density					
0	4 (10.00)	34 (14.53)	43 (28.10)	48 (13.95)	129 (16.73)
1–2	32 (80.00)	156 (66.67)	91 (59.48)	204 (59.30)	438 (62.65)
3–4	4 (10.00)	37 (15.81)	15 (9.80)	73 (21.22)	129 (16.73)
5–6	0 (0.00)	7 (2.99)	4 (2.61)	16 (4.65)	27 (3.50)
7–8	0 (0.00)	0 (0.00)	0 (0.00)	3 (0.87)	3 (0.39)
Mean (std. deviation)	1.58 (0.93)	1.63 (1.19)	1.23 (1.20)	1.83 (1.41)	1.63 (1.29)
Min	0	0	0	0	0
Max	4	6	6	8	8
Decision making					
< = 20	11 (27.50)	37 (15.81)	7 (4.58)	18 (5.23)	73 (9.47)
21–40	12 (30.00)	63 (26.92)	85 (55.56)	83 (24.13)	243 (31.52)
41–40	11 (27.50)	40 (17.09)	19 (12.42)	86 (25.00)	156 (20.23)
61–80	6 (15.00)	72 (30.77)	31 (20.26)	123 (35.76)	232 (30.09)
>80	0 (0.00)	22 (9.40)	11 (7.19)	34 (9.88)	67 (8.69)
Mean (std. deviation)	46.00 (20.85)	58.20 (25.17)	53.95 (21.40)	64.18 (21.56)	59.40 (23.17)
Min	20	20	20	20	20
Max	80	100	100	100	100
Meeting attendance					
< = 20	0 (0.00)	15 (6.41)	1 (0.65)	11 (3.20)	27 (3.50)
21–40	3 (7.50)	9 (3.85)	1 (0.65)	7 (2.03)	20 (2.59)
41–40	8 (20.00)	49 (20.94)	25 (16.34)	97 (28.20)	179 (23.22)
61–80	9 (22.50)	41 (17.52)	25 (16.34)	113 (32.85)	188 (24.38)
>80	20 (50.00)	120 (51.28)	101 (66.01)	116 (33.72)	357 (46.30)
Mean (std. deviation)	83.00 (20.02)	80.68 (24.14)	89.28 (16.70)	78.37 (19.84)	81.47 (21.07)
Min	40	20	20	20	20
Max	100	100	100	100	100
Labor contribution (person-days)					
< = 5	16 (40)	135 (57.69)	123 (80.39)	257 (74.71)	531 (68.87)
6–8	9 (22.50)	30 (12.82)	7 (4.58)	23 (6.69)	69 (8.95)
9–12	4 (10)	29 (12.39)	13 (8.50)	14 (4.07)	60 (7.78)
>120	11 (27.50)	40 (17.09)	10 (6.54)	50 (14.53)	111 (14.40)
Mean (std. deviation)	8.18 (6.26)	5.93 (5.67)	3.43 (4.68)	4.7 (5.94)	5.01 (5.75)
Min	0	2	0	0	0
Max	23	24	18	24	24
Cash contribution (₦)					
< = 50,000	40 (100.00)	232 (99.15)	151 (98.69)	328 (95.35)	751 (97.41)
50,001–100,000	0 (0.00)	1 (0.43)	1 (0.65)	6 (1.74)	8 (1.04)
100,001–150,000	0 (0.00)	1 (0.43)	1 (0.65)	6 (1.74)	8 (1.04)
150,001–200,000	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.58)	2 (0.26)
>200,000	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.58)	2 (0.26)
Mean (std. Deviation)	1840.00 (4130.471)	2774.263 (10,480.18)	3932.68 (14,038.77)	8999.10 (30,579.8)	5733.08 (22,325.31)
Min	0	0	0	0	0
Max	25,000	102,400	136,200	314,000	314,000
Total	40	234	153	344	771

Source: Field Survey, 2016.

4.2. Categories of Benefits Derived from Social Groups

The categories of benefits (that the farming households derived for participating in social groups), the number of benefiting households and their percentages are presented in Table 2. Results (pooled) showed that most of the households (58.10%) received an intermediate benefit. A high benefit was received by 23.09% of the households, while 18.81% received low benefits. This is an indication that the majority of the cassava farmers in Nigeria are in the intermediate benefit category. The mean value of 1.62 for all the groups implies that an average cassava farming household in Nigeria derives nearly 50% more benefits than the contribution made to the social group they belong to. About 58% of the cassava farming households in Nigeria obtained intermediate benefit from their social groups. The north-central and south-south zones of Nigeria, however, had a higher percentage, 45% and 28%, respectively, of cassava farming households that obtained low benefits from participating in social groups. The south-east and south-west zones had a higher percentage, 18% and 32%, respectively, of cassava farming households in the high benefit category. Among the zones in Nigeria, the south-west had the highest mean value (1.81 ± 1.40) for the benefit received by cassava farming households from the social groups they belonged, implying that an average cassava farming household in the south-west derives nearly double the benefits compared to the contributions made to the social groups they belonged. Our results fairly compare with that of [11]. Though the percentage of farming households with high benefits is a bit lower in our study, the percentage of households with intermediate and low benefits that we estimated are higher. Nevertheless, the patterns of the results from the two studies are similar.

Table 2. Categories of benefits derived from social groups.

Zones	Low Benefit (%)	Intermediate Benefit (%)	High Benefit (%)	Total (%)	Mean (Standard dev.)
North-central	18 (45.00)	19 (47.50)	3 (7.50)	40 (100)	1.56 (0.93)
South-east	35 (14.96)	157 (67.09)	42 (17.95)	234 (100)	1.62 (1.17)
South-south	43 (28.10)	87 (56.86)	23 (15.03)	153 (100)	1.21 (1.13)
South-west	49 (14.24)	185 (53.78)	110 (31.98)	344 (100)	1.81 (1.40)
Pooled	145 (18.81)	448 (58.10)	178 (23.09)	771 (100)	1.62 (1.27)

Source: Field Survey, 2016.

4.3. Factors Influencing Benefit Derived from Social Capital

Table 3 presents the result of the ordered probit model used to investigate the factors influencing the level of benefit derived from membership in social groups in the study area. Six variables are statistically significant at various levels. The likelihood ratio chi-square of 1126.01 with a *p*-value of 0.0000 reveals that the model as a whole is statistically significant.

Age (and age square) significantly affected benefit received from a social group at a 5% level of significance. This implies that the more the number of aged households, the less the probability of receiving a low benefit (by 1.08%), intermediate benefit (by 0.05%) and the more the likelihood of receiving a high benefit (by 0.007%). This may be because older farmers participate more actively in social activities. The level of education also significantly determined the level of benefit (at 5 percent significant level), meaning that an increase in the years of schooling increases the likelihood of receiving low benefit by 0.548%, and intermediate benefit by 0.265%. On the contrary, an increase in the years of schooling decreases the likelihood of receiving high benefit by 0.004%. The reason for this may be that increased formal education may minimize active participation in social group activities; hence, reduction in benefit received.

Table 3. Estimates of ordered probit on determinants of the benefit received (pooled result).

Variables	Coefficients	Std Error	$p-$Value	Marginal Effects		
				Benefit Categories		
				Low	Intermediate	High
Age	0.06550	0.02900	0.023 **	−0.01080	−0.000522	0.00007
Age^2	−0.000673	0.00027	0.015 **	0.00011	5.37×10^{-6}	7.27×10^{-7}
Gender	0.00575	0.15700	0.971	−0.00094	−0.00005	-6.22×10^{-6}
Household Size	−0.00884	0.01740	0.611	0.00146	0.000071	9.54×10^{-6}
Marital status	0.25700	0.25000	0.305	−0.03710	−0.00274	−0.00040
Education	−0.03330	0.01480	0.025 **	0.00548	0.00265	−0.00004
Farm experience	−0.00262	0.01010	0.795	0.00043	0.00002	2.83×10^{-6}
Membership Density	3.27000	0.19600	0.000 *	−0.53800	0.02610	0.00353
Cash contribution	2.25×10^{-9}	0.00001	1.000	-3.71×10^{-1}	-1.80×10^{-11}	-2.43×10^{-12}
Labor contribution	−0.09420	0.01750	0.000 *	−0.01550	0.000751	0.0001017
Meeting attendance	−0.00212	0.00353	0.548	0.00349	0.0000169	2.29×10^{-6}
Decision making	0.00930	0.00340	0.006 *	−0.00154	−0.00007	0.00001
/cut1	3.1410	0.8580				
/cut2	9.0417	0.9998				
Number of Observation	771					
LR ch2(12)	1126.01					
Prob>chi2	0.0000					
Pseudo R2	0.7543					

*, **, and present 1% and 5% significant levels, respectively.

The social capital variables that significantly affected (at 10% level of significance each) the benefits derived from social groups are membership density, labor contribution and decision making. An increase in the membership density will reduce the possibility of receiving low benefit by 53.8%, while it will increase the chances of receiving intermediate and high benefits by 2.6% and 0.35%, respectively. On the other hand, increasing labor contribution by a unit will reduce the probability of receiving a low benefit and increase the possibility of receiving both intermediate and high benefits. Lastly, participation in decision making within a social group reduces the chances of receiving low and intermediate benefits with a unit increase, while it will increase the likelihood of receiving a high benefit. This is an indication that it is not sufficient to be a member of a social group, active participation in the group is equally important, as previously reported by [11].

The determinants of benefits derived from social groups were disaggregated on a zonal basis, and the results are presented in Tables A3 and A4 in Appendix A. At the zonal levels, the result of the marginal effects suggests that there is no significant variable for the benefits received in the north-central zone. However, in the south-east, education is statistically significant (at 5%) for low, intermediate and high categories of the benefit received from the social group. This implies that the more educated the farming households are, the higher will be the likelihood of receiving a benefit.

Membership density and meeting attendance affected benefit received (at 5% level of significance) in the south-west zone. A unit increase in membership density increased the likelihood of receiving low, intermediate and high categories of benefit by 5.2%, while a unit increase in meeting attendance increased benefit received at all levels by 0.36%.

In the south-south zone, two factors significantly influenced the benefit derived. These are household size and marital status. Household size decreased the likelihood of receiving a high benefit of 0.22%, while being a married household head had a likelihood of receiving a high benefit. This is an indication that married farmers who are heads of their households received more benefit when they participated in social activities than their unmarried counterparts. Our overall results on the influence of education, labor and decision making index are similar to those of Adepoju et al. [11]. However, our study revealed more significant demographic and social capital dimension variables (e.g., age and membership density). Since, based on our results, the advancement in age favors high benefit,

while farm experience does not, we submit that farmers with longer years of experience in farming (which is also related to advanced age) are better placed to receive a high benefit. For education, which showed in this study, a decreased likelihood of high benefit, we suspect a correlation with farming experience which has to do with training received in the course of gathering experience. So, it is not plausible to discourage the more educated farming households not to take an active part in social activities. The memberships of the social groups are likely made up of fewer households with appreciable years of formal education. Increase in membership density and participation in decision making, which also favor high derivable benefits have some important implications (Grootaert [42], Yusuf [46], and Okunmadewa et al. [47]). One is that apart from the high benefits that members will derive, decisions, opinions and contributions in cash and in-kind will be optimal, and this further enrich the expected outcomes and benefits from the social groups. Secondly, and on labor contribution, the cost of achieving goals and objectives and deriving more high benefits will be reduced in as much as it is the members themselves that are supplying the manual labor needed by the group for any of such work. More memberships that will generate more labor to achieve more goals and objectives and in essence, derive more benefits, is therefore encouraged.

4.4. Food Security Status of the Cassava Farmers in Nigeria

The food security status of the cassava farmers in Nigeria is presented in Table 4. Generally, 41.5% of the cassava farming households are food secured, while others are food insecure. Except in south-west zone where more than 50% of the cassava farming households are food secured, the level of food insecurity among cassava farming households is high in the south-south (73%), north-east (61%), and north-central (60%). It is essential to take note of the high level of food security among cassava farming households in the south-south zone of Nigeria. Our results are similar in the pattern of food security status with those of Ahungwa et al. [81], Osuji et al. [82], Oyetunde-Usman and Olagunju [83], where the numbers and percentages of food-insecure households are more than those of the food secure households. However, in the studies of Abu and Soom [84] and Ahmed et al. [85], the number and percentages of food secure households are more than their food-insecure households. Our results seem to reveal the food security impact of cassava commercialization in the different zones of Nigeria. The cassava sub-sector, according to Abass et al. [86], in the south-west zone, has become more commercial in the last three decades, due to increased investments in cassava processing factories. The factories offer substantial market opportunities to cassava farming households to sell their roots and make a decent income, thereby contributing to poverty alleviation. However, the trend of cassava commercialization in the other zones is at a much slower pace. Thus, food security among farming households is an essential indicator for measuring the performance or success of development initiatives, as well as the commercialization of the agriculture sector, and specifically, the cassava sub-sector.

Table 4. Food security status of cassava farming households in Nigeria.

Zones	Food Secure (%)	Food Insecure (%)	Total (%)
North-central	16 (40.00)	24 (60.00)	40 (100)
South-east	89 (38.03)	145 (61.97)	234 (100)
South-south	41 (26.80)	112 (73.20)	153 (100)
South-west	174 (50.58)	170 (49.42)	344 (100)
Pooled	320 (41.50)	451 (58.50)	771 (100)

4.5. Social Capital Determinants of the Food Security Status of Cassava Farming Households

The social capital dimensions driving household level of food security in Nigeria are presented in Table 5, while Table A5 in Appendix A presents the decomposition into selected geographical zones. Eleven (11) independent variables comprising five social capital dimensions (membership density, cash contribution, labor contribution, meeting attendance and decision making) and six control

variables (age, gender, household size, marital status, education and farming experience) were used. Marital status was the only control variable that significantly influenced food security with a marginal value of 0.074 and at a 1% level of significance. This means that the married household heads have a higher likelihood of being food-secure increases with more (1% increase) married households by 7.4%. This is an indication that married household heads are more likely to be food secured relative to their unmarried counterparts. The result is expected—married households have adults that will work to ensure that the household is food secured. This finding is supported by the report from Oni and Fasogbon [87]. We, however, do not infer that being married is one of the conditions to be food secured. Rather, married household heads may tend to strive harder to keep the household members put collective efforts into farming activities that may result in increased food security for all the members. In the study area and a similar environment, agriculture development programs should be geared towards including married household heads even when there is a priority on youth and the vulnerable.

Table 5. Logit regression estimates of social capital determinants on household food security (pooled result).

Social Capital Dimensions	Coefficients	Std Error	*p*-Value	Marginal Effects
Membership Density	0.243	0.0940	0.010 *	0.010 *
Cash contribution	0.000013	6.52×10^{-6}	0.046 **	0.047 **
Labor contribution	−0.0335	0.199	0.092 ***	0.092 ***
Meeting attendance	−0.00215	0.00435	0.620	0.620
Decision making	−0.000175	0.00393	0.964	0.964
Control variables				
Age	0.00434	0.0368	0.906	0.906
Age^2	−0.00133	0.000341	0.696	0.696
Gender	0.0520	0.185	0.779	0.779
Household Size	−0.287	0.210	0.173	0.173
Marital status	0.492	0.296	0.095 ***	0.074 ***
Education	−0.107	0.176	0.541	0.541
Farm experience	0.157	0.188	0.401	0.401
Constant	−0.470	1.100	0.669	

*, **, and *** represent 1%, 5%, and 10% significant levels, respectively.

From the social capital variables, membership density and cash contribution positively determined the likelihood of being food secured, while labor contribution had a negative relationship. Membership density and cash contribution significantly affected food security with marginal values of 0.010 and 0.047, respectively. This suggests that a 1% increase in membership density and cash contribution will increase the household food security level by 1.0% and 4.7%, respectively. The implication is that the more the households actively participate and make a cash contribution in social groups, the more food secured they will be. The result is in line with findings of Adepoju et al. [11]. The groups' activities can drive active participation in any social group and ample cash contribution to it that members perceive as being able to generate the desired benefits. On the other hand, an increase in labor contribution reduces the probability of being food secured with a marginal value of 0.092. With this result, there are indications that an increase in labor contribution will reduce household food security status by 9.2%. This implies that the more the labor contribution, the less the food secured the households become because more time will be spent developing other farms rather than working only on the family farmland. These results have profound implications for the organization of agriculture or cassava development programs in Nigeria, especially in the zones/zone with high food insecurity. First, the results imply that formation of cooperative systems (with high membership density) where the members make cash contributions for investment in a collective farming activity (increased cash contribution) is likely to prevent food insecurity. Secondly, the priority for such investments should be in the mechanization of cassava production or processing, thereby, reduce excessive labor contribution. These two elements if combined in the organization of agriculture or cassava development programs

would have a significant positive effect on food security of a large population of cassava farming households, preventing them from falling into food insecurity or bringing them out of food insecurity. In general, our results support a significant relationship between social capital and household food security, as previously found by Obaa [88] and Malual [66].

Several variables controlled the food security level of cassava households in the north-central (Table A5 in Appendix A) compared to other zones. Among the control variables that positively influenced food security status in this zone are marital status, farm experience and membership density (Table 5). An increase in these variables by a unit enhanced the probability of the household being food secure. Here, the importance of farm experience, high membership density of social groups and married household heads being members of such groups are further affirmed as strategies for ensuring food security. Extension and training enhance farm experience. Thus, extension and training could improve on the hidden skills of the cassava farming households, which possibly, in turn, increased their expertise in farming activities that rendered them more food secure.

Meanwhile, household size, years of education and meeting attendance significantly affected food security status negatively. An indication that increases in these variables reduced the probability of the households being food secure. In other words, high frequency of meeting attendance and proliferations affected household resources, because more people consumed from the same resources, hence, the household members may have less food to go around when compared with smaller household size. This suggests that attendance at meetings should be limited to the most important and crucial issues. The result seems to suggest that an increase in years of education reduced the possibility of being food secure. This seems to be a counter-intuitive but long period of education and education expenditure that lead to insufficient attention and resources to the farming activities could also be detrimental. Here again, we encourage full attention to the farming activities, as well as access to extension services and training, which are correlates of education. In the south-east zone of Nigeria, none of the control variables had any significant effect on the food security status of the cassava farmers (Table A5 in Appendix A).

On the other hand, in the south-south zone, social capital had no significant relationship with household-level food security (Table A5 in Appendix A). This is an indication that the social interaction of cassava farming households in the zone had no significant contribution to their food security status. Nonetheless, household size influenced the food security status negatively and marginally by 0.025, meaning that a unit increase in household size will reduce the probability of the household being food secure by a 2.5%.

Lastly, in south-west zone, none of the control variables affected the food security status of the household (Table A5 in Appendix A). Nevertheless, a social capital variable that is, cash contribution positively influenced household food security. Cash contribution significantly affected household food security (at 5% level of significance) and with a margin of 0.045. This indicated that a unit increase in cash contribution increased the probability of food security by 4.5%. This is expected because financial commitment to a group is expected to yield benefits which consequently affect household food security status.

Generally, the trend of effects of the control and social capital dimension variables on food security in this study agrees with results from some previous studies, e.g., Ahmed et al. [85], Achida et al. [89], Adepoju [90], Lutomia et al. [91]. These studies either analyzed the separate effects of some control variables or their joint (with social capital dimensions) effects on food security or welfare. However, according to Haddad et al. [92] and Antoni [93], as Achida et al. [89] pointed out, it is not always that social capital produces a significant positive outcome on household's welfare or food security. Therefore, apart from the significant and indicative variables in our study, most of the other control and social capital dimension variables are of utmost policy relevance that should be taken into account in the design of agriculture development or policy interventions in the various zones.

5. Conclusions and Recommendation

This study has presented an analysis of the influence of social networking on the food security status of cassava farming households in Nigeria using various social-science tools, techniques, and indices (composite score, ordered and fractional probit, food security index, and logit model). The findings revealed that an average cassava farming household in Nigeria belong to about two social groups. The south-west zone recorded full participation for all the categories of socio-economic factors considered in the selected social capital dimensions. Whereas, the cassava farming households from the south-west zone made the highest average contributions in the group, the contributions were still below those made by fish farmers, as shown in other studies. Also, households with tertiary education made the least cash contribution.

Majority of the cassava farmers derived intermediate benefit from participating in social groups. Membership density, decision making, and age of farmers directly influenced the benefit received. However, educational level and labor contribution negatively affected the level of benefit. The study further revealed that 41% of the households in the study area were food secure. The household food security increased with an increase in membership density, that is, group participation, cash contribution and being married. Food insecurity increases with an increase in labor contribution.

The following conclusions and recommendations are made:

(1) Participation in social groups will depend much on the perception that household members have about the quantum and quality of the benefits they can derive from participating in such social groups. This also depends on the set up of the social groups and the environment where they operate. Cassava farming households are reasonably committed to social group activities, regularity at meetings and interaction among members and between groups or association were reasonable. Thus, agriculture or cassava development agender should devise mechanisms for improving the quantity and quality of benefits that members of cooperative or farmers' associations derive from their associations.

(2) Increase in membership density and participation in decision making, which also favor high derivable benefits have important implications. One is that apart from the high benefits that members will derive, decisions, opinions and contributions in cash and in-kind will be optimal, and this further enrich the expected outcomes and benefits from the social groups. Secondly and on labor contribution, the cost of achieving goals and objectives and deriving more high benefits will be reduced in as much as it is the members themselves that are supplying the manual labor needs of the group for any of such work requiring it. More membership that will generate further labor to achieve additional goals and objectives and in essence, derive more benefits is therefore encouraged.

(3) Our results indicated that cassava farming households with married household heads are more likely to be food secured relative to their counterparts. This possibly because married household heads may tend to strive harder to keep the household members make collective efforts into farming activities that may result in increased food security for all the members. Thus, we recommend that agriculture development programs should prioritize involving married household heads even when there is a priority on women, youth and the vulnerable.

(4) The results further affirm the importance of farm experience, high membership density of social groups and married household heads being members of social groups as important policy elements for ensuring food security of farming household. In addition, extension and training could improve on the hidden skills of the farming households, which possibly, in turn, increase their expertise in farming activities that may render them more food secure.

(5) Our study revealed that high frequency of meeting attendance affected household resources, especially for large household size compared with smaller household size. This suggests that attendance at meetings should be limited to the most important and crucial issues.

(6) The influence of control variables, such as marital status, farm experience, membership density, as well as household size, years of education, meeting attendance in the social group and others on the food security status of cassava farming households are region-specific and are according to the situation of each region. Hence, most of the control and social capital dimension variables are of utmost policy relevance that should be taken into account in the design of agriculture development, food security or policy interventions depending on the peculiar situation of each region in Nigeria.

To our knowledge, this study is the first to investigate the influence of social networking (and socio-demographic control variables) on food security among cassava farming households in Nigeria using some reliable analytical approach. The approach, however robust it may be, many to be exhaustive. Our method could be replicated in future studies by using other extrapolative methods to provide new exciting evidence of the influence of social networking on food security of value chain actors of agriculture commodities. We propose future studies to explore more dimensions of social capital and indices, such as bonding, bridging, household calorie acquisition, and others.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Definition of socio-demographic variables used in the analysis.

Data Type	Variables (Unit)	Definition of Variables and Method of Collection/Question/s Used
	Independent	
Socio-Demographic	Age (Years)	Definition: Age of household head in years Method of collection/Question/s used: Direct questionnaire elicitation (See Appendix B-Table A6)
	Gender (Dummy: 1 = Male; 0 = Female)	Definition: Sex of household head Method of collection/Question/s used: Direct questionnaire elicitation (See Appendix B-Table A6)
	Household size (Number)	Definition: Number of persons (including other relatives living) in household Method of collection/Question/s used: Direct questionnaire elicitation (See Appendix B-Table A6)
	Marital status (Dummy: 1 = Married; 0 = otherwise)	Definition: Whether the respondent is married or not (1 = Married; 0 = otherwise) Method of collection/Question/s used: Direct questionnaire elicitation (See Appendix B-Table A6)
	Education (Years)	Definition: Total number of schooling years Method of collection/Question/s used: Direct questionnaire elicitation (See Appendix B-Table A6)
	Farming experience (Years)	Definition: Total number of years of experience in farming Method of collection/Question/s used: Direct questionnaire elicitation (See Appendix B-Table A6)

Table A2. Description of social capital and food security variables used in the analysis.

Data Type	Variables (Unit)	Definition of Variables, How Selected/Calculated and Previous Studies		
	Dependent variables			
Social Capital	Level of the benefit received	Definition: Benefits received by respondents from their membership of a social group. How selected/calculated: 1. Direct questionnaire elicitation (See Appendix B-Table A7); 2. Then estimation was done on a binary scale. A score of 1 was allotted to 'Yes' and 0 to 'No' responses on highlighted benefits. With ten statements, a respondent can score a maximum of 10 points and a minimum of 0 points. The categorization is as follows (using a composite score): High category = Between Mean + S.D and 10 points Medium (intermediate) = between lower and upper categories Low Category = Between 0 and Mean − S.D. Previous Studies: Sirkin [72], and Adepoju and Olawuyi [25]		
Food Security	Food Security Index	Definition: Food security index (FSI) which differentiates households into their food security status (food secure or food insecure) using their level of food expenditure. How selected/calculated: 1. Direct questionnaire elicitation (See Appendix B-Table A9); 2. Calculated as the Per capita food expenditure of the i^{th} household divided by two-third of the mean per capita food expenditure of all the households. Previous Studies: Omonona and Agoi [15], and Adepoju and Olawuyi [25].		
	Independent Variables		**Expected Sign on (Benefit Received) SC**	**Expected Sign on (Food Security)**
Social Capital Dimensions	Membership density (Coefficient/index)	Definition: This is the average number of active memberships in association per household as calculated. How selected/calculated: 1. Direct questionnaire elicitation (See Appendix B-Table A7); 2. The coefficient/index was calculated as the average number of active memberships in association per household. This is expected to be positively related to both benefits received through social capital acquisition, as well as household welfare. Previous Studies: Aker [24].	Positive (+ve)	Positive (+ve)

Table A2. *Cont.*

Data Type	Variables (Unit)	Definition of Variables, How Selected/Calculated and Previous Studies		
	Meeting attendance/frequency of interaction (index)	Definition: A variable (score) representing regularity of meeting or interaction between members of a group. How selected/calculated: 1. Direct questionnaire elicitation (See Appendix B-Table A8); 2. The score for this was derived/obtained through daily interaction which was scored 100%, while weekly, monthly, every six months and annual meetings were scored 80%, 60%, 40%, and 20%, respectively. Frequency of interaction was used as a proxy for meeting attendance, and it is therefore expected to be positively related to benefit received from the social group, Previous Studies: Maluccio et al. [81], and Aker [24].	Positive (+ve)	Positive (+ve)
	Labor contribution (Coefficient/index)	Definition This is the number of days that household members asserted to have worked for their various groups. How selected/calculated: 1. Direct questionnaire elicitation (See Appendix B-Table A7); 2. It was calculated as the total number of days worked by household members or the number of days worked per month as membership contribution. The coefficient is ambiguous as it was reported to be positive in some studies, while in others it is negative. Previous Studies: Yusuf [46]; Okunmadewa et al. [47], (positive); Grootaert [42] (negative).	Positive (+ve)/Negative (−ve)	Positive (+ve)
	Decision-making (index)	Definition: A variable representing the perceived level of respondents' involvement in disseminating information within their various groups. How selected/calculated: 1. Direct questionnaire elicitation (See Appendix B-Table A8); 2. This is estimated as follows: Very strong perception of sharing information within a group was scored 100%, another level of perception such as very weak, weak, moderate and strong scored 20%, 40%, 60%, and 80%, respectively. According to previous studies, the expected sign is positive. Previous Studies: Grootaert [80], Yusuf [46], and Okunmadewa et al. [47]	Positive (+ve)	Positive (+ve)

Table A2. *Cont.*

Data Type	Variables (Unit)	Definition of Variables, How Selected/Calculated and Previous Studies		
Social Capital Dimensions	Cash contribution (index)	Definition: A variable/index representing the amount paid as membership due per annum in an association. How selected/calculated: 1. Direct questionnaire elicitation (See Appendix B-Table A7); 2. This (index) was obtained by the summation of the total cash contributed to the various associations which the household belongs. Cash contribution can also reveal respondents' commitment to the group. The coefficient, as noted by Grootaert et al. [43] is therefore expected to be positive. Previous Studies: Grootaert et al. [43]	Positive (+ve)	Positive (+ve)

Table A3. Estimates of fractional probit on determinants of the benefit received (by zone: north-central and south-east).

Variables	North-Central						South-East					
	Coeff.	Robust Std Err	*p*-Value	Marginal Effects			Coeff.	Robust Std Err	*p*-Value	Marginal Effects		
				Benefit Categories						Benefit Categories		
				Low	Intermediate	High				Low	Intermediate	High
Age	0.0249	0.0275	0.366	0.364	0.366	0.363	−0.0114	0.0175	0.514	0.516	0.515	0.510
Age^2	−0.00022	0.00336	0.507	0.507	0.508	0.505	0.00008	0.00015	0.600	0.601	0.600	0.597
Gender	0.1501	0.1979	0.448	0.429	0.426	0.408	−0.0850	0.06170	0.169	0.176	0.174	0.173
Household Size	−0.0183	0.0154	0.234	0.234	0.228	0.231	−0.0062	0.01077	0.566	0.568	0.565	0.566
Marital status	0.0389	0.1785	0.827	0.825	0.824	0.825	0.487	0.1267	0.700	0.694	0.694	0.694
Education	−0.00455	0.01217	0.709	0.709	0.707	0.706	−0.0145	0.00616	0.019 **	0.018 **	0.018 **	0.020 **
Farm experience	−0.00368	0.01305	0.778	0.778	0.778	0.777	−0.0008	0.00448	0.860	0.860	0.860	0.860
Membership Density	−0.07613	0.0764	0.319	0.327	0.339	0.299	−0.0120	0.03746	0.749	0.751	0.750	0.746
Cash contribution	1.08×10^{-6}	9.98×10^{-6}	0.913	0.913	0.913	0.913	-8.18×10^{-7}	11.42×10^{-6}	0.566	0.564	0.567	0.569
Labor contribution	0.01058	0.01424	0.457	0.462	0.476	0.456	−0.0077	0.00763	0.310	0.315	0.309	0.318
Meeting attendance	−0.00018	0.00368	0.962	0.962	0.962	0.962	0.0203	0.00112	0.083 *	0.091 *	0.084	0.088
Decision making	0.00296	0.00320	0.356	0.349	0.355	0.360	0.00172	0.00129	0.183	0.179	0.183	0.184
Constant	−1.6072	0.6151	0.009				0.6967	0.5518	0.207			
Number of Observation	40						234					
Wald $chi^2(12)$	5.83						18.78					
Prob>chi^2	0.9246						0.0940					
Pseudo R^2	0.0067						0.0074					

* and ** represent 10% and 5% significant levels, respectively.

Table A4. Estimates of fractional probit on determinants of the benefit received (by zone: south-south and south-west).

Variables	South-South						South-West					
				Marginal Effects						Marginal Effects		
	Coeff.	Robust Std Err	*p*-Value	Benefit Categories			Coeff.	Robust Std Err	*p*-Value	Benefit Categories		
				Low	Intermediate	High				Low	Intermediate	High
Age	−0.00012	0.01657	0.994	0.994	0.994	0.994	0.00536	0.00915	0.558	0.560	0.558	0.559
Age^2	−0.00008	0.00015	0.619	0.619	0.618	0.622	−0.000096	0.000089	0.281	0.287	0.282	0.283
Gender	0.09656	0.1090	0.376	0.354	0.365	0.382	−0.0489	0.0630	0.437	0.440	0.442	0.442
Household Size	−0.02158	0.0132	0.103	0.104	0.101	0.095 *	0.00787	0.00480	0.101	0.099 *	0.099 *	0.101
Marital status	0.1862	0.1251	0.137	0.118	0.106	0.097 *	0.02719	0.0946	0.774	0.772	0.771	0.772
Education	0.00447	0.00995	0.653	0.653	0.653	0.650	0.00295	0.00604	0.626	0.625	0.625	0.626
Farm experience	0.00870	0.00613	0.156	0.146	0.155	0.174	0.00463	0.00426	0.277	0.278	0.280	0.278
Membership Density	0.05181	0.05109	0.311	0.292	0.310	0.358	0.08282	0.0289	0.004 ***	0.002 ***	0.004 ***	0.008 ***
Cash contribution	-1.84×10^{-6}	2.26×10^{-6}	0.415	0.413	0.418	0.431	-1.54×10^{-6}	1.12×10^{-6}	0.168	0.164	0.169	0.167
Labor contribution	−0.00384	0.0115	0.739	0.739	0.738	0.737	−0.00906	0.00596	0.128	0.127	0.130	0.131
Meeting attendance	0.00361	0.00382	0.345	0.345	0.341	0.349	0.00344	0.00142	0.016 **	0.017 **	0.017 **	0.016
Decision making	−0.00152	0.00252	0.547	0.551	0.550	0.552	−0.00127	0.00157	0.419	0.424	0.417	0.423
Constant	−0.15151	0.5800	0.009				−1.4259	0.2797	0.000			
Number of Observation	153											
Wald $chi^2(12)$	19.46											
Prob>chi^2	0.0781											
Pseudo R^2	0.0130											

*, **, and *** represent 10%, 5%, and 1% significant levels, respectively.

Table A5. Logit regression estimates of social capital determinants of household food security by zone.

Social Capital Dimensions	North-Central				South-East				South-South				South-West			
	Coeff.	**Std Err.**	***p*-Value**	**Marginal Effects**	**Coeff.**	**Std Err.**	***p*-Value**	**Marginal Effects**	**Coeff.**	**Std Err.**	***p*-Value**	**Marginal Effects**	**Coeff.**	**Std Err.**	***p*-Value**	**Marginal Effects**
Membership Density	2.81	1.657	0.090 ***	0.088 ***	0.630	0.191	0.001 *	0.001 *	0.210	0.221	0.341	0.340	−0.0930	0.152	0.540	0.784
Cash contribution	−0.0003	0.00017	0.133	0.124	-9.26×10^{-6}	0.000017	0.583	0.583	0.00002	0.00001	0.218	0.219	0.0003	0.00002	0.045 **	0.040 **
Labor contribution	−0.090	0.195	0.644	0.645	−0.140	0.0424	0.001 *	0.001 *	−0.0204	0.0570	0.721	0.721	0.0147	0.0325	0.650	0.156
Meeting attendance	−0.0723	0.0415	0.081 ***	0.049 **	0.0093	0.00683	0.172	0.171	−0.112	0.0148	0.447	0.446	−0.0091	0.0081	0.260	0.166
Decision making	0.0425	0.0280	0.129	0.148	−0.0047	0.0065	0.942	0.942	−0.120	0.0125	0.337	0.334	−0.0036	0.007	0.610	0.720
Control variables																
Age	0.259	0.408	0.526	0.500	−0.128	0.086	0.139	0.138	0.0542	0.0942	0.565	0.565	0.0508	0.0560	0.364	0.112
Age^2	−0.005	0.0051	0.324	0.277	0.0012	0.00076	0.116	0.115	−0.0006	0.0009	0.482	0.481	−0.0006	0.0053	0.273	0.127
Gender	0.457	1.693	0.787	0.770	0.0586	0.316	0.853	0.853	−0.248	0.455	0.586	0.593	0.0423	0.318	0.894	0.571
Household Size	−0.727	0.313	0.020 **	0.013	−0.382	0.402	0.343	0.342	−1.202	0.537	0.025 **	0.021 **	0.335	0.334	0.316	0.320
Marital Status	2.82	1.707	0.099 ***	0.050 **	0.753	0.539	0.163	0.106	0.951	0.854	0.266	0.144	−0.0518	0.479	0.914	0.590
Education	−0.400	0.194	0.040 **	0.025 **	0.010	0.274	0.971	0.971	−0.103	0.487	0.833	0.833	−0.131	0.351	0.708	0.946
Farming Experience	0.455	0.213	0.037 **	0.032	−0.103	0.336	0.759	0.759	0.0514	0.432	0.905	0.905	0.227	0.313	0.468	0.634
Constant	0.887	7.928	0.911		2.0815	2.445	0.395		1.079	3.140	0.731		−1.099	1.795	0.540	

*, **, and *** represent 10%, 5%, and 1% significant levels, respectively.

Appendix B

Table A6. Questionnaire on the socio-demographic data and variables.

	Questions	Codes	Response
1	Is the respondent head of the household?	[1] = Yes [0] = No	
	Respondent's Age in years		
	Respondent's Gender	[1] = Male [0] = Female	
2	Respondent's relationship to HH head	[1] = Spouse [2] = Son, [3] = Daughter [4] = Brother, [5] = Sister, [6] = Others	
5	Marital status of HH head:	[1]= Single [2] = Married [3] = Divorced [4] = Separated [5] = Widowed	
6	Educational level of HH head	[1] = Primary school [2] = Secondary school [3] = Post-secondary [4] = Non-formal education	
7	Total years of education		
8	Household size	Number of persons living with you (including other relatives)	
1	How many years of farming experience do you have?		

Table A7. Questionnaire on the social capital: Social groups and benefits derived from social groups. Questions: Which of the following association(s) (social capital) do you belong to?

Association	[1] = Yes [0] = No	Major Activities (Including Contributions in Cash and Kind)	*Benefits	Benefit Code
Community development				1 = information on market outlets;
Cooperative				2 = information on credit source
Religious group				3 = source of subsidized fertilizer;
Credit and saving group				4 = improved seeds and chemicals;
Informal insurance				5 = new opportunities/technologies/enterprise;
Women group				6 = services/labor supply from the members during harvesting;
NGO/Aid group				7 = financial assistance in times of need;
Processing association				8 = sharing my risks, shocks, ill-health and adverse conditions with members of my group;
Cassava grower association				9 = I benefit from lowered economic and social transaction cost;
Cassava Marketer association				10 = easy access to land
Transporter association				11 = others
Others				

Table A8. Questionnaire on social networking. Question: In the last 12 months, who are the persons you have interacted with to exchange information on the benefits you highlighted in the (Table A7: Appendix B) question above.

Name of Person	Sex [1] = Male [2] = Female	Distance from Your Home to Them	Type (as Appendix B above)	Frequency [1] = Daily [2] = Weekly [3] = Monthly [4] = Every 6 months [5] = Annually	Perception [1] = Very weak [2] = Weak [3] = Moderate [4] = Strong [5] = Very strong	Did You Give Information? [1] = Yes [0] = No	Did You Receive Information? [1] = Yes [0] = No	Role of Person(s) [1] = Fellow Farmer [2] = Comm./Group Leader [3] = Extension Agent [4] = Researchers [5] = Trader [6] = NGO Staff

Table A9. Questionnaire on food consumption levels and expenditures.

Staple foods and beverages				
	Unit (e.g., kg, liter, packet, bundle, number)	**[1] = Once a year [2] = Every 6 months [3] = Every 3 months [4] = Monthly [5] = Weekly**	**Average quantity each time (e.g., 2 kg, a bundle, etc.)**	**Average price per unit (₦)**
Staple foods				
1. Roots and Tuber crops and products				
Cassava				
Yam				
Potatoes				
Sweet potatoes				
2. Cereals and products				
Maize				
Wheat				
Barley				
Rice				
Sorghum				
Millet				
3. Grain legumes and products				
Beans				
Cowpea				
Soybean				
Groundnut				
Egusi/Melon				
Staple foods and beverages cont'd	**Unit (e.g., kg, liter, packet, bundle, number)**	**[1] = Once a year [2] = Every 6 months [3] = Every 3 months [4] = Monthly [5] = Weekly**	**Average quantity each time (e.g., 2 kg, a bundle, etc.)**	**Average price per unit (₦)**
Bananas				
Other, specify …				
Beverages and drinks				
Tea (including cocoa drinks and/or coffee)				
Opaque beer (*chibuku*)				
Coffee (liquid)				
Soft drinks				
Juices				
Local beer				
Bottled/clear beer				
Drinking water (purified water)				
Wine				
Fruits, meat, vegetables and other products				
1. Fruits				
Oranges				
Mangoes				
Pawpaw				
Pineapple				
Bananas (ripe)				
Apple				
Guava				

Table A9. *Cont.*

Coconut				
Sugar cane				
Other				
2. Meat and other products				
Beef				
Goat meat				
Sheep meat				
Pig meat				
Chicken				
Turkey				
Ducks				
Bush meat				
Fish				
Eggs				
Milk				
Cheese				
Butter				
Yoghurt				
Honey				
Other				
3. Vegetables				
Tomatoes				
Onions				
Cabbage				
Spinach				
Kale				
Carrot				
Staple foods and beverages cont'd	**Unit (e.g., kg, liter, packet, bundle, number)**	**[1] = Once a year [2] = Every 6 months [3] = Every 3 months [4] = Monthly [5] = Weekly**	**Average quantity each time (e.g., 2 kg, a bundle, etc.)**	**Average price per unit (₦)**
Pumpkin				
Egg plant				
Cucumber				
Pepper				
Garlic				
Fats, Oils, Sweeteners, Snacks and others				
Cooking fat				
Margarine				
Groundnut oil				
Coconut oil				
Bread				
Biscuits				
Popcorn				
Cashew nuts				
Sugar				
Salt				
Chocolate				
Curry				
Ginger				
Macadamia nuts				

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