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DETERMINANTS OF VALUE ADDITION AMONG SMALLHOLDER SWEET POTATO FARMING HOUSEHOLDS IN EBONYI STATE, NIGERIA

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ABSTRACT

Smallholder farmers play a crucial role in sweet potato production, but limited value addition hinders their income generation and market participation. This study explored the factors that smallholder farmers in Ebonyi State considered when adding value to their sweet potato production. Using a multi-stage sampling technique, primary data was gathered from 400 small-scale sweet potato growers out of the state's 380,000 growers. Interview schedules were the instrument utilized for data collection. Information was gathered on the sweet potato processing method as well as the socioeconomic traits of the growers. Statistics from the descriptive and probit regression models were used to analyze the data. Findings revealed that the traditional method of processing sweet potatoes was predominant in the area. At a 1% probability level, the probit regression coefficient of educational attainment and farmers' association membership was significant and positively correlated with the addition of value to sweet potatoes. Additionally, at a 5% probability level, access to credit was substantial and positively associated with the addition of value to the sweet potato. At 1% and 5% probability levels, respectively, coefficients of gender and farming status were significant and inversely associated with the addition of value to sweet potatoes. The study concludes that the most common processing methods used by sweet potato farmers are traditional processing methods. Therefore, strategies to educate farmers about the value of forming farmer groups are needed, as most training on value addition and access to knowledge about market opportunities can be easily shared through farmers' groups.

Keywords: Smallholder farmers, Sweet potato, Traditional method, Value-addition,.

INTRODUCTION

In many regions of Africa, the sweet potato (Ipomea batatas L. Lam) is an important crop for the local diet (Nhanala & Yencho, 2021). Sweet potatoes can be used as a normal food source, a cash crop, a raw material for agro-based industries, and for animal feed, among other things. Particularly in rural areas, it is a significant source of income. A significant traditional crop, sweet potatoes are often farmed by small-scale farmers primarily for domestic use (Aboajah et.al., 2018). Due to its lower cost of cultivation, this low-input crop is used as a vegetable, a dessert, a source of starch, and a substitute for yam in food. It is a significant root crop that feeds a significant portion of the world's population, especially in the tropics and subtropics, where the majority of this crop is grown and eaten. Especially in the moist tropics, sweet potatoes are among the world's oldest crops. Before grains were developed, sweet potatoes were one of the first staple foods. Currently, it is ranked as one of the root crops, along with cassava, sweet potatoes, yams, and aroids, which are the second most significant group of staple foods in developing nations *(*Low et.at., 2020). The sweet potato is a staple crop for many farmers in more than 100 nations because it can generate large yields on poor soil with minimal input. These regions include the tropics, subtropics, and warm temperate regions.

Sweet potatoes are a crop with a short growing season that can be grown alone or in complicated cropping systems with other crops like yam and maize. It has been noted as the most affordable source of dietary vitamin A available all year round, particularly the orange-fleshed types (Low *et al*. 2020). The crop is inexpensive, may be purchased in small amounts, and is simple to grow. It is one of the sub-Saharan African root and tuber crops with a positive per-capita growth rate (Idris, 2020). It can grow in a variety of ecological settings and has a high production potential that might be fulfilled in a brief growth season. It has a high yield that considerably exceeds that of cereal crops and can thrive in both fertile and infertile soils (Gurmu, 2019). After wheat, rice, maize, potato, barley, and cassava, sweet potatoes are the seventh most significant food crop in the world, producing more than 133 million tons annually (Balarabe et.al.,2020). Asia is the world's largest producer of sweet potatoes, according to estimates of its annual production at 125 million tons (Balarabe *et al*., 2020). With 117 million tons produced annually, China produces nearly 90% of the world's sweet potatoes (Zhang, et.al., 2021). Following Asia's remaining nations in terms of production are Africa and Latin America (Oke, & Workneh 2019). Nigeria produces the most sweet potatoes in Sub-Saharan Africa (SSA), with an estimated yearly production of 4.03 million tons (FAO, 2018).

According to the Food and Agriculture Organization (FAO, 2018), the production, marketing, and consumption of sweet potatoes have spread over the past ten years to almost all ecological zones in Nigeria. However, despite the sweet potato's obvious potential to contribute to the nation's food needs, its bulkiness, perishability, low farmer awareness of its value addition, and low consumer acceptability impede its full exploitation and usage. In the majority of Sub-Saharan African nations, sweet potatoes are primarily seasonal, which causes significant variance in the amount and quality of roots in markets and accompanying price variations. Few empirical studies have been conducted on

the crop globally, despite sweet potatoes' capacity to achieve universal goals such as eradicating poverty, creating wealth, diversifying small-scale farmers, and ensuring food security (Afzal et.al., 2021). Despite being one of the most significant food and vegetable crops in the world and being crucial in the fight against vitamin and other nutritional deficiencies, sweet potatoes are still seen as a small crop and food for the underprivileged. There isn't much commercial processing done to make flour and chips, which may be preserved for Nigerian consumption all year long. As a result, it is given a low priority on the food list.

However, as sweet potatoes have a shelf life of only a little over two weeks after harvest, the post-harvest system of sweet potatoes is impacted by the problems of bulk and perishability. Therefore, turning sweet potatoes into products that can be stored is both desirable and necessary (Agoh, 2021). However, the potential benefits of the crop for farmers, consumers, and other chain actors are significantly limited by the limited number of applications and lack of acceptable processing technology. (Nmerengwa et.al., 2022).

Value addition is the deliberate process of reshaping a raw sweet potato into a more developed or practical form, hence increasing its worth. It is the process of transforming a commodity into a more valuable product from its initial state. The conversion of unprocessed agricultural goods into food products fit for customer consumption is value addition. In order to increase the value of unprocessed agricultural products, local processing, packaging, cooling, drying, extracting, and other sorts of processes are included. After harvest, value addition is concentrated on perishable crops to minimize losses, increase crop value financially or nutritionally, and ensure food safety. Farmers' path out of poverty has been highlighted as a value addition. According to Clark (2019), sweet potatoes can be processed to create a variety of snack and dessert foods, as well as sweet potato juices, drinks, soups, baby food, and ice cream. According to Alalade (2019), a range of items, including flour, crisps, canned sweet potatoes, starch, and sweet potato beer, can be made from sweet potatoes, including sparri (sweet potato garri).

Sweet potato value addition has the potential to increase crop productivity while also significantly contributing to rural households' food and nutritional security as well as their ability to generate cash (Seroney, 2019). Additionally, processing sweet potatoes into non-perishable goods helps farmers with their storage issues while also maintaining food supply during times of scarcity (Caicedo Solano *et al.*, 2020). As a result, this is a crucial technique for helping smallholder farmers in Africa commercialize their agriculture.

To ensure farmers adoption or practice of adding value to their sweet potato products after harvest, certain measures must be put in place. For example, researchers who conducted studies on the factors that affect sweet potato value addition discovered that farmers in Kwara state cut sweet potatoes into slices and sundry them, grind them into powder, and make sweet potato chips. Additionally, the possibility of them participating in the value addition of sweet potatoes is greatly determined by their access to credit, level of training, and quantity of sweet potatoes collected. In a related study, Alalade (2019) found that farmers in Kwara State performed tasks like sorting and packaging, cutting and drying in the sun, grinding the sweet potatoes into flour, baking, adding flavorings, manufacturing juice and jam, and flour preparation. Additionally, the size of the household, total amount produced, availability of finance, farm size, proximity to the market, and membership in a group all have an impact on their involvement in sweet potato value addition. The research conducted by Agoh (2021) on the variables impacting gender participation in the use of technology for adding value to sweet potatoes post-harvest in Imo State, Nigeria, discovered that the factors used by both processors to determine the value addition of sweet potatoes were household size, educational attainment, processing experience, processing equipment, and access to financing. Age is the only factor that negatively affects value addition. Similarly, Nmerengwa et al. (2022) in Abia State found that age, degree of education, annual income, processing equipment, processing experience, extension contact, availability of financing, participation in cooperative societies, and household size all affect the addition of value to sweet potatoes. At various levels of significance, each was positively correlated with the value addition of sweet potatoes. To the best of the researcher's knowledge, nothing was known about the elements that influence the increase in value of sweet potatoes in Ebonyi State, Nigeria, and this research aims to bridge that information gap. Specifically, the study describes the socioeconomic traits of growers of sweet potatoes, sweet potato processing methods, and the factors that affect the value addition of sweet potatoes in the area of study.

METHODOLOGY

The research was done in Ebonyi State, which has a land mass of roughly 5,935 square kilometers and is located between latitudes $5^0$40' and $6^0$45' North and longitudes $7^0$30' and $8^0$46' East (Awoke & Okorji, 2004). Ebonyi State comprises three agricultural zones: Ebonyi North, Ebonyi Central, and Ebonyi South, with thirteen (13) local government areas (LGAs). The state has a population of 2,880,383 (National Bureau of Statistics [NBS], 2016). Ebonyi State is an agrarian state and a significant national rice market and processing center. The state also grows cassava, rice, yams, sweet potatoes, oil palm, pepper, okra, and groundnuts. The primary means of livelihood for the rural farming communities in Ebonyi State is agriculture, which includes the production, processing, and marketing of crops and livestock products.

The study region was Ebonyi State, which included all three agricultural zones: Ebonyi South, Ebonyi North,

and Ebonyi Central. The sample process involved several stages. Two local government areas (LGAs) were purposefully chosen for each zone in the second stage, depending on sweet potato cropping level. For Ebonyi Central, Ikwo and Ishielu LGAs were chosen, Ohaukwu and Abakaliki LGAs for Ebonyi North, and Afikpo-South and Onicha LGAs for Ebonyi South. Twelve council wards were created in the third stage by intentionally choosing two council wards from each LGA. From a total of 380,000 farmers in the state, a simple random sample procedure was utilized to choose respondents who are sweet potato producers in the study area. As a result, thirty-four (34) respondents were randomly chosen from each of the four council wards namely Enyibichiri, Noyo Alike, Nkalagu and Ntezi, giving the Ebonyi Central Zone a total of one hundred and thirty- six (136) farmers due to its larger population. A total of two hundred and sixty-four (264) farmers in the zones were chosen from thirty-three (33) farmers each in the eight council wards of the Ebonyi-North namely Amagu unuhu, Amachi Ndebo, Ngbo and Ezzamgbo.and Ebonyi-South zones namely Oso, Owutu, Abaomege and Ukawu . Consequently, 400 total farmers were administered using the interview schedule. Data collection tools included a structured interview schedule. In order to define the socioeconomic traits of the sweet potato growers in the study region and the processing method they employed, descriptive statistics were utilized to analyze the data provided for the study. To analyze the factors that contribute to the addition of value to sweet potatoes in the research area, probit regression was utilized.

The regression model was specified implicitly as:

$$Yi^* = \mathrm{B}^1 Xi + \mathrm{E}$$

$$Yi \quad = 0 \text{ if } Yi^* < 0$$

$$Yi \quad = 1 \text{ if } Yi^* > 0$$

Where:
Yi* = an underlying latent variable that indexes adding value to sweet potatoes
Yi = observable dummy variable that indexes adding value to sweet potatoes (add value =1, not add value =0).
B1 = a vector of estimated parameter
E= the error term
Xi--------n = individual characteristics such as
X_1 = Age (in years)
X_2= sex (dummy variable Male =1, Female =0)
X_3=Household size (No)
X_4= Educational level (years)
X_5= Farm size (hectare)
X_6= Farming Experience (years)
X_7= Farming status (dummy variable, 1= full-time, 0 = part-time)
X_8 = Membership to farmers Association (dummy variable, 1 = member, 0 = non-member)
X_9 = Access to credit (dummy variable, 1=access, 0 = no access)

RESULTS AND DISCUSSION

Socio-economic characteristics of the farmers

The outcome in Table 1 displays the socioeconomic traits of the farmers in the research area. According to the figures, there were roughly 53.93% women and 46.07% men. This suggests that women make up the majority of farmers in Ebonyi State in terms of gender distribution and sweet potato production and processing. This is in agreement with the findings of Amusa *et al.* (2022), who stated that the mean contribution of women ($\bar{x}$ =3.47 ± 0.16) in decision-making in post-harvest activities was relatively higher compared to that of men $\bar{x}$ =2.54 ± 0.48). The study also revealed that about 78.01% of the sweet potato farmers were within the age range of 31-50 years. It suggests that young people of active age dominated the activities in sweet potato production and processing in the study area. This finding is consistent with the findings of Masamha *et al* (2017), who discovered that among the Kigoma region, Tanzania farmers, most female household heads were aged 17–30 years (34.1%) and 31–45 years (31.7%) while male household heads, the majority (43.7%) were aged 31–45 years. This implies that most of the farmers who engaged in cassava production were energetic individuals who had the ability to carry out the various farm operations required in the field. Results indicated that 78.1% of respondents were married, indicating that most of the state's sweet potato growers were married. The table also demonstrates that the farmers had disproportionately big homes since they regarded having more children after getting married as a substitute for hiring labor. Farmers have varied degrees of education, with roughly 75.39% having formal education, according to the farmers' educational status. This suggests that the majority of farmers were educated and are in a better position to access and process advances in sweet potato production and subsequently value addition, as indicated by the high literacy rate among this demographic.

More (47.12%) were cultivated between 1 and 3ha.Others (26.70%, 5.76%) cultivated between 4-6ha and more than 7ha, respectively. This implies that the majority of the sweet potato farmers are small-scale farmers. This finding is in agreement with the findings of Ifeanyi-Obi et al., (2017), who discovered that majority of the cocoyam farmers in south east of Nigeria owned farms of one hectare and below. Farmer's estimated annual income indicated that 10.47% of the farmers had an estimated annual income of less than ₦100,000, 15.18% earn up to ₦100,000-₦200,000 per annum, while 53.40% of the farmers had an estimated annual income of ₦201,000-₦300,000, and 20.94% earn up to ₦301,000-₦400,000 per annum. The implication of this result is that the majority, about 74.34% of the farmers, earn between ₦200,000-₦400,000 annually, which still indicates that they are small-scale farmers and still need income from other crops or other sources to augment the

ones they get from marketing sweet potatoes and their products.

Table I: Socio-economic characteristics of the farmers

Variable	Percentages (N=382)	Mean
Sex		
Male	46.07	
Female	53.93	
Age		
21-30	5.24	43.1
31-40	30.89	
41-50	47.12	
51-60	15.18	
61&above	1.57	
Marital Status		
Single	8.38	
Married	78.01	
Divorced	2.09	
Widowed	11.52	
Household size		
1-5	35.60	
6-10	50.79	7
11-15	12.04	
16-20	1.57	
Level of Education		
No formal education	24.61	
Primary education	22.51	
Secondary education	32.98	
Tertiary education	19.90	
Farm size		
Less than 1ha	20.42	2.8 ha
1-3ha	47.12	
4-6ha	26.70	
7ha &above	5.76	
Annual Income		
Less than ₦100,000	10.47	
₦100,000-₦200,000	15.18	
₦201,000-₦300,000	53.40	
₦301,000-₦400,000	20.94	

Source: Field Survey 2019

Processing pattern/techniques of sweet potato

Table 2 reveals that all (100%) of the farmers adopted traditional processing techniques, from tuber selection to peeling, washing of tubers, slicing and cutting, roasting, frying, and pounding. These operations represent the most labor-intensive units of sweet potato value addition. The operations are carried out by the farmers and other household members. However, the majority (60.2%) of the respondents used modern processing methods for blending the dried sliced tuber into floury form, and 57.07% used modern techniques for grating sweet potato roots. The use of these traditional processing techniques greatly limits the value addition of sweet potatoes (Kewuyemi *et al.*, 2022). When processed into different product forms, such as sweet potato flour, chips, and others, the sweet potato's bulkiness and perishability are significantly reduced, making it more acceptable to consumers in a variety of forms and facilitating its transportation over longer distances, increasing its shelf life.

Estimates of Sweet Potato Value addition

The probit regression coefficient demonstrated a significant association between the farmers' socioeconomic characteristics and the value-added and processing of sweet potatoes. The chi2 value of 158.27, which was significant, proved the goodness of fit of the probit regression line. Coefficients of educational level, membership in farmer associations and access to credit were positively related to sweet potato value addition and processing at various probability levels. While the coefficients of gender and farming status were negatively related to sweet potato value addition and processing at various levels, implying that an increase in variables that were positively related to sweet potato processing or

value addition would increase processing of/value addition of sweet potatoes, an increase in variables that were negatively related to processing of or value addition of sweet potatoes would decrease processing of or value addition of sweet potatoes.

Table 2: Processing pattern of sweet potato

Processing technique	Traditional(n=382)	Modern(n=382)
Tuber selection	100	
Peeling	100	
Washing	100	
Slicing/Cutting	100	
Grating	39.8	60.2
Drying	100	
Roasting	100	
Frying	100	
Pounding	100	
Blending into floury form	42.9	57.07

Figures in the table represent percentages
Source: Field Survey 2019

At a 1% probability level, the coefficient of sex was negative and significant. This suggests that women farmer process more sweet potatoes than men do. This result agrees with the prior expectation that women farmers are more involved in post-harvest and processing activities. It is also in consonance with the findings of Agoh *et a*l. (2020), who found out that those female farmer groups are mostly involved in cleaning (2.47) and packing (2.42). The grand mean for the male post- harvest processors was 2.15, while that of the female was 2.34. This result showed that female postharvest processors were more involved in sweet potato processing activities than their male counterparts. The low percentage of male participation in processing may suggest their lack of appreciation for the activity. Greater male participation would have reinforced the efforts of women in pursuing processing activities. Furthermore, studies have indicated that sweet potatoes are considered a woman's crop, which may explain the high female participation in value addition and processing. The low involvement rate of men in processing may indicate that they do not value the endeavour. Greater male involvement would have supported women's ambitions to pursue processing activities. Additionally, research has shown that sweet potatoes are viewed as a woman's crop, which may help to explain the high proportion of women who work in value addition and processing.

The coefficient of the educational level was positive and significant at the 1% probability level. This is consistent with the prior expectation that the farmer's education level has a positive and significant effect on sweet potato value addition and processing, implying that the likelihood of adding value and processing increases with the farmer's formal education level. On average, each additional year of education increases the probability of a farmer processing sweet potatoes, which, by extension, increases the farmer's income. This is consistent with the research results of Paltasingh and Goyari (2018) who reported that farmers with higher levels of education also frequently accept technology more quickly. Education and technology adoption are positively correlated because educated producers and marketers are exposed to new technologies and innovation, are more responsive to new ideas, and are more eager to accept them. Farmers with more education are better able to comprehend, value, and react to market movements. Education also improves a person's ability to digest information and make the most of any given circumstance, allowing them to reduce risk and deal with uncertainty (Gao *et al.*, 2020).The ability of farmers to receive, process, and apply information pertinent to the technology grows with education, which results in a larger utilization of new technologies (Chen, 2021).

At a 5% probability level, the farming status coefficient was negative and significant. This suggests that many producers of sweet potatoes were also engaged in the cultivation of other crops, in addition to carrying out other off-farm tasks including carpentry, masonry, and wine tapping to augment sweet potato processing activities. Their means of subsistence did not solely depend on the processing of sweet potatoes. This result is at odds with that of Rahman, Mishra, and colleagues (2020), who discovered that income from non-farm sources contributes positively and significantly to food security at a 5% level of likelihood. Farming households can increase their income by engaging in side jobs and crafts through off-farm income-generating activities. When there is a lack of food, the income from these activities serves as a safety net by allowing households to make up the shortfall. By allocating some of this revenue to crop production and processing, the household can also improve its access to food.

At the 1% level, the membership coefficient of the farmers' association or group was both positive and highly significant. It is implied that farmers who are members of cooperatives or social organizations frequently receive more information. They familiarize themselves with the most recent sweet potato

processing techniques, increasing the crop's worth. Contrary to their competitor, who continues to use outdated or indigenous methods of processing without updating their knowledge through interaction with other farmers and organizations, the level to which sweet potatoes add value is positively correlated with group membership, and this relationship can be explained by the fact that people in groups are more susceptible to the influence of their peers than people who are alone.

Most farmers who belong to various farmer associations are involved in processing or value addition. This can be attributed to the fact that farmers interact and influence one another in groups, which encourages the adoption of processing methods. Membership in a group ensures collective production, marketing, and training, ensuring the pooling of resources and lowering information asymmetry, ensuring economies of scale, and lowering transaction costs. According to Pingali et al. (2019), groups can be quite productive, particularly when it comes to combining outside ideas and distributing knowledge. Farmers who are members of a group have access to loans that will let them buy processing equipment.

The credit access coefficient was positive and significant at the 5% level. This suggests that farmers with access to credit have a higher likelihood of processing their sweet potatoes into value-added products because, with enough money, a farmer may buy processing equipment that will help in the processing of sweet potatoes. This outcome is similar to the research of Agoh (2020), who found that access to credit enhances the respondent's involvement in the value addition of sweet potatoes at the 5% level of significance. Farm households with access to the credit market have the chance to acquire the resources required to embrace new technology. By assisting farmers with financing the purchase of equipment that adds value, access to credit may promote the adoption and ongoing use of value-adding technologies. This is to be expected because agricultural households rarely have enough money to purchase value-added equipment and other related components, which increases the significance of loans. Access to credit is necessary, but it must be offered in a way that allows customers to pay their debts off quickly and avoid being deeply indebted and ultimately giving up on the technology that improves their quality of life.

Table 3: Probit regression estimates of sweet potato value addition

Variable	Coefficient	Std error	Z-value
Age	.0183041	.116631	0.16
Sex	-1.832466	.1760618	-10.41***
Household size	-.0178545	.1267658	-0.14
Level of education	.0794052	.0198678	3.99***
Farm size	-.1203153	.1171728	-1.03
Farming experience	.0469799	.081025	0.58
Farming status	-.5078757	.2042767	-2.49**
Membership of farmers group	1.674615	.2988612	5.60***
Credit access	.3938061	.1639495	2.40**
Constant	1.531436	.4781084	3.20***
Log likelihood	-177.54		
LR Chi^2	158.27***		
Prob.Chi^2	0.0000		
Pseudo R^2	0.5083		

Source: Computed from STATA

CONCLUSION AND RECOMMENDATIONS

The study concluded that the majority of sweet potato farmers in Ebonyi State are female, middle-aged, and have high levels of education. The most common processing methods used by sweet potato farmers are traditional processing methods. The study also found that sex, level of education, farming status, membership in a farmer group, and credit access are significant determinants of sweet potato value addition. It is recommended that the government provide training and extension services to sweet potato farmers on improved processing methods and value-added techniques through workshops, demonstrations, and the distribution of educational materials. Also, promote the formation and membership of farmer associations to facilitate the sharing of information and resources on sweet potato value addition through strengthening and providing support for the establishment of farmer associations and by encouraging farmers to join existing associations.

REFERENCES

Aboajah F.N., Ejechi, M.E Viashima, S.S, Adeyongu, S.K. & Muogbo P.C. (2018) Sweet Potato Production for Poverty Alleviation in Nasarawa State, Nigeria. *International Journal of Environment, Agriculture and Biotechnology* (IJEAB) 3, Issue-2, Mar-Apr-2018 ISSN: Pp 2456-1878

Afzal, N., Afionis, S., Stringer, L. C., Favretto, N., Sakai, M., & Sakai, P. (2021). Benefits and

trade-offs of smallholder sweet potato cultivation as a pathway toward achieving the sustainable development goals. *Sustainability*, *13*(2), 552.

Agoh, E. C. (2021). Factors Influencing Gender Participation in the adoption of value addition to sweet potato technologies among post-harvest processors in Imo state, Nigeria. *The International Journal of Agriculture, Management and Technology*, *5*(1), 262-271

Agoh, E, Ukeje, B., & Nwakor, F. N. (2020). Gender Analysis in the Adoption of Sweetpotato Value Addition Technologies by Rural Farmers in Imo State, Nigeria. *Journal of Community & Communication Research*, *5*(1), 1-8.

Ahmad Yahaya, M., Shimelis, H., Nebie, B., Ojiewo, C. O., & Danso-Abbeam, G. (2022). Sorghum production in Nigeria: opportunities, constraints, and recommendations. *Acta Agriculturae Scandinavica, Section B—Soil & Plant Science*, *72*(1), 660-672.

Alalade, O. A., Oladunni, O. A., Adisa, R. S., Olayode, O. O., & Paul, A. B. (2019). Effect of value addition on farm income of sweet potato farmers in Kwara State, Nigeria. *Journal of Agricultural Extension*, *23*(4), 92-98.

Amusa, T. A., Anugwo, S. C., & Egwue, O. L. (2022). Comparative Analysis of the Contributions of Men and Women to Farming Decisions among Rice Producing Households in Ebonyi State, Nigeria. *Journal of Agricultural Extension*, *26*(3), 86-97.

Awoke, M.U. & Okorji, E.C. (2004). The Determination and analysis of constraints in Resource use efficiency in multiple cropping systems by small-holder Farmers in Ebonyi State, Nigeria. African Development, Vol. XXIX, No. 3, pp. 58-69

Balarabe, Z. A., Yaro, A. M., Yakubu, S. A., Shu'aibu, A. U., Safiyanu, S. A., & Aliyu, S. A. (2020). Economic Analysis of Marketing White Skinned Sweet Potato (Ipomoea Batatas) in Selected Markets of Kano State, Nigeria. *Fudma Journal Of Sciences*, *4*(2), 129-134.

Caicedo Solano, N. E., García Llinás, G. A., & Montoya-Torres, J. R. (2020). Towards the integration of lean principles and optimization for agricultural production systems: a conceptual review proposition. *Journal of the Science of Food and Agriculture*, *100*(2), 453-464.

Chen, X., Ou, X., Dong, X., Yang, H., Ubaldo, C., & Yue, X. G. (2021, July). Impact of farmer organization forms on agricultural product quality from the perspective of technology adoption. In *2021 6th International Conference on Intelligent Information Processing* (pp. 92-99).

Clark, N. (2019). *Nancy Clark's sports nutrition guidebook*. Human Kinetics.

FAOSTAT, Statistics Division of the Food and Agriculture Organisation, http://faostat.fao.org/site/567/Deskstop Default.aspx? Pag ID = 567 accessed March , 22, 2020 Data base Results

Gao, Y., Zhao, D., Yu, L., & Yang, H. (2020). Influence of a new agricultural technology extension mode on farmers' technology adoption behaviour in China. *Journal of Rural Studies*, *76*, 173-183.

Gurmu,F. (2019). Sweet potato research and development in Ethiopia: a comprehensive review. *Journal of Agricultural and Crop Research*, *7*(7), 106-118.

Idris, M. (2020). Understanding agricultural productivity growth in Sub-Saharan Africa: An analysis of the Nigerian economy. *International Journal of Economics and Financial Research*, *6*(7), 147-158.

Ifeanyi-Obi, C. C., Togun, A. O., Lamboll, R., Adesope, O. M., & Arokoyu, S. B. (2017). Challenges faced by cocoyam farmers in adapting to climate change in Southeast Nigeria. *Climate Risk Management*, *17*, 155-164.

Kewuyemi, Y. O., Kesa, H., & Adebo, O. A. (2022). Trends in functional food development with three-dimensional (3D) food printing technology: Prospects for value-added traditionally processed food products. *Critical Reviews in Food Science and Nutrition*, *62*(28), 7866-7904.

Low, J. W., Ortiz, R., Vandamme, E., Andrade, M., Biazin, B., & Grüneberg, W. J. (2020). Nutrient-dense orange-fleshed sweet potato: advances in drought-tolerance breeding and understanding of management practices for sustainable next-generation cropping systems in sub-Saharan Africa. *Frontiers in Sustainable Food Systems*, *4*, 50.

Masamha, B., Uzokwe, V. N., Ntagwabira, F. E., Gabagambi, D., & Mamiro, P. (2019). Gender influence on participation in cassava value chains in smallholder farming sectors: evidence from Kigoma region, Tanzania. *Experimental Agriculture*, *55*(1), 57-72.

Nhanala, S. E., & Yencho, G. C. (2021). Assessment of the potential of wild Ipomoea spp. for the improvement of drought tolerance in cultivated sweetpotato Ipomoea batatas (L.) Lam. *Crop Science*, *61*(1), 234-249.

Nmerengwa, J., Onwusiribe, C. S., & Amadi, P. E. (2022). Analysis of Factors Influencing Level of Adoption of Sweetpotato Value Addition By Women Processors In Abia State. *Journal of Community & Communication Research*, *7*(1). Pp 103-114

Oke, M. O., & Workneh, T. S. (2019). A review on sweet potato post-harvest processing and preservation technology. *International Journal of Agricultural Sciences*, *9*(9), 001-014.

Paltasingh, K. R., & Goyari, P. (2018). Impact of farmer education on farm productivity under varying technologies: case of paddy growers in India. *Agricultural and Food Economics*, *6*(1), 1-19.

Pingali, P., Aiyar, A., Abraham, M., & Rahman, A. (2019). Linking farms to markets: reducing transaction costs and enhancing bargaining power. In *Transforming food systems for a rising India* (pp. 193-214). Palgrave Macmillan, Cham.

Rahman, A., & Mishra, S. (2020). Does non-farm income affect food security? Evidence from India. *The Journal of Development Studies*, *56*(6), 1190-1209.

Seroney, E. K. (2019). *The relationship between choice of farm enterprises and food security among households living along Kerio valley, Tambach ward, Elgeyo-Marakwet County, Kenya* (Doctoral dissertation, Egerton University).

Zhang, B., Yang, J., & Cao, Y. (2021). Assessing Potential Bioenergy Production on Urban Marginal Land in 20 Major Cities of China by the Use of Multi-View High-Resolution Remote Sensing Data. *Sustainability*, *13*(13), 7291.