DETERMINANTS OF HOUSEHOLD FOOD SECURITY AMONG MICROVEG PROJECT BENEFICIARIES IN SOUTHWESTERN NIGERIA

BY

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CERTIFICATION

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DEDICATION

I dedicate this thesis to Almighty Allah, the Lord of the Universe and the Master of the Day of Judgment for unless He, the ultimate Builder builds the house, whoever does, labours in vain and whenever He decrees a thing to be, no mortal can change His will.

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ABSTRACT

Achievement of no poverty and zero hunger of the Sustainable Development Goals is hinged on implementation of development interventions. The MicroVeg project which synergises fertiliser microdosing with indigenous vegetable production is one of such interventions targeted towards economic and food security among resource poor farm families in southwestern Nigeria. Endline project report reflected a boost in household food security of project beneficiaries. However, factors which accounted for the boost were not adequately documented. Therefore, determinants of household food security among MicroVeg project beneficiaries in southwestern Nigeria were investigated.

A four-stage sampling procedure was used. Four states (Ekiti, Kwara, Lagos and Osun) were randomly selected. Thereafter, five, seven, 10 and 12 Project Sites (PS) constituting 40% were randomly selected proportionate to size, from Lagos, Kwara, Osun and Ekiti states, respectively. Subsequently, 40% of Farm Groups (FG) were selected from which 40% of Project Beneficiaries (PB) were randomly sampled, giving a total of 28 FG and 277 PB. Interview schedule was used to elicit information on respondents' socioeconomic and enterprise characteristics, motivating factors for growing vegetables, Indigenous Vegetables Productivity (IVP), food consumption pattern, monthly household food and non-food expenditure, coping strategies and household food security. Indices of: farmland holding (marginal:<1.0; small:1.0-1.9; medium:2.0-2.9; large:≥ 3.0) ha, IVP (low: ≤ 17,029.57, high: 17,029.58-190,000.00)kg/ha and food security using FANTA scale (food secure:0.00-10.22; food insecure:10.23-33.00) were generated. Data were analysed using descriptive statistics, factor analysis, Pearson product moment correlation, ANOVA and multiple linear regression at $\alpha_{0.05}$.

Age, farm size, household size, farming experience and annual farm income of beneficiaries were 46.20±14.05 years, 2.10±3.40ha, 7.00±5.20 persons, 20.40±12.70 years and ₦864,844.90±1,447,850.00, respectively. Most PB (83.0%) sourced farm credit from personal savings, while 46.9% were marginal scale farmers. Respondents were motivated to grow vegetables by personal and socioeconomic influence factor (λ = 0.88), profitability and cash-flow influence factor (λ = 0.51) and family background and incentive influence factor (λ = 0.91). Most PB (72.6%) recorded low IVP. Food items mostly consumed weekly were yam (18.28±12.20kg), maize (6.07±5.25kg) and cowpea (4.63±4.30kg). Monthly household expenditure on food, vegetable farms, children education and savings were ₦28,592.06±25,142.67, ₦32,859.78±64,086.80, ₦33,568.84±36,189.18 and ₦38,959.03±73,739.81, respectively. Coping strategies mostly used were modified cooking method (0.75), substituting commonly bought food items with cheaper ones (0.74) and reduced number of meals (0.72). More than half (51.3%) of PB's households were food secure. Dependency ratio (r=0.065), indigenous vegetable output (r=0.141), farm income (r=0.090) and non-farm income (r=0.010) were significantly related to household food security. No significant difference existed in household food security among PB across the selected states. Age (β=0.162), dependency ratio (β=0.350), total farm size (β=0.073), vegetable farm size (β=3.384) and income from vegetables (β=6.100) significantly increased household food security.

Household food security of MicroVeg project beneficiaries in southwestern Nigeria was determined by age, dependency ratio, total farm size, indigenous vegetables farm size and income from indigenous vegetables.

Keywords: Indigenous vegetables, No poverty, Zero hunger, Coping strategies, Dependency ratio

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CHAPTER ONE
INTRODUCTION

1.1 Background to the study

The contribution of Agriculture to Nigerian GDP has dwindled in the last decade thereby losing its place gradually, as one of the most paramount sectors of the country's economy. It contributed 26.75% of the total GDP in 2009 and 21.91% in 2019 (Plecher, 2020). Prior to independence in 1960, agriculture provided adequate quantity and quality food for the Nigerian populace. The oil boom recorded in the 1970s resulted in a drastic shift from agriculture as the major driver of the nation's economy (NISER, 2015). Agricultural output in Nigeria declined within a decade thereof up to 1981 when Nigeria began the importation of important stable foods the likes of rice, fish, wheat and sugar to strengthen local supplies. Till date, Nigeria still spends significant proportion of her foreign reserves importing staple foods. Adesina (2012) and Nwankpa (2017) affirmed that more than 1.3 trillion naira was spent to import rice, fish, wheat and sugar in the year 2010 alone. The ever-increasing population growth however, continued to broaden domestic food supply and demand gaps leading to perpetual rise in food prices. The interaction of the aforementioned factors steered food insecurity while the achievement of self-sufficiency has become more burdensome over the years owing to diminishing agricultural production and inept food marketing system. To attain food production self-sufficiency and subsequently achieve food security in Nigeria, the federal government has implemented countless agricultural development reforms since 1970s till date. Few of the more recent programmes include Nigerian Agricultural Cooperatives and Rural Development Bank, NACRDN (2000); Root and tubers Expansion Programme, RTEP (2002), Agricultural Transformation Agenda (2011), FADAMA III (2008 till date) etc.

However, many of the programmes and/or projects could not transform the agricultural sector going by their empirical records.

Food insecurity seriously undermines development in the sub-Sahara region of Africa. Therefore, the problem has attracted global attention over the years. As of 2017, 25% of the entire population of sub-Saharan Africa (SSA) was estimated to be undernourished (FAO *et al*., 2018). This figure represented almost one-third of total people who were suffering from chronic hunger across the globe estimated at 821 million, as at then.

A holistic description of food security was devised at the World Food Summit in 1996. Basically, the definition incorporated the four domains of food security as including; availability, access, utilization and stability. According to the definition, food security is achieved when all people at all times, can gain physical and economic accesses to safe and nutritious food to support an active and healthy life (FAO, 1996, 2012 and Bashir *et al*., 2018a,b). On the contrary, Obayelu and Orosile (2015) in Ogunniyi *et al*. (2021) asserted that the failure to afford an undisrupted access to adequate quantity of food in appropriate quality that guarantees healthy living renders a household food insecure. Food insecurity is an extreme form of poverty, essentially a situation whereby a person, household, community and even an entire nation is deprived of basic human needs (Kakwani and Son, 2016). Despite the production of more than enough food around the world, over 690 million people of the global population still go hungry (https://sustainabledevelopment.un.org/sdg2). World hunger has been on the rise in recent times, after a steady decline for over ten years, touching 8.9 percent of people across the globe. From 2018 to 2019 alone, the count of malnourished people grew by 10 million, culminating in almost additional 60 million people who became undernourished compared to the figure recorded in 2014 (Action Against Hunger International Nutrition Security Policy, page 8).

African countries exporting natural resources as well as oil and gas recorded an incredible economic growth following a global boost in commodity prices. This resultantly gave Africa a good place among the twenty-first century global economy throughthe 2020s up to the year 2013 (Collier, 2018; Dodo, 2020). Hence, the African

region gained full membership of the world economy as well as an envious actor in the arena of international economy. In spite of this astonishing growth, Africa still faces myriads of serious local and transnational challenges including rapid population growth, youth unemployment, undernourishment, conflict-induced famines, climate change threats, drug trafficking, domestic terrorism, outstretched political crises as well as short-term wars of low-intensity and maritime piracy to mention a few. Consequently, these challenges have been a brick wall in the way of Africa in her relentless struggle for achieving food security and eradicating hunger (Harris, 1972; Dodo, 2020). Dodo (2020) opined that if these challenges are not decisively tackled head-long by political leaders in the whole of African, meeting the nutrition needs and achieving food security and other targets established in the faced-off Millennium Development Goals (2010-2015) and Sustainable Development Goals (2015–2030) will also amount to yet another illusory inquest for Africa just like numerous similar policy objectives of their kind.

The United Nations (2021) Hunger Report affirmed that hunger depicts periods during which populations experience severe food insecurity sometimes going for an entire day without eating sequel to dearth of access to food as well as dearth of money or other resources. Significant progress has been recorded in hunger reduction across the globe before the recent increase. In the year 2020, world leaders in collaboration with the civil society and United Nations committed to meet a set of eight Millennium Development Goals by the year 2015. Eradication of "extreme poverty and hunger" was the first of these goals. Count down to 2015, the UN in its report tracking world's progress on the achievement of that set goal stated that (i) the world's undernourished people reduced from 15% in 2000-2004 to about 8.9% in the year 2019, (ii) roughly 690 million people were undernourished globally and (iii) Stunting rate in children (children being too short for their age owing to chronic malnutrition) got reduced from 33% of children under age five in 2000 to 21.3% in the year 2019 (https://www.actionagainsthunger.org/world-hunger-facts-statistics). Therefore, world leaders plotted a new set of seventeen Sustainable Development Goals (SDGs) the second of which was set to "end hunger, achieve food security and enhanced nutrition

and foster sustainable agriculture" by 2030.People living in poverty are faced with perpetual household food insecurity, utilize improper care practices and inhabit precarious environments with little or no access to good quality water, proper hygiene and sanitation, insufficient access to quality education and health services, which all collectively, contribute to hunger (State of Food Insecurity and Nutrition in the World, 2020).This clearly depicts a strong interconnectedness between hunger and poverty involving interactions among myriads of demographic, social, political, and societal factors. Conflict is another major driver of severe food crises. Officially, famine was recognized as a form of conflict, by the UN Security Council (FAO *et al*., 2018). Prolonged conflicts and weak institutions worsen hunger and undernutrition. Also, climate change and other weather related events have influenced the availability of food in many countries thereby contributing to the rising food insecurity. Economic abatements in countries that depend mainly on the export revenues from oil and other primary commodities has equally affected availability of food and as such reduced the ability of people to gain access to food drastically (https://sustainabledevelopment.un.org/sdg2). The latest impediment to sustainable availability and access to food across the globe is the ravaging COVID 19 pandemic. The swift onset of the pandemic and the resultant scope of policy responses inflicted remarkable costs on Nigeria's economy thus affecting the entire population in adverse ways. However, the kind of impacts on it had on food systems and the poor remain obscure.COVID-19 posed a crucial health challenge for underdeveloped and developing countries coupled with severe socioeconomic impacts. The sharp drop in oil prices was an immediate concern for Nigeria's economy. This reality posed a serious threat to reverse the recorded years of modest economic growth in oil-dependent African countries Nigeria inclusive (IMF, 2020a). Evidently, Nigeria's economy remains vulnerable to volatile oil prices and as dependence on oil lingers (Arndt *et al*., 2018; FGN, 2020b).

Sustainable development goals 2 (SDG2) attempts to 'end hunger, achieve food security, improved nutrition, and promote sustainable agriculture' while the first goal seeks to put an end to poverty in all its forms everywhere; both goals are distinctly stated the foremost of the SDGs (Pérez-Escamilla, 2017). Food security requires

ensuring sustainable access to readily available and affordable food in adequate quantity and quality, to meet the physiological needs of all citizens (Okuneye, 2014). However, the principal aim of food security rests on the capacity of all individuals to acquire adequate food needed at all times and utilise same in meeting the body's needs. The concept of food security is composite. Household food security in the overall implies access at all times, by all members, to sufficient food needed for active and healthy life. Accessibility is equally a very important element required to attain food security, despite the fact that large proportions of Nigerians are involved in food production. Lack of adequate access to food, low income and climate change precipitate poverty and hunger.Malnutrition, hunger and chronic food insecurity have been a global burden in the last two decades, not as a result of food-deficit at national and global levels, rather owing to dearth of access as well as the redistribution of food at the level of the household. Abassi *et al.* (2016)stated that the commonest kind of food insecurity exists when there is no food for consumption as occasioned by insufficient resources thereby resulting in physical and psychological outcomes of hunger.

Drammeh *et al.* (2019) stated that the World Health Organisation in its recent report affirmed that adequate and proper expenditure in intervention programmes focusing on nutrition can save the lives of over 3.7 million people by the year 2025. The major impetus for food insecurity span through social factors, income as well as environmental calamities. These factors put together cause many households to encounter varying degrees of food insecurity in Sub-Saharan Africa (Mbwana *et al.,* 2016).Balanced and varied diets reduce the extent of malnutrition while dietary intake is jeopardized by food insecurity. Socio-economic status (SES) of householdsis a major factor affecting household food security in Sub-Saharan Africa. Low SES subsequently low-income households tend to consume low-quality foods in inadequate quantities with restrained diversity in diet resulting in low-quality diet lacking in essential nutrients (Nnakwe and Onyemaobi, 2013).Food insecurity remains epidemic in developing countries. Countless people still experience chronic hunger and sometimes death caused by food insecurity.Researching and documenting the determinants of food

security requires identifying the factors predisposing the principal attributes of food security: (i) food availability and (ii) food access which have been the two magnitudes of household food insecurity broadly studied. Food availability depends largely, on factors affected by the demand-side, while the supply side dictates factors affecting access to food. Hence, factors provoking disparities in both demand and supply of food would also influence the food availability and access, respectively and subsequently resulting to food insecurity (Bashir and Schilizzi, 2013). FAO (2014) estimated the proportion of Nigerians living below the poverty line of less than $1.25 daily as 68% from 2005 to 2012. Food insecurity and poverty are inseparable. The concluded Millennium Development Goals (MDGs) and the currently running Sustainable Development Goals (SDGs) of the United Nations readily testify to this submission. The MDGs combined the two concepts as its first goal while the SDGs have them as its two foremost goals. Overall, both MDGs and SDGs emphasized the fact that poverty is a precursor of food insecurity. Development interventions are crucial to the achievement of sustainable development goals. MicroVeg project is one of such interventions. Food security is attained when all citizens have sustainable access to readily available and affordable food in sufficient quantity and quality to meet their physiological needs (Okuneye, 2014). However, the fundamental goal of food security is the ability of all individuals to acquire sufficient food needed at all times and utilize same to meet the body's needs.

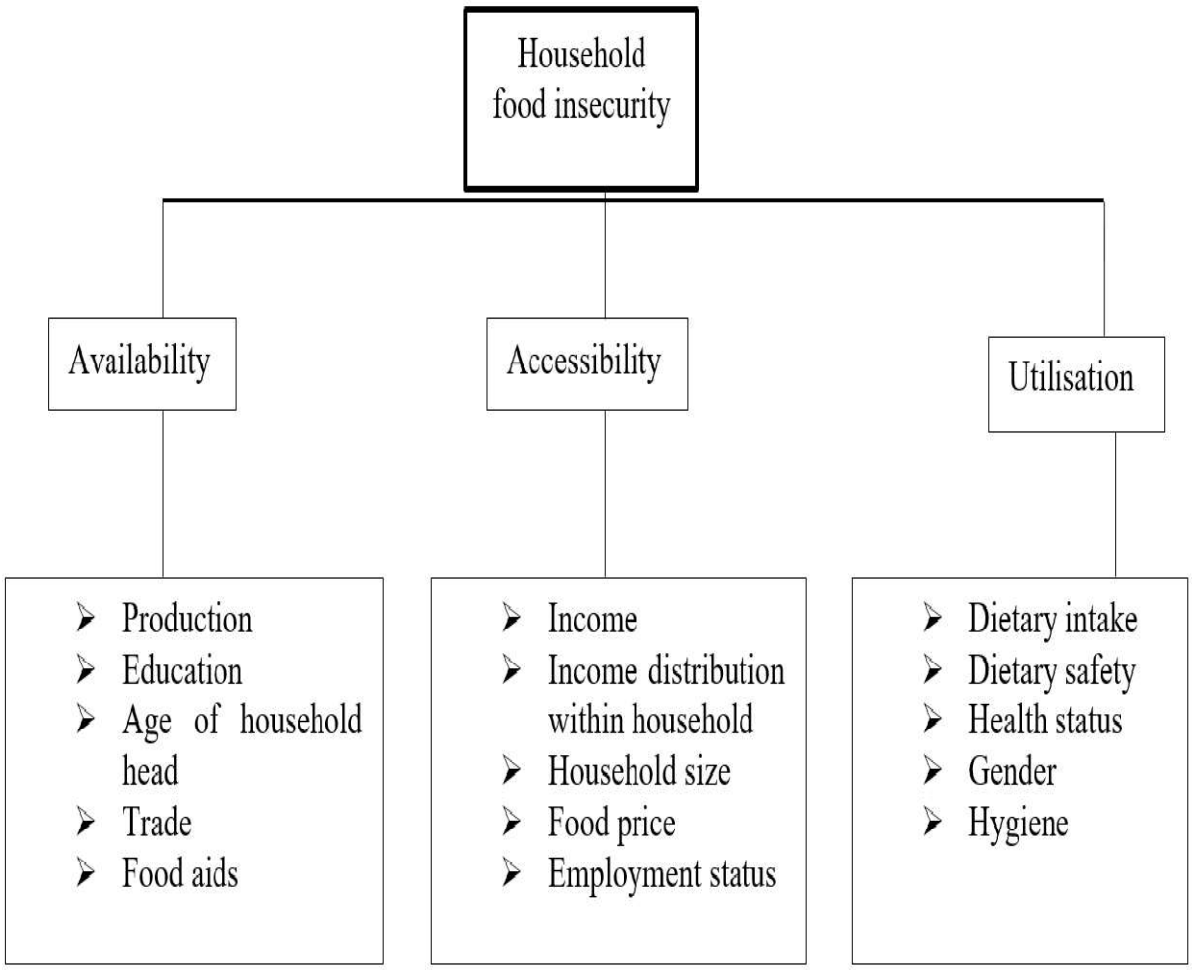

Fig. 1: Conceptual model of household food insecurity(Source: Drammeh *et al.,* 2019)

MicroVeg Project synergizes fertilizer microdosing with indigenous vegetable production technologies. The project advocated for massive propagation and utilization of the selected indigenous vegetables towards achieving economic and nutritional security of the resource-poor farm families. Vegetables are important in achieving food security more importantly during the times of drought or poor harvest. They are also vital for income generation. The leaves or aerial parts of indigenous leafy vegetables have been integrated as food in a community's culture over the years. They are highly recommended for their relatively higher nutritional value than the introduced varieties. Rural dwellers can hardly afford meats, fish, eggs etc. at all times. However, consumption of indigenous vegetables gives diversity to their daily food intake, add flavour and zest to diet and also augment the protein and vitamin needs in rural diets because they are rich in vitamins, minerals, trace elements, and dietary fibre.

Nigeria being the most populous country in sub-Saharan Africa occupies a strategic position for programme and policy intervention aimed at addressing food insecurity and other social problems. One of such numerous development projects is MicroVeg project. MicroVeg project, a product of two completed projects in Nigeria (NiCanVeg) and Republic of Benin (InuWam) synergised fertilizer micro-dosing with innovations on indigenous vegetables production for economic empowerment and food security of resource-poor rural farming households in West Africa. Indigenous vegetables (leaves and fruits) constitute main sources of nutritious food for the poor rural families in Nigeria and Benin Republic who are grossly deprived of the resources to purchase high value food items (meat, fish, milk and eggs). Indigenous vegetables are richly nutritious, containing key vitamins and minerals and high levels of carotenoids (Vitamin A), phenols and flavonoids that support human health. The vegetables also have great potential to revamp food security, nutrition and income in farming communities. Four high premium indigenous vegetables: Fluted pumpkin-Ugu (Telfaira occidentalis f. Hooke) *for Nigeria only*, Bassil-Efinrin Nla (Ocimum gratissium) *for Benin Republic only*, African eggplant called Igbagba (Yoruba) in Nigeria and Gboma in the Republic of Benin (*Solanum macrocapon L.*) and Local amaranth -Tete Abalaye (Yoruba) (Amaranthus viridis L.) have been

shown to have high market value, economic returns, cross-cultural acceptability and marketability in Nigeria and Benin Republic as revealed by the concluded NiCanVeg project (2011-2014). These indigenous vegetables have been proven to compare favourably with the routinely cultivated vegetable species in terms of nutritional values hence the valuable dietary contribution of these vegetables to household nutrition security and were thus selected. The focus of the project entails the generation of knowledge and innovations on the four selected indigenous vegetables in the area of fertilizer micro dosing, value addition and seed production techniques and the testing and deployment of different approaches (SDA and IP) for scaling up to ensure maximum uptake of indigenous vegetables production, utilisation and consumption in Nigeria and Benin Republic towards achieving food and economic security of resource-poor farm families across the project sites. MicroVeg project (2015-2018) was implemented in seven states (Lagos, Ekiti, Ogun, Oyo, Ondo, Osun and Kwara) in Nigeria and four Departments in Republic of Benin.

MicroVeg project funded from a programme jointly owned by Canada's International Development Research Centre (IDRC) and Global Affairs Canada (GAC); the Canadian International Food Security Research Fund (CIFSRF) had its multi-disciplinary research team constituted from Universities of Manitoba and Saskatchewan, Canada, Obafemi Awolowo and Osun State Universities, Nigeria and Universite de Parakou, Benin Republic. The focus of MicroVeg project was to advance indigenous vegetables production and yields; preserve soil and water ecosystems, enable fertilizer cost-saving, propel marketing and promote consumption and value addition in West Africa. The project, implemented in phases (March 2015 to March 2018) had resource-poor indigenous vegetable farmers as its beneficiaries. MicroVeg project was gender inclusive as it aimed to achieve equal gender inclusion (at least 50% of project participants being women). Seven (7) States and four (4) Departments were covered in Nigeria and Benin Republic respectively using Innovation Platform and Satellite Dissemination Approaches (IPA and SDA).

1.2. Statement of the problem

According to (FAO, 2003; Omotesho *et al.* 2010), about 852 million men, women and children worldwide are perpetually hungry owing to extreme poverty; while about 2 billion people suffer intermittent food insecurity sequel to varying degrees of poverty in spite of the availability of vast potential wealth. All over the world, of the 86 low-income and food deficient declared countries, 43 were found within the African continent which habours higher proportions of the world's 6.7 billion people living below the poverty line (Eluhaiwe, 2008). Food insecurity has remained a major anxiety and risk in Nigeria (Otaha, 2013). The Food Security Information Network (FSIN, 2017) estimated the number of food insecure people in northeast Nigeria alone, as 5.1 million. Obamiro *et al*., (2003) emphasized that rural farming households have little or no access to productive resources hence rural poverty has remained a very critical issue in Nigeria. Despite various approaches and huge amount of money spent on several attempts made at ensuring food security of Nigerians, no remarkable results have been recorded till date.

Past studies the likes of Beyene and Muche (2010), Sakyi (2012), Kassie *et al*. (2012), Aidoo *et al.* (2013), Zakari *et al*. (2014), Tefera and Tefera (2014) and Ojeleye (2015) documented the determinants of food security within and outside Nigeria with main focus on socio-economic characteristics. The studies investigated diverse farming households and established associations between some socio-economic characteristics and food security. Beyene and Muche (2010) reported farm experience, farm and off-farm incomes as determining food security among rural households in Central Ethiopia. Education, age of household head, gender, household size, low dependency ratio, receipt of social grants and remittances, steady income source from formal employment, and household production of vegetables all determined access to food among rural households in South Africa (Sakyi, 2012), while Kassie *et al*. (2012) found land quality, quality of extension services, farm size and distance to market as the factors influencing food security in Kenya. Also, Aidoo *et al.* (2013) found farm size, marital status, household size, credit access and off-farm income as determinants of household food security in Ghana, Zakari (2014) found genderof household head,

access to market, labour supply, food aid among other factors as influencing household food security in Southern Niger, while Tefera and Tefera (2014) found family size, size of cultivated land, total farm income and off-farm income as major determinants of household food security in Southern Ethiopia. Ojeleye (2015) found food security status perception, household size, household per capital medical expenditure, dependency ratio, access and usage of consumer credit and total crop production (grain equivalent) as the major determinants of food security among farm households in Northern Nigeria. However, not many of the previous studies considered beneficiaries of projects that are particularly targeted towards achieving food security, the likes of MicroVeg project.

Over the years, the indigenous leafy vegetables have been neglected by researchers and development process. In all discussions of the status of food in Nigeria, indigenous leafy vegetables often disappear from mention (Adebooye *et al.* 2003 as cited by Oloyede *et al.* 2011). Some of these vegetables remain underutilized due to lack of awareness of their nutritive values, in addition to the economic advantage they can bring and are as such gradually going into extinction. However, the quest for concerted efforts at retaining these indigenous vegetables species to fully harness the food and economic values locked in them gave rise to MicroVeg project. Unlike other arable crops such as maize and cassava, vegetables have short production cycle which enables farmers to produce throughout the year round given readily available irrigation facilities. Bearing in mind that MicroVeg farmers are supplied with irrigation facilities which empowers them to produce at all times and are also availed the opportunity of fair market prices for their vegetable produce through group marketing and the innovation platforms, the project beneficiaries are expected to have relatively steady flow of income. Hence, they can be readily assumed to have relatively steady and strong financial footings and are as such not really limited to achieve food security by the limits imposed by poverty. However, beyond poverty, many other factors determine food security some of which were itemized in the past studies referenced earlier even though these factors may vary from region to region. In a bid to achieve improved impactful and sustainable future project results in line with set objectives, it becomes

imperative to investigate the situation around MicroVeg project beneficiaries' production and income among other variables, to isolate the determinants of household food security. Therefore, this study answered these research questions:

i. What are the socioeconomic and enterprise characteristics of the MicroVeg Project beneficiaries?
ii. What factors motivate MicroVeg Project beneficiaries to engage in vegetables production?
iii. What is the level of indigenous vegetables and selected food crops production among MicroVeg Project beneficiaries?
iv. What is the household food consumption pattern of MicroVeg Project beneficiaries?
v. What are the household food and non-food expenditures of MicroVeg Project beneficiaries?
vi. What is the household food security status of MicroVeg Project beneficiaries?
vii. What are the coping strategies adopted by MicroVeg Project beneficiaries to minimize household food insecurity at times of food shortages?

1.3 Objectives of the study

The broad objective of this study was to assess the determinants of household food security among MicroVeg Project beneficiaries in southwestern Nigeria. The specific objectives were to:

i. describe the socioeconomic and enterprise characteristics of MicroVeg Project beneficiaries;
ii. identify the factors that motivate MicroVeg Project beneficiaries to engage in indigenous vegetables production;
iii. examine the level of indigenous vegetables and selected food crops production achieved by MicroVeg Project beneficiaries;
iv. examine the food consumption pattern of MicroVeg Project beneficiaries' households;

v. examine the household food and non-food expenditure of MicroVeg Project beneficiaries;

vi. determine the household food security status of MicroVeg Project beneficiaries;

vii. identify the coping strategies adopted by MicroVeg Project beneficiaries to minimize food insecurity during the times of food shortage.

1.4 Hypothesis of the study

H_{01}. No significant relationship exists between selected socioeconomic & enterprise characteristics and household food security status of MicroVeg project beneficiaries.

H_{02}. No significant relationship exists between quantity of indigenous vegetables produced and household food security.

H_{03}. There is no significant difference in the level of vegetable production during rainy and dry seasons among respondents.

H_{04}. No significant difference exists in household food security of MicroVeg project beneficiaries across the four selected project states.

H_{05}. There is no significant contribution of independent variables to household food security.

1.5 Significance of the study

Lack of adequate resources to obtain sufficient food needed by individuals and households results to inadequate nutrition, poor calorie intake and poor nutrition; as low income households may not be immune to hunger and its attendant myriads of health challenges as limited economic access to food often leads to chronic or transitory malnutrition more often than not (Mutisya *et al.*, 2015). Malnutrition has become the major cause of the health burden of diseases observed across the world more importantly in the Sub-Saharan Africa with surging under-five obesity, susceptibility to infection and mortality (IFPRI, 2016) while poor nutrition status has remarkable adverse effects on economic development. On the other hand, Harris (2016) submitted that a healthy population in steady physical and mental conditions tends to

be highly productive. Varying socio-economic statuses and unequal livelihood resources endowment across households have serious implications for risk exposure, strength, and capability to prevent, mitigate or cope with risks for positive livelihood attainments including improved food security (Daud *et al*. 2018; Ogunniyi *et al*. 2020). At the household level, food insecurity bothers on several factors including age, level of education, poverty, employment status, low income, gender of household head, household size, and food prices (Drammeh *et al*., 2019).

Ihab *et al.* (2015) affirmed that the development of policies focusing on the challenges related to household hunger and food insecurity requires a thorough understanding of the characteristics and determinants of household food insecurity. Against the backdrop of the socioeconomic status theory which believes that economic access to food and hence household food security is mainly influenced by differences in socioeconomic status, class and party, this study isolated the determinants of household food security among MicroVeg project beneficiaries in southwestern Nigeria with the intent of guiding the project team and development practitioners at large towards improved performance of future projects. Findings from this study will particularly give insights on required modifications in policies and practices on best practices needed to improve and drive future interventions towards achieving laudable results.

1.6 Operational definition of terms

MicroVeg Project: MicroVeg project 107983 synergizes fertilizer micro-dosing with indigenous vegetables production innovations for economic empowerment and food security of resource-poor farming households in West Africa. The project an offshoot of NiCanVeg and INUWAM projects was implemented in seven states in Nigeria and four departments in the Republic of Benin (2015-2018). The three indigenous leafy vegetables in focus in Nigeria included Amaranthus viridis L., Solanum macrocarpon and Telfeira occidentalis.

NiCanVeg Project: This project was implemented in the South-west, Nigeria between 2011 and 2014. The project entailed the dissemination of improved technologies

towards massive production and utilisation of selected underutilised indigenous vegetables to achieve economic empowerment and food security among resource-poor farmers.

InuWam Project: This project was also implemented between 2011 and 2014 but in the Republic of Benin. The theme of this project was fertilizer micro-dosing in the Sahel.

Beneficiaries: Beneficiaries in the context of this study, imply all indigenous vegetable farmers partaking in the MicroVeg project who fully benefit from the project relief packages which are aimed at achieving economic empowerment and food security of the participants.

No Poverty: The first of seventeen United Nation's Sustainable Development Goals Vision 2030. The goal aims to end poverty in all its forms everywhere within the stipulated time.

Zero Hunger: This is the second of the seventeen United Nation's Sustainable Development Goals Vision 2030. The goal aims to end hunger, achieve food security and improved nutrition and promote sustainable agriculture within the stipulated time.

Food Security Index: This is used to draw the food security line in a bid to delineate food secured from food insecure households. Commonly used indices usually range from the ratio of calories consumed to calories required to food expenditure pattern of households etc. This study utilized reversed Household Food Insecurity Assessment Scale of Food and Nutrition Technical Assistance scale (FANTA scale) USAID (2005) to generate food security index used to draw food security line.

FANTA 2: This is a revised version of the household food insecurity assessment scale (HFIAS) of United States Agency for International Development (USAID).

CHAPTER TWO
LITERATURE REVIEW

2.1. Concept of food security

The concept of food security is very flexible. This is reverberated in the numerous attempts that had been made at defining the concept within the contexts of research and policy. Maxwell and Smith (1992) affirmed that over 200 definitions of the concept had been in published writings as early as the 1980s. With the relatively short advent of the concept of food security, this giant foot is highly impressive even though it has made coherent discussion more difficult over the years. The achievement of Sustainable Development Goal 2 – Zero Hunger within the stipulated time of 2030, leaving no-one behind remains one of the most significant challenges facing mankind (United Nations, 2015). The SDGs are sets of inspirational and aspirational goals focusing on yearning for revolution towards achieving sustainable development. Current discussions around SDG 2 bother on exceptional population growth faced by Africa bearing in mind that the continent equally faces remarkably severe climate change impacts (Niang *et al*., 2014). The prevalence of undernourishment among African population jumped from 17.6% in the year 2014 to 19.1% in 2019, implying more than twice of world's average and highest of all the regions in the world (FAO *et al.*, 2020). United Nations (2019) projected a population rise in sub-Saharan Africa's from its current 1.07 billion to 1.40 billion by the year 2030 and possibly up to 3.78 billion by century ending. The current projection of the world population is seemingly overestimated nevertheless the population of sub-Saharan Africa is estimated to reach 3.07 billion by 2100 (Vollset *et al*., 2020).

According to Van Ittersum *et al*., (2016), Sub-Saharan Africa remains the region mostly at the risk of chronic food insecurity across the world given the current overdependence on cereal imports, alarming rate of population growth and stagnated

agricultural productivity. An estimated one in four people in sub-Saharan Africa (SSA) were undernourished in 2017 (FAO *et al*., 2018). This represents about one third of the 821 million people suffering from chronic hunger globally. In addition, several other people experience micronutrient deficiencies (Kumssa *et al*., 2015; Harika *et al*., 2017). Sustainable Development Goal 2 is intricately linked with SDG 1 which is aimed at ending poverty in all of its forms. SDG 2 is not just about hunger reduction. Also, it is focused at ensuring food security and achieving improved nutrition through the promotion of sustainable agriculture. Addressing the triple burden of malnutrition – undernutrition, micronutrient deficiency and obesity requires increased food production as well as major breakthroughs in ready access to affordable nutritious food, education as well as behavioural change concerning diets. Sustainable agriculture is pivotal to the achievement of SDG 2 as United Nations (2015) affirmed that over 70% of households depend largely on agriculture for their livelihood.

Smallholder farmers produce majority of food consumed in SSA (Herrero *et al*., 2017). However, Sibhatu and Qaim (2017) and Fanzo (2018) affirmed that they are the most vulnerable to food insecurity and poverty. Hence, smallholder farmers are very critical for agricultural interventions that are aimed at improving food and nutrition security. In the past few years, numerous studies have appraised the interrelation between agriculture and nutrition (Gillespie *et al.,* 2017; Ruel *et al.,* 2018; and Ritzema *et al*., 2019) to mention a few. In spite of the progress made, while analysing the existing database and ex-post evaluation of nutrition-sensitive interventions so far, much remains unknown regarding the roadways torevamped food and nutrition security of rural households (Carletto *et al*., 2017; Mary *et al*., 2018). This is partially owing to the multiplicity of agricultural systems in SSA, withagro-ecological and market conditions driving their incidence (Garrity *et a*l., 2012).The timing and amount of rainfall affect the availability of food items through the year round as they dictate the types of crops grown and the timing of harvest. The occurrence of livestock systems, with agro pastoral systems in dry areas as well as mixed crop-livestock systems in higher rainfall zones are also driven by agro-ecological conditions. However, Ruel *et al*. (2018) submitted that the question of relationship between market participation and food and

nutrition security in rural communities—most importantly access to as well as consumption of varied diets has not been adequately answered by the existing literature bearing in mind that farmers obtain their food in two ways: growing food crops and/or rearing livestock for consumption of the products and selling of these products to generate income channelled to the purchase of food items for consumption. In the state of food insecurity 2001, FAO (2002) affirmed that 'Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'. Food access is a fundamental part of food security. It implies an individual's capacity to acquire levels of sufficient foods required for the consumption of adequate diet of right nutritional levels, using incomes or other resources on either direct purchase and/or barter. Access to food is also dependent on the physical, social, and policy environments working together to determine the effectiveness of households in using their resources to meet their food needs.

However, the preponderanceof high levels of poverty seriously undermines the ability of most Nigerian households to make enough income, to augment own production, in meeting their food needs. Muhammad and Sidique (2019) submitted that Nigeria still ranks among the poor and undernourished nations of the world. Most of Nigerian populace have been rendered hopeless, as more than 70% of the disposable income of poor households goes to food requirements, yet over 30% of children under five years are malnourished which are all consequent upon the residual effects of poverty and hunger (Roser and Ritchie, 2018).

2.2. The origin of food security

The concept of food Security originated from the debates on the global crisis which led to international food problems during the mid-1970s. Attention was initially paid to the problems of food supply focusing mainly on assuring *availability* and *price stability* of basic foodstuffs to a reasonable extent at the national and international levels. Hunger, food crisis and famine were also examined inclusively, subsequent to the events of mid-1970s. All these efforts led to reconsideration of food security, such

that the behaviour of potentially vulnerable and affected people was considered crucial. The manifestation that the technical successes of the green revolution in Asia did not result in an automatic rapid reduction in the levels of prevailing poverty and malnutrition paved way for the third crucial modification to the views of food security. Sequel to this reality, lack of effective demand was found as the origin of poverty and problems of related endemic hunger.

Sen (1981) in his seminar study closely identified consumption, demand and access of vulnerable people to food as a new area of emphasis. He eluded food security as a concept and shifted focus to the entitlements of individuals and households to food. In furtherance to this, Sen expanded his concept to encompass a third aspect of secured access to available supplies, by vulnerable people (FAO, 1982). He advocated that equitable attention be given to both the demand and supply sides of food security equation. The 1986 report on poverty and hunger of the World Bank emphasized the temporal dynamics of food insecurity 1986. The report gave an explicit and much recognized difference between chronic food insecurity related to structural poverty and low incomes and transitory food insecurity concerned with periods of exacerbated pressure occasioned by natural disasters, conflict or total collapse of the economy.

Food security from individual to global levels was only recognized as an issue by the mid-1990s. By that time, access bothered on sufficient food with continuous concern on protein-energy malnutrition. However, the exposition was further widened to include food safety and nutrition balance, with major focus on food constitution and minor nutrient fulfilment for a healthy active life. Food preferences determined culturally or socially were then considered. Going by its potential high level of context specificity, the concept of food security had rather become intermediate set of actions contributing to healthy active life having gradually lost its simplicity (Clay, 2002).

The Human Development Report of UNDP (1994) adopted a broader perspective. The perspective promoted human security while food security became only one of its constituents. Human security, firmly connected with human rights perspective to development over the time, has impacted discussions about food security (Dreze and Sen, 1989). These broad statements of common goals and implicit

responsibilities were readily accepted by the international community, with the major practical response of organizing national and international public action focusing mainly, on narrower and simpler objectives. In international development policy discourse, the declared primary objective has increasingly been the elimination and/or alleviation of poverty. The World Food Summit of 1996 portrayed this policy direction with its basic objective being international action on food security with the target of reducing the global numbers of undernourished or hungry people to half by the year 2015 as gazetted in the earlier concluded United Nation's Millennium Development Goals (2000 – 2015). Sequel to the inability to achieve this goal in its entirety, it has thus been listed as the second (SDG 2) of the currently running seventeen Sustainable Development Goals of the United Nations which aims to achieve zero hunger, leaving no one behind in the global sphere by the year 2030 (United Nations, 2015).

2.3 The concept of consumption pattern

Consumption pattern depicts variations in goods and services consumed. The decision of individuals on the kind and varieties of food item consumed is highly affected by disposable income and sociocultural factors among others. The fraction of total income that is expended on consumption is called average propensity to consume (APC) while the increase in consumption expenditure resulting from each unit of increase in total income is called marginal propensity to consume (MPC). The first person that made consumption one of the central foci of macroeconomic theory was Keynes in his theory though many other theories of consumption have been advanced after the Keynesian consumption function. Keynes theory (1774) termed absolute income hypothesis, related current consumption expenditure to current disposable income. According to this theory, marginal propensity to consume (MPC) is less in the short run than in the long-run. Similarly, a smaller proportion of income is consumed when income increases whereas income consumption expenditure tends to exceed income at low income levels. The theory further posits that marginal propensity to consume diminishes as income increases. In other words, the richer a person is, the less

he would consume out of any absolute increase in income. The assumption of a diminishing MPC was an important part of Keynesian theory.

In recognition of the shortcomings of Keynesian theory especially in allowing expenditure to change as income changes, modern theories were postulated to incorporate longer view of expected income. These new theories include relative income hypothesis, permanent income hypothesis and life cycle hypothesis.

Relative income hypothesis postulated by Duesanabery (1958), posits that a household consumption is not a function of its current absolute income. Rather, the household's consumption is dictated by its relative position in the income distribution among all households in the neighbourhood. Hence, a rise in a household's income, which leaves its relative income unchanged, will lead to no change in average propensity to consume (APC). Hence, relative income hypothesis allows the APC to vary in the short-run while it remains constant in the long-run. This is contrary to the absolute income hypothesis

Permanent income hypothesis assumes a direct proportional relationship between permanent consumption (CP) and permanent income (YP). Permanent income depicts the long run income generated in such a way that wealth remains fixed. According to the hypothesis, actual or measured income consists of permanent income and transitory income. Transitory income means income arising from temporary and unexpected sources such as money from friends, relation and even unexpected salary increases. Also, actual consumption it treated as being equal to permanent consumption and transitory consumption.

The life cycle hypothesis put forward by Ando and Modigham (1963), states that a household or an individual maximizes its utility subject to its wealth. Wealth is viewed as the main determinant of current consumption.This wealth is nonetheless accumulated through savings expected to allow individuals maintain consumption in later years when income from employment is relatively low. The hypothesis posits that in the early years of an individual, money is spent without any commensurate income. Over time, the individual gets to a stage to work, earns and continues up to the stage when his earnings are in excess of spending. This excess is saved for the time when he

is old and can no longer work. Hence, he falls back on the savings. One or more of these hypotheses can be relevant depending on the focus of any particular study. Yusuf *et al* (2002) who studied the current consumption of students who have relatively homogenous groups and live in the same environment found absolute income and relative income hypotheses relevant to their study.

2.4 Consumption patterns of households in Nigeria

The combination of quantities, qualities, tendencies and acts that characterize the use of resources for human survival, enjoyment and comfort of households or among human groups in a community is referred to as pattern of consumption. The varieties of food and non-food items consumed differ by region. Consumption pattern contributes immensely to both social and economic policies of the country. The consumption pattern of developing countries like Nigeria is usually skewed towards food while that of most developed countries often skew to non-food items (NBS, 2019). Developed societies tend to spend less on food but more on non-food commodities. For instance, Lagos state, Nigeria is a state with an emerging economy. The expenditure of Lagos state on non-food items reportedly exceeded its expenditure on food. Also, consumption patterns vary from one zone to another. NBS (2019) reported the existence of zonal variation in Nigeria. From the report, a thorough scrutiny of a sample state within one zone in comparison with another state from another zone, readily attests to this fact. These zonal variations, the report affirmed can be explained in statistical terms, as the states within each zone have correlations in consumption patterns. Meanwhile, some unusual disparities occur where some states deviate from following the same pattern.

According to NBS (2019), the total household expenditure on food and non-food at the national level for the year 2019 was found as N40,207,388,459,367.00as against N21, 620,601,543,613.90 reported in 2009/10. Of this, 56.65% (60.2% in 2009/10) of total household expenditure in 2019 was expended on food while 43.35% (39.8 % in 2009/10) was expended on non- food items. The largest chunk of household expenditure constituting a combined 24.16 percent of total household expenditure in

2019 was expended on food consumed outside the home, transportation costs, starchy roots, tubers and plantains. The analysis of food expenditure by households in 2019 further revealed that starchy roots, tubers and plantains, rice, vegetables, fish and sea food, grains and flours in that order, among various food items consumed outside the home, constituted the top food items households spent bulk of their money on, in 2019 accounting for a combined 59.19% of food expenditure and 33.53% of total household expenditure on food and 24.8% of total household expenditure. On the other hand, household expenditure on non-food items were mainly incurred on education, health, transport and services (information technology and communication equipment as well as insurance, financial services etc.), rent, fuel and light which accounted for a combined 79.40% of non-food expenditure (NBS, 2019). Details of the highlighted expenditure pattern are found in Tables 2.1 and 2.2.

Table 2.1: Household Food Expenditure in Nigeria

FOOD CATEGORY/GROUP	EXPENDITURE	SHARE IN FOOD EXPENDITURE	SHARE IN TOTAL EXPENDITURE
Food consumed Outside of Home	4,597,611,647,231	20.19	11.43
Starchy roots, Tubers & Plantain	2,526,248,133,445	11.09	6 .28
Rice	1,978,469,588,752	8.69	4.92
Vegetables	1,760,581,587,249	7.73	4.38
Fish and Seafood	1,334,251,774,137	5.86	3.32
Grains and Flours	1,283,558,827,015	5.64	3.19
Pulses, Nuts and Seeds	1,194,512,649,507	5.24	2.97
Meat	1,190,937,052,520	5.23	2.96
Fruits	1,011,397,190,439	4.44	2.52
Oil and Fats	990,280,623,220	4.35	2.46
Baked/Processed Products	963,894,524,602	4.23	2.40
Poultry and Poultry Products	879,915,554,716	3.86	2.19
Other Miscellaneous Foods	707,845,869,649	3.11	1.76
Maize	673,145,908,531	2.96	1.67
Non-Alcoholic Drinks	551,193,833,558	2.42	1.37
Milk and Milk Products	481,024,780,593	2.11	1.20
Coffee, Tea, Cocoa and the Likes (Beverages)	296,596,090,172	1.30	0.74
Sugar, Sweets and Confectionary	205,537,993,903	1.30	0.74
Alcoholic Drinks (Bottle and Can)	150,246,013,133	0.66	0.37
TOTAL FOOD CONSUMPTION EXPENDITURE	**22,777,249,642,372**	**100.00**	**56.65**

Source: NBS (2019).

Table 2.2: Household Non-food Expenditure in Nigeria

NON-FOOD CATEGORY/GROUP	EXPENDITURE	SHARE IN FOOD EXPENDITURE	SHARE IN TOTAL EXPENDITURE
Transport	2,588,901,034,916	14.85	6.44
Health	2,460,266,138,597	14.12	6.12
Education	2,428,993,052,871	13.94	6.04
Services inc Telecoms	2,222,067,290,758	12.75	5.53
Rent	2,122,889,646,502	12.18	5.28
Fuel/Light	2,016,183,780,851	11.57	5.01
Clothing and Footwear	1,822,511,258,144	10.46	4.53
Household goods	1,142,507,512,895	6.55	2.84
Entertainment	428,217,151,903	2.46	1.07
Water	197,601,949,559	1.13**URE30,138,816,995 100 43.35**	0.49
TOTAL NON-FOOD CONSUMPTION EXPENDITURE	**17,430,138,816,995**	**100.00**	**43.35**

Source: NBS (2019).

2.5 Food coping strategy concept

In practice, households do not simply resign to the ill-fate of food shortages but rather make efforts to deal with it. In this regards, concerned households either change their eating behaviours or engage in food-acquisition activities. These responses, referred to as food-coping strategies depict the mechanisms engaged by households whenever one or more of factors such as drought, high food prices, low income etc. disrupt their means of meeting their food needs (Ninno *et al*., 2013). Devereux (2001) defined coping strategies as responses to inimical events or shocks. Coping strategies imply a set of activities engaged in a particular sequence of actions by a household while responding to shocks such as famine, drought and other calamities (Querish, 2007; Berlie, 2015). Coping strategies also refer to all calculated acts engaged by individuals as well as households of poor socio-economic status engage to constrict their spending and/or earn income to afford the basic necessities of life (food, shelter, clothing) in order not to fall short of the 'level of welfare' in their society (Snel and Staring, 2001; Grobler and Dunga, 2017). On the other hand, coping strategies were viewed by Ellis (2000) as the techniques engaged by households to pull through when faced with unexpected livelihood failure. Strategies utilized differ within and between households (Maxwell *et al*., 2003). Households with different poverty levels and varying degrees of wealth engage varying coping behaviours. Meanwhile, some coping strategies are universal to all households although the levels enable a household to remain-afloat depending on household assets (Devereux, 2001). Generally speaking, the lower the asset status of a household, the more frequent the engagement of devastating responses like disposing productive assets including farm implements among other things (Hoddinot, 2004).

All households employ food coping strategies for different reasons. Young and Jaspers (1995) asserted that the need to preserve productive assets required to sustain future living gave rise to the engagement of coping strategies. Households that experience mild food shortages may employ food coping strategy to increase food availability. According to Maxwell *et al*., (1999), even though many families suffer food insecurity, women and girls; the primary food producers in African households usually strive to

design strategies to provide food for the members of their households. Women being the primary player in the preparation and sometimes provision of food engage various strategies to cope with food insecurity, more often to their own disadvantage (Kruger *et al*., 2008).

The administration of these coping strategies signifies the incidence of household food insecurity though not necessarily its severity. For instance, Maxwell *et al*., (2003) asserted that a household that moves from consumption of meat to soya mince is not as food insecure as another household that skips meals and stay hungry all day. Generally speaking, no universal set of food coping strategies exists but they tend to thread the same pattern. The four broad categories of coping strategies include modifying diet, food rationing, food-checking strategies; and altering the household as put forward by Kruger *et al*., (2008).

Pattern of coping strategy reflects the diagrammed sequence of responses engaged by typical farm households in the face of food crisis as shown in Figure 2 (Watts, 1988). These sequences of responses are often divided in the literature into three distinct stages (Corbett, 1998). In the earliest stage of crisis mostly at the onset (stage one), households employ risk-minimizing and loss-management strategies basically involving low commitment of domestic resources which enable quick recovery from crisis once it is ameliorated. However, households are progressively coerced into greater commitment of resources to cater for subsistence needs as the crisis persists i.e. during the time of occurrence (stage two). There may be gradual sale of key productive assets, making it harder to return to the pre-crisis state. Household's vulnerability to food insecurity is extremely high at this stage. Later stage (stage three) strategies are signs of failure to cope with food crisis and usually involve destitution and distress migration (Corbett, 1988). This generalized pattern of coping strategies are practically applied as tools for food security monitoring (Frazankenberger and Goldstein, 1991).

Table 2.3: The four Generic Categories of Food-Coping Strategies

Category	Explanation	Examples
Alteration of diets (diet changing strategies)	Consuming less preferred and/or cheaper food items	Substituting fish, eggs or milk for meat.
Food rationing (managing insufficient food)	Skipping of meals Staying hungry without meals for a whole day Feeding working members of the household at the expense of non-working members (buffering) Serving limited portion of food	Eating 1 or 2 meals daily instead of 3 square meals of food per day, at the least. Giving larger shares of food to fathers while small portions are served to other members of the household (particularly women and children).
Food seeking (increasing the amount of food made available in the short term)	Borrowing money or food Gathering food from the wild	Borrowing food Borrowing money for procuring food Purchase of food on credit Gathering food items from the wild.
Altering the household (household structure strategies)	Decreasing the number of people to feed in the short term Sending children away from the household	Sending children to stay with friends or relatives in order to feed

Source: Kruger *et al.,* (2008)

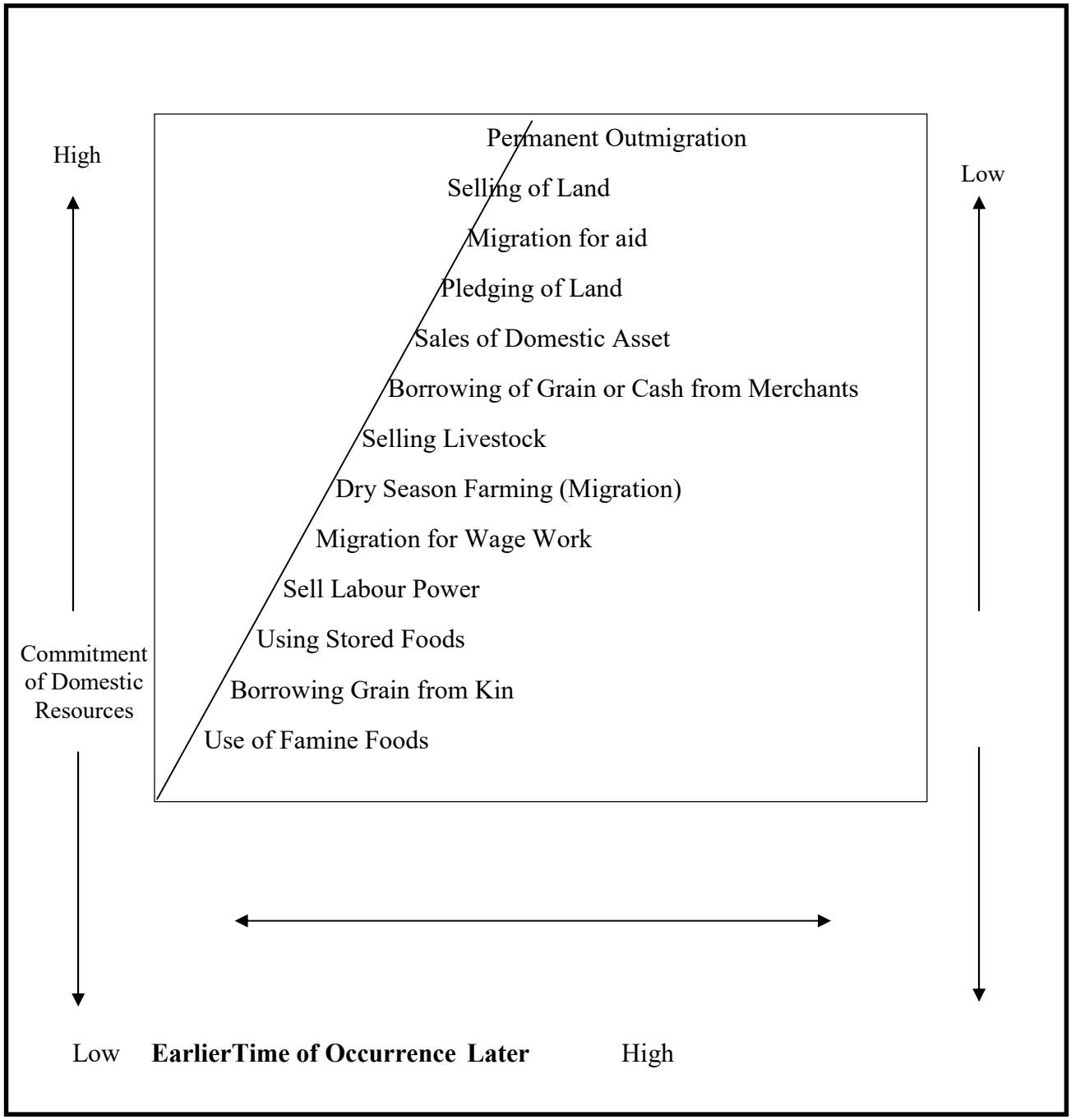

Figure 2: A Model of Response to Food Shortage Source: Watts, (1988)

2.6. Approaches to measuring food security

Two approaches are basically employed to measure food security, as gathered from relevant literatures. These are quantitative and qualitative approaches.

2.6.1. Quantitative Approaches

A number of the quantitative approaches used in measuring food security include the Food and Agriculture Organization (FAO) technique, Household Income and Expenditure Survey (HIES) and the Food intake Survey (FIS). FAO advanced an Aggregate Household Food Security Index (AHFSI) by incorporating availability, stability and access to food supplies. Gurkan (1995) affirmed that the validity and relevance of the index has been assessed using the factors and processes which are assumed to causally affect the household food security status. The primary building block of the AHFSI is the FAO's estimation of the prevalence of under-nutrition in the developing countries and regions; the estimates are combined as the extent of food gap between the undernourished and the national average requirements for dietary energy, inequality in the distribution of food gaps as well as the instability in the annual availability of dietary energy.

Household Income and expenditure Survey (HEIS) and Food Intake Survey (FIS) estimate dietary intake in relation to energy and protein needs. Typically, the two methods utilize indirect measurement using food balance sheets, national income distribution and consumer expenditure data which links hunger with nutrition. Anthropometrics is yet another quantitative method. It measures physical effects on growth and thinness (FAO, 2002). The Omonona *et al.* (2007) food expenditure method for measuring household food security also falls under the Household Income and Expenditure Survey (HIES) technique.

2.6.2. Qualitative approaches

The qualitative measures of food security include the following, among others:

2.6.2.1. Food economy approach

Food economy approach partitions a geographical area to food economy zones each of which represents a common livelihood system (Devereux, 2002). Based on locally

established characteristics of asset ownership, months of self-provisioning etc., this approach stratifies communities into three to six wealth groups while allocating households to the wealth groups, in order to infer estimates of food insecure populations for target purposes. This approach is a very viable diagnostic tool but does not give accurate statistics. Food economy analysts do not project data in point estimates but in ranges. The disadvantages of the approach include (1) it takes a lot of time and resources; (2) it doesn't generate absolute numbers but relative proportions (3) it is not yet validated against conventional measures of poverty and food insecurity

2.6.2.2. Group ratings

Group ratings very similar to the food economy approach. The method also evolved out of wealth ranking. IFPRI tested the approach for reliability in countries like Malawi and Honduras. Basically, this approach assigns single or mixed-sex group members of the community to any of "food secure", intermittently insecure" or "food insecure" categories and then compares results from different groups afterwards. Bergeron *et al.* (1998) submitted that the conclusion for Honduras was unfortunately disappointing for an alarming low level of consistency of responses between sets of raters.

2.6.2.3. Dietary diversity

Dietary diversity method is also pioneered by IFPRI. The method is extremely simple. It entails giving an array of locally consumed foods of around 30 to 40 items and asking households to indicate which of the listed items they consumed in the past week. The numbers indicated for different items they consumed are added straight without weighing. For example, meat is simply scored higher than cereals just like most other dietary assessments do. Then, the method simply concludes that higher numbers depict diverse diet and household food security (Hoddinott and Johannes, 2001).

2.6.2.4. Coping strategy index

Maxwell (1996), the proponent of the coping strategy index recognized nine coping strategies from sampled focus groups in urban Accra. He scored each household based on frequencies of adoption of the identified strategies from which composite indices are generated to rank households based on their degree of food insecurity. Coping strategy index refers to a food consumption related coping strategy instrument

including the generic list of coping strategies. Maxwell *et al*., (2003) submitted that the basis for using the coping strategy index tool is to estimate the frequency of food coping strategy. That is, how recurrently is the coping strategy utilized and in what intensity as well as the degree of food insecurity suggested by the strategy used.

The type of food coping strategy to use is informed by the severity, duration and type of food stress encountered. Hence, the coping behaviour of a household paints a clear picture of the real level of distress experienced which varies from poor variety to hunger. Sequence of coping strategy may differ across households and different members of the households within the same location (Maxwell *et al*., 1999). This method is fast, cheap and effortless to administer though its conceptualization is slightly complex and an array of information is generated on household behaviour under stress. However, coping strategies are locality specific. That is, coping options applicable in the rural areas are not the same as the ones in urban areas thus scaling up to the national level pose enormous problems. This method equally has the same shortfall as the group rating approach (Maxwell *et al*., 1999).

2.6.2.5. Food security module

In this method, the core module questionnaire contains eighteen and ten questions for households with children and households with no children, respectively. The series of questions in the module are converted into food security scale using a form of non-linear factor analysis; the Rasch Measurement Model which falls to the category of Item Response Theory (IRT) models, (Hamilton *et al*., 1997). Food security scale is continual, ranging from zero to ten. The scaling model computes values for each household based on their responses to the questions. Data collected are used to categorize the population studied into four definite classes of food security considering the varying contexts, experiences and behavioural styles characterizing each class of security. The four categories include:

i. Food secure – having little or no evidence of food insecurity
ii. Food insecure without hunger – whereby food insecurity is mainly shown by the concerned households' adjustment to food management

iii. Food insecure with moderate hunger – in which case food intake for children is reduced while adults experience hunger due to resource constraints,

iv. Food insecure with severe hunger - household with children reduce children's food intake so much that the children experience hunger owing to inadequate resources within the household and adults show evidence of serious hunger (for instance, staying hungry for the whole day).

A common example of food security module is the Household Food Insecurity Assessment Scale (HFIAS) which was established by the Food and Nutrition Technical Assistance (FANTA) project funded by the USAID. The scale assumes that the experiences of food insecurity by households cause predictable reactions and responses which can be scored and quantified using surveys (Coates *et al.*, 2007). HFIAS reflects three universal domains of inadequate household-level food access experiences includeing: anxiety about household food supply; insufficient quality, including variety and preferences and insufficient quantity of food supply and the attendant physical consequences of insufficiency (Deitchler *et al.*, 2011). Figure 4 illustrates the three domains of the HFIAS.

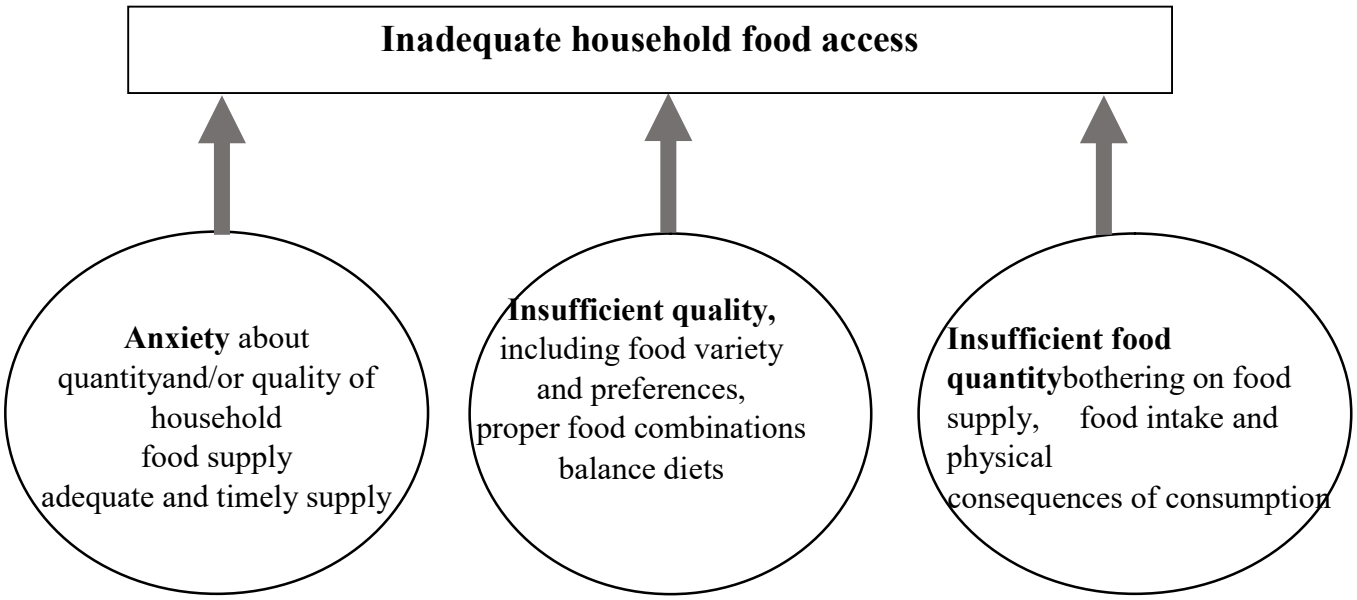

Figure 3: The universal domains of inadequate house hold level food access.

Source: Adapted from Deichler *et al.* (2011)

2.7. Conceptual framework for Food security

Food security is said to exist when all people, at all times have physical and economic access to sufficient food for their dietary needs to guarantee a productive and healthy life (USAID policy determination paper: PD. No. 19, 1992). World Food Summit affirmed poverty as the major cause of food insecurity and submitted that poverty alleviation will greatly improve food access to many people (Overseas Development Institute (ODI), 1997). Corruption, terrorism, conflict and environmental degradation are some of the other essential contributory factors to food insecurity. Bilali *et al*. (2019) itemized the basics of food security as including the following:

Food availabilityentails ensuring consistent availability of food in sufficient quantities. The levels of food production, food stock and net trade determine food availability.

Food access entails having adequate resources to obtain appropriate food needed for nutritious diets. Food access is usually described in terms of three elements including affordability, preference and allocation. Accessibility bothers on economic access i.e. food purchasing power, physical access (transport and infrastructure), and lastly, sociocultural access and preferences. Food access concerns focus on food prices, incomes, expenditure, and markets.

Food utilization is primarily concerned with appropriate use of food taking good cognisance of food safety, nutrition and social values. Basically, utilization implies the outcome of feeding practices, diet diversity, food preparation and fair intra-household distribution.

Stability in food availability, access, and utilization bothers on the impacts of crises and shocks the likes of adverse weather conditions, climate change and political instability, or the influence economic factors on long term food security.

The food security framework developed by USAID is represented in Figure 4. The framework reveals the three main domains of food security and the existing relationships between them showing their linkages and factors influencing them in the context of the broader policy and social environments. As reflected in the framework, domestic production and food stocks, food imports and food aids determine food availability and food prices. According to the framework, three main factors influence food access at the individual or household level. These factors are own food production, market purchases and food transfers. Market purchases are often affected

by the cash income available to households and food prices. Hence, households' food access is grossly determined by their levels of purchasing power. On the other hand, the combination of natural, capital and human or community resources available to the households affect levels of food production as well as the cash income obtained by individuals and households. Government or NGOs, food banks and community support systems aid food transfers. Also, the World Food Programme (WFP) conceptual framework for household food access (Figure 5) points out other means of food access as hunting, fishing and gathering which represent food harvests from the natural environment. Also, Households are capable of generating cash income from sale of own food produce, hunting, gathering and at times sales of food receipts. Direct cash transfers, formal employment or trade activities account for some other sources of cash income. These incomes are also channelled to food and non-food expenditures as well as accumulation of household assets.

Finally, food utilization is an aftermath of food availability and accessibility and there exists a kind of hierarchical relationship between these three major domains of food security. Food utilization is influenced by adequate nutrition knowledge, proper food processing, dietary intake, appropriate food storage conditions, child care practices, and health status. FANTA (2003) submitted that food insecurity could be borne out of inadequate food; inadequate access to food among certain group of the population or the consequence of households' poor utilization of food. However, experience have shown that many communities and households that have access to varieties of food in adequate quantity hardly achieve food and nutrition security partly due to lack of adequate nutrition knowledge, processing, preservation and storage skills and oftentimes owing to improper food choices and preferences as well as inappropriate food combination in quantity and varieties. For instance, significant nutrients can be lost to unguided processing, fermentation, over-heating, frying and roasting sequel to nutrition knowledge-gap. In essence, food access is a means to food and nutrition security but not an end in itself. Hence, there's need for concerted efforts on training and value-reorientation of farming households on the significance of nutrition security.

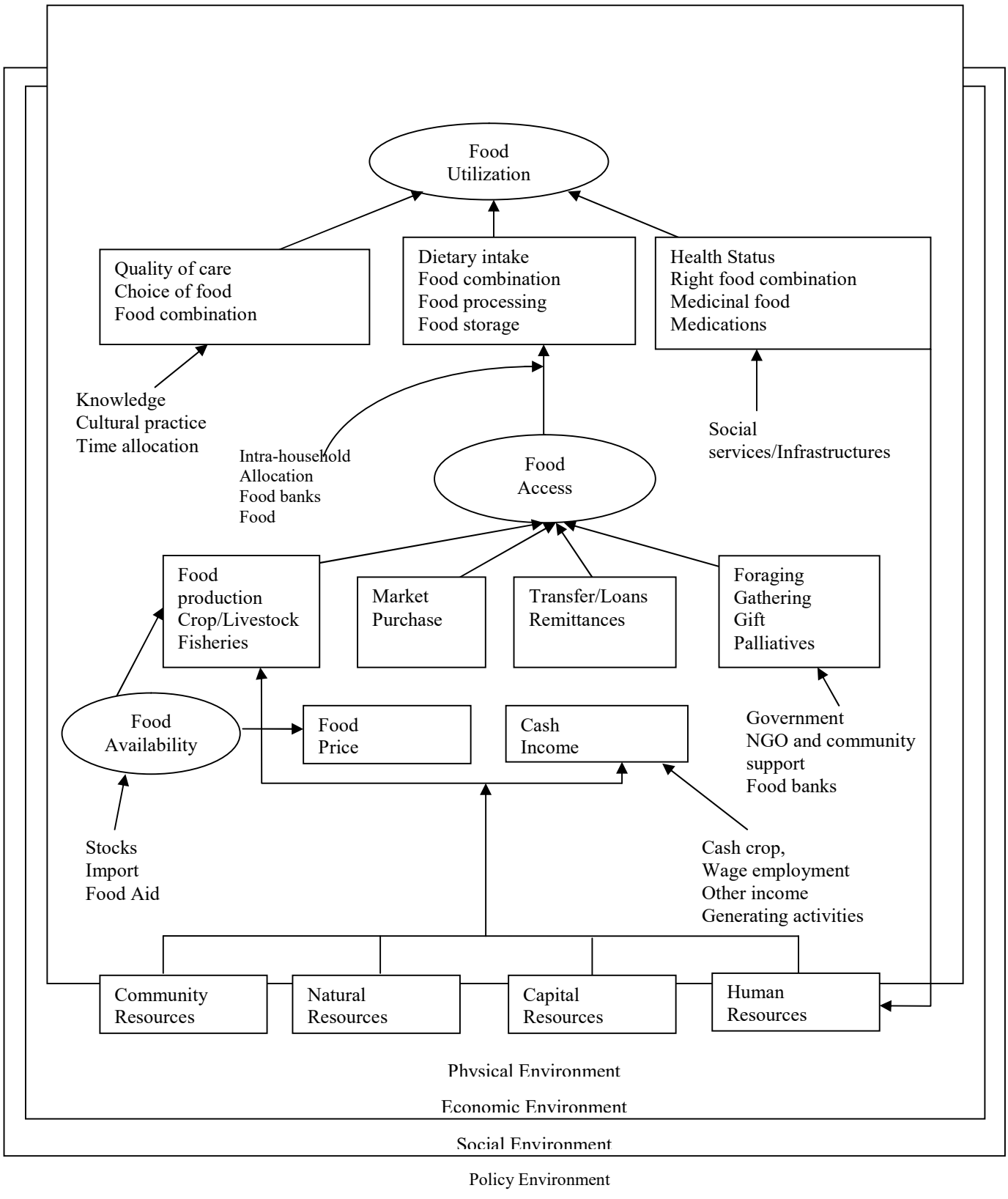

Figure 4: Conceptual framework for food security Source: Adapted from USAID (1999)

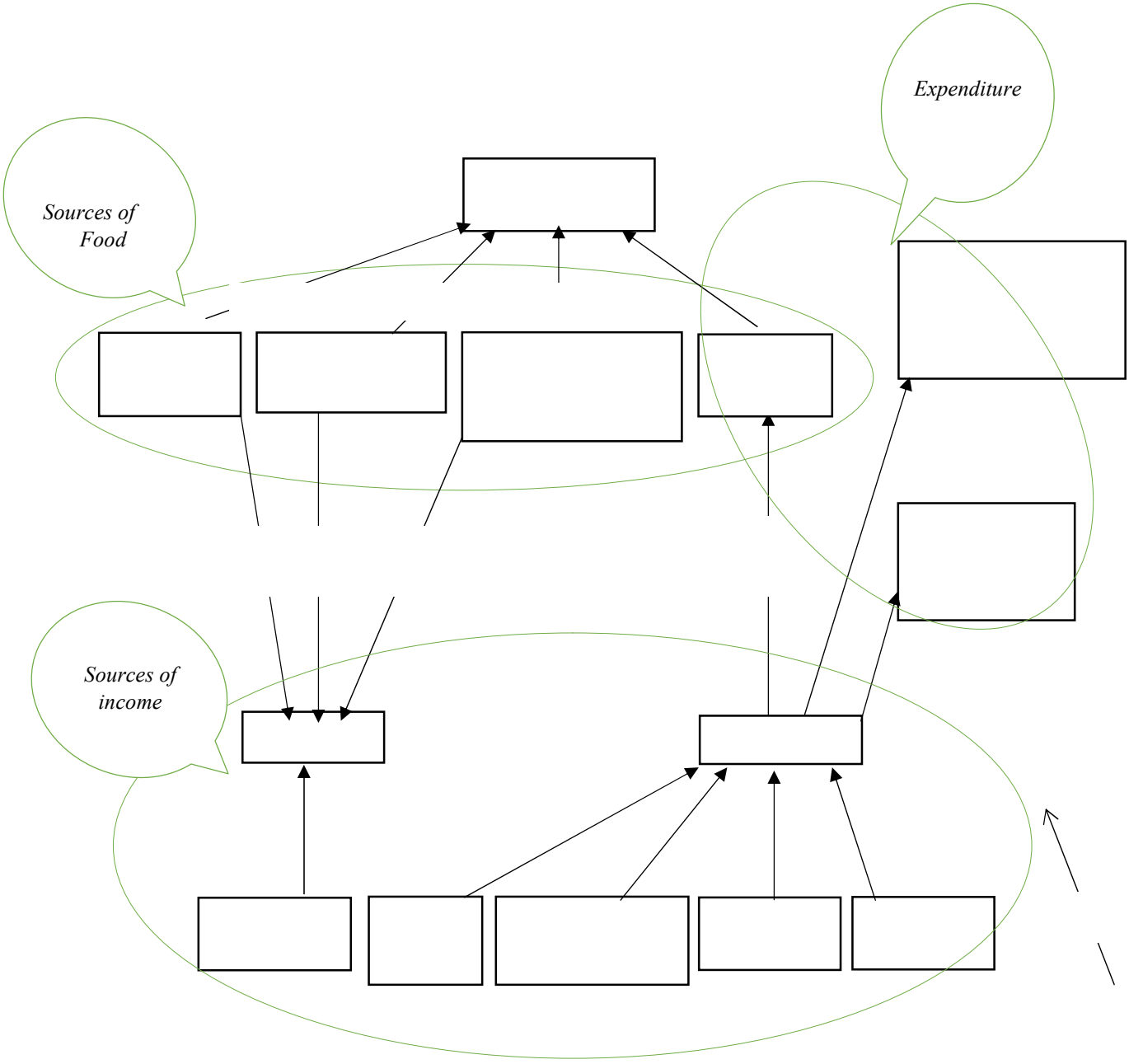

Figure 5: Conceptual framework for household food access.

Source: World food program emergency food security assessment handbook (2005)

2.8. Food entitlements

During the early part of 1980s, the contribution of Amartya Sen to the concept of food accessibility paved a remarkable lead way on means of tackling food security issues. Before that time, food security researches were mainly focused on food availability. Baiphethi and Jacobs (2009) affirmed that Sen's debate shifted focus from food availability to food accessibility entirely. Food entitlement approach is significantly unique as it focuses on the level of authority possessed by people over food which is entirely different from if there is enough food to eat or not. In his analysis of food entitlements, the three basic concepts introduced by Sen as the main factors determining how food is acquired and the level of food acquired include endowment set, entitlement set and entitlement mapping. Endowment setimplies the combination of all resources owned by a person both tangible (land, animals, etc.) and intangible (labour power, knowledge, skills, community or organization membership, etc.) and other assets. Entitlement setdepicts all possible combinations of goods and services which a person can obtain legally, via the use of his/her endowment set. For instance, a farmer could produce food via the use of use his land and other factors of production; a fisherman could catch fishes for sale or barter for some other food items he wants, using his boat and other equipment while a labourer may barter his labour supply for food. In other instances, an unemployed person using his citizenship as a resource may claim welfare in form of food support programmes or other unemployment benefits through transfers from the government. Entitlement mappingrepresents the relationship between endowment set and entitlement set. It implies the rate at which resources in the endowment set can be transformed into goods and services in the entitlement set. Food access depicts entitlements for production or acquisition of food (Sligh and Christman, 2007).

Main factors related to food access include:

i. Access to productive resources: land, water, agro-forestry, biodiversity, seeds and other genetic resources required for the production of food for domestic consumption and commercial purposes.

ii. Access to diverse knowledge: traditional and/or current best practices to achieve enhanced productivity.
iii. Access to domestic and international markets to obtain reasonable and steady prices.

2.9 Causes of food insecurity

Food crisis usually results from remote or immediate causes. Causes of food insecurity are in many folds which include individual-induced causes; corporate causes; some societal problems as well as national and international consequences of some insufficiencies and deficiencies, as argued by Fadiji and Omokore (2010). They further advanced that some of the causes of food insecurity worthy of mentioning, include:

i. Population growth: increment in human reproduction with no matching growth in crop production.
ii. Low level of food crop production: inability of food supply to meet demand for food.
iii. Continuous rise in food prices: a steady hike in food prices with its attendant effect of reduced purchasing power among the populace.
iv. Crisis and war/conflicts (increased refugees): crisis and instabilities in numerous parts of the world leading to relocation of refugees, work-force displacement and family abandonments.
v. Environmental disasters including desertification, floods and global warming caused by unanticipated natural occurrences.
vi. Insufficient water supply: inadequate water supply as experienced by many parts of the world breeding thirst and hunger.
vii. External debt burden: Heavy indebtedness has incapacitated numerous underdeveloped and developing countries from recording remarkable progress.
viii. Over reliance on grants/aids/donations: countless countries still rely on such supports from advanced countries sequel to their inability to harness their endowed resources.

ix. Biofuel development: generation of biofuel from crops puts serious pressure on demand for energy to the detriment of food crops.

The Executive Director of World Food Programmes (WFP) was quoted as follows: "Soaring food prices up to 55% (June 2007 through February 2008) including 87% hike of rice prices in March- and diminishing global food stocks owing to more world food consumption compared to production, seriously threatening the WFP's ability to keep millions from starvation" (Goodman, 2008). Therefore, it is pertinent for various Governments of the world to pay adequate attention to this trend in order to forestall imminent food crisis. Also, Idachaba (2004) observed the supply side factors can cause food insecurity. He identified one cause of food insecurity on the supply side, as food marketing challenges and further argued that the declining agricultural production in Nigeria confirms the unattractiveness of agriculture occasioned by low returns to farmers, which often lead to drastic reduction in food production.

2.10. Determinants of food security

Resources are the basic determinants of food and nutrition security. These resources include: Human resources (e.g. peoples' knowledge, skill and time); economic resources (e.g. income, land and assets); and organizational resources (e.g. formal and non-formal institutions, childcare organizations and extended families). The environmental dimension to agricultural production and climatic factors affecting food security are being considered determinants of recent. Food availability for individuals within the household may also be strained by prevailing social, cultural and religious norms. This further buttresses the fact that food security is indeed a very broad context. It entails issues relating to the physical, environmental, and biological and the prevailing changes being brought to bear on these by increasing intensification of human activities (Adejuwon, 2006). Resources are controlled in different ways at different levels of society. More of the resources are usually controlled by men at the household level and this often inhibits the realization of sufficient food and health care services. Resource use depends on how a problem is conceived and understood, perceptions and priorities of the resource controllers. Education is vital in determining

the utilization of resources to secure food, health and child care. World Bank (2001) pinpointed three pillars underpinning food security as: food availability, food accessibility and food utilization. Food availability for the farm household means ensuring sufficient food is available for them through own production. However lack of functional storage facilities and pressing needs oftentimes force farmers to sell their excess produce at harvesting period only to rely on market purchases during lean seasons. Food access means reduction in poverty. UNESCO (2010) affirmed that not everyone has adequate and unrestricted access to their food need which leads to serious challenges facing the world today: widespread hunger and food insecurity. Household food security determines the nutritional wellbeing of people at large. A household is food secured when it has the ability to acquire enough food to meet the dietary needs of its members either from its own production or through purchases (Ibrahim *et al*., 2009). Increasing food access has potential impact on nutrition. Food security is achieved by providing sufficient quantities of different varieties of food to ensure consumption of adequate diet by all members of the household. Increased and sustainable availability of nutritious foods at household and community levels can be attained by introducing new crops, promoting underexploited traditional food crops, home gardening and other forms of interventions (Faber and Wenhold, 2007; IFAD, 2013). However, nutrition interventions via the agricultural sector can empower the linkage between increased agricultural production and improved nutritional outcomes further. Food utilization means achieving good nutritional outcome, which is nutrition security. Having sufficient food does not automatically guarantee good nutritional outcome for instance when poor health results in incessant sickness. Food availability in explicit terms, entails having sufficient consistently available quantities of necessary and appropriate varieties of food produced domestically or obtained via commercial imports and other sources within the reach of individuals. In this context, food availability relates to the physical existence of food from own production or purchases. Food availability at the national level combines domestic food production, commercial imports, food aid, domestic food stocks and the fundamental determinants of all these factors (Gross *et al*., 2000). Food supplies stability refers to a situation whereby households do not risk

losing access to food as a result of unforeseen shocks (climatic crisis) or periodic events (e.g. seasonal food insecurity). Food stability at the household levels is therefore critical to national food security. However, the trend in world hunger measured by the prevalence of undernourishment which reverted in 2015, after decades of steady decline, has remained nearly unchanged in the past three years, at a level slightly below 11%.The number of people who suffer from hunger has slowly increased with more than 820 million people in the world still being hungry today, thereby underscoring the onerous challenge of attaining the Zero Hunger target by 2030 (FAO, IFAD, UNICEF, WFP and WHO 2019).

2.11 Theoretical and Conceptual Frameworks

2.12 Theoretical framework

Nworgu (2006) defined theory as a set of postulations capable of explaining or accounting for certain phenomena or events. Theory explains phenomenon, identifies causal trajectories and actions that might not be readily discerned but whose effects can be felt, seen or perceived. This study adopts three theories found relevant to explain the variables considered in the work. The theories include:

1. Access based theory of food security
2. Theory of reasoned action/planned behaviour
3. Socio-economic status theory

2.12.1. Access based theory of food security

The submission of USAID (1992) cited in USAID (2007) reveals that access based theory recognizes food security as a multidimensional phenomenon demanding assured access to sufficient food, sanitary environment and health service. This theory propounds the four dimensions of access to food as including physical, physiological, social and economic accesses. Physical access bothers on access to sustainable production and processing techniques, capacity to convey inputs to producers, food to consumers, adequate storage and stable food supply. Economic access relates to expansion of employment to guarantee broad economic access needed for sustainable and balanced economic growth. Economic access is also concerned with market efficiency, price level, wage and functional economic inducement structures. Social access demands transparent decision making in a democratic and locally responsive polity which provides a forum to hear the voices of the malnourished and nutritional insecure. Considered also is the nutritional implications of normative social roles such as time constraints and restrained economic access to resources among women. It also pays social and economic attentions to the marginalised groups. Physiological access entails availability of health services for direct nutrition intervention, adequate prevention as well as effective curative services among primary health care service providers. As it applies to this study, access based theory suggests access to food as a requisite for food security and further stresses the fact that food access goes beyond

mere availability of food but also involvesphysical, economic, social and physiological accesses to food. This necessitates that food security of a household depends largely on these multidimensional accesses.

2.12.2. Theory of reasoned action and/or planned behaviour

Ajzen (2006) observed that these theories have similar objectives that bother on attitude and behaviour. Theory of planned behaviour an expansion of the theory of reasoned action affirmed that a person's attitude guides his/her behaviour and the subjective norm (Ajzen, 2006). The three elements of the theory include attitude, subjective norm and behavioural intentions (Miller, 2005).

Attitude: entails the totality of beliefs on a particular behaviour which is weighted by the evaluation of these beliefs.

Subjective norm: is concerned with the effect of people in one's social environment on his/her behavioural intentions.

Behavioural intention: combines both attitudes towards behaviour and subjective norms towards that behaviour which has been established to herald actualbehaviour

The relevance of this theory to this study lies in the fact that the decision of household diet is always planned and thought about. Diet intake is affected by attitude and the environment that is, dietary intake and hence food security is greatly influenced by attitude towards good nutrition. The environment largely encompassing other household members, their preferences and health condition will influence household dietary intake. The theory therefore suggests that food security of households is a planned behaviour capable of being affected by attitude to nutrition, religion and ethnic affiliation of any concerned household.

2.12.3 Socioeconomic status theory

The socio-economic status theory was conceptualized by Weber (1958). He posited that inequality exists around three interconnected tracks: class, status, and party. Each was comprehended as a foundation for power and influence. Class is centred on economic resources and is partly regarded as political clout, while status was conceived

as honour and prestige. For Weber, status groups were hierarchically arranged on the basis of exclusive lifestyles, consumption patterns, and manners of conduct or action.

Parsons (1970) in his attempt to further explain the theory of socio-economic status, associated status with position in the social structure. In social connections with others, status differences affect how people associate. For Parsons, income and wealth were salient, but secondary to social status or honour. The role of Socio-Economic Status (SES) is reflected in direct and indirect ways. First, groups with higher status are usually expressed in terms of education and greater knowledge than lower-status groups. Second, high status group are better disposed to access and process information from the mass media to their advantage than the lower-status group. For that reason, the increased release of relevant and useful information into a society continuously widens the gaps between these statuses.

In application to this study, socioeconomic status theory depicts how socio economic status could influence the food security of a household. Households with higher socioeconomic status often have the income needed to acquire adequate diet compared to households with lower status. Also households with high SES have better access to accurate and timely information on relevant programmes/projects of intervention that bothers on food and nutrition security and other related concepts than households with low SES. Hence, the SES of households tends to widen the food security gaps between high and low class-statuses.

However, the contribution of socioeconomic status to household good security is relative. Umeh and Asogwa (2012) found that increase in income decreased food expenditure but increased non-food expenditure even though household income was found as a significant determinant of food and non-food expenditure among rural dwellers in Nigeria.

Based on the interplay of these theories, this study predicted the determinants of household food security among MicroVeg project beneficiaries in Nigeria.

2.13.Conceptual framework

Conceptual framework is a systematically stylised array of research ideas to pilot research layout (Aworh, Babalola, Gbadegesin, Isiugo-Abanihe, Okunmadewa and Oladiran, 2006). Miles and Huberman (1994) defined conceptual framework as a written or visual representation which graphically illustrates in a descriptive form, the three main things to study. That is, the basic ideas or variables and the conjectured linkages among them. It is a schematic representation of study variables, the inter-relationships among the variables and the envisaged impending outcome.

The conceptual framework of this study (Figure 6) was designed as the interface for three variables; the dependent, independent and intervening variables. The framework depicts a pictorial representation of household food security of the respondents (dependent variable) and the independent variables considered in the study included socioeconomic and enterprise characteristics, factors motivating respondents to grow indigenous vegetables, level of indigenous vegetables and selected food crops production, food consumption pattern, household food and non-food expenditure, household food security and the coping strategies utilized by respondents' households to deal with food shortage. Interrelationships exist amongst the independent variables, which subsequently affect the dependent variable. The framework also shows the intervening variables which affect both the independent and dependent variables indirectly. Intervening variables though not assessed in the study, have the propensity to influence the study outcome. For this study, the intervening variables may include variables such as sociocultural factors, food taste and preference, environmental factors, crop failure due to climate variations and the likes.

Socioeconomic characteristics including age, gender, household size, farming experience and income will affect farm size (enterprise characteristic) which will in turn affect the levels of indigenous vegetables and selected food crops production as well as expenditure on indigenous vegetables and selected food crops farms. Also, years of formal education will affect sources of information, input, credit and indigenous vegetables output marketing channels (enterprise characteristic) which will affect the level of indigenous vegetables and selected food crops production in a

reverse manner. Factors motivating respondents to grow indigenous vegetables will affect socioeconomic (farm income) and enterprise (farm size) characteristics, expenditure on indigenous vegetables and selected food crops farms as well as level of indigenous vegetables and selected food crops production and vice versa. Socioeconomic characteristics such as age, gender, household size and income will affect both food consumption pattern and expenditure on food and savings. Food consumption pattern and food expenditure will affect each other, while both will affect the coping strategies utilized to deal with food shortages. In the overall analysis, the interrelationships among all of these variables including the indirect influence of the intervening variables will in turn exert influence on household food security status of the respondents – the dependent variable.

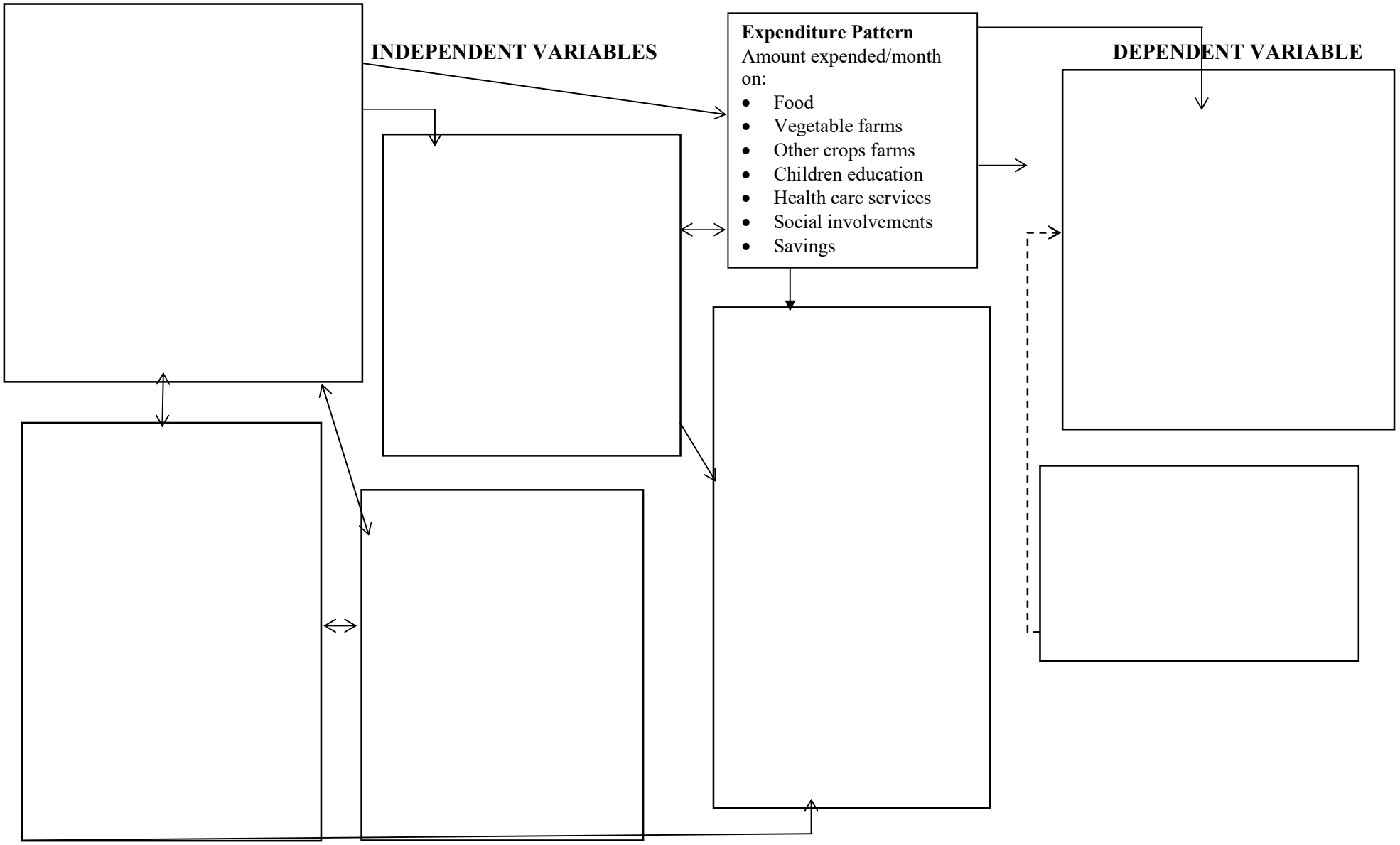

Figure 6: Conceptual Framework for Determinants of Household Food Security among MicroVeg Project Beneficiaries in Southwestern Nigeria

CHAPTER THREE
METHODOLOGY

3.1. Study Area

The study was carried out in the southwestern, Nigeria consisting of the Lagos, Ogun, Oyo, Osun, Ondo and Ekiti States, collectively known as the South-west geopolitical zone of Nigeria. The area lies between the longitude 2° 31^1 and 6° 00^1E and the latitude 6° 21^1 and 8° 37^1N, with a total land area of about 77,818 km^2. It is bounded in the east by the Edo and Delta States, in the north by Kwara and Kogi States, in the west by the Republic of Benin and in the south by the Gulf of Guinea. Kwara State, though one of the states in the North-central geopolitical zone formed part of the MicroVeg project states hence was selected alongside three other (Ekiti, Lagos and Osun) states for this study. The climate of South-West Nigeria is tropical and characterized by wet and dry seasons. Mean temperature ranges between 21 and 34 °C, while the annual rainfall ranges between 150 and 3000 mm. The wet season is associated with the southwestern monsoon wind from the Atlantic Ocean, and the dry season with the northeastern trade wind from the Sahara Desert. South-West, Nigeria is made up of fresh water swamp and mangrove forest vegetation at the belt, the low land in forest stretching inland to the Ogun and part of the Ondo states, with the secondary forest stretching towards the northern boundary by the derived and southern Guinea savannas. The major industries in the southwestern region of Nigeria include agriculture, oil (upstream and downstream), iron and steel processing, plastics, textiles, and pharmaceuticals. Major agricultural enterprises found in the region include crop farming, poultry production and livestock (Olajide, 2014 and Ojo *et al*., 2020).

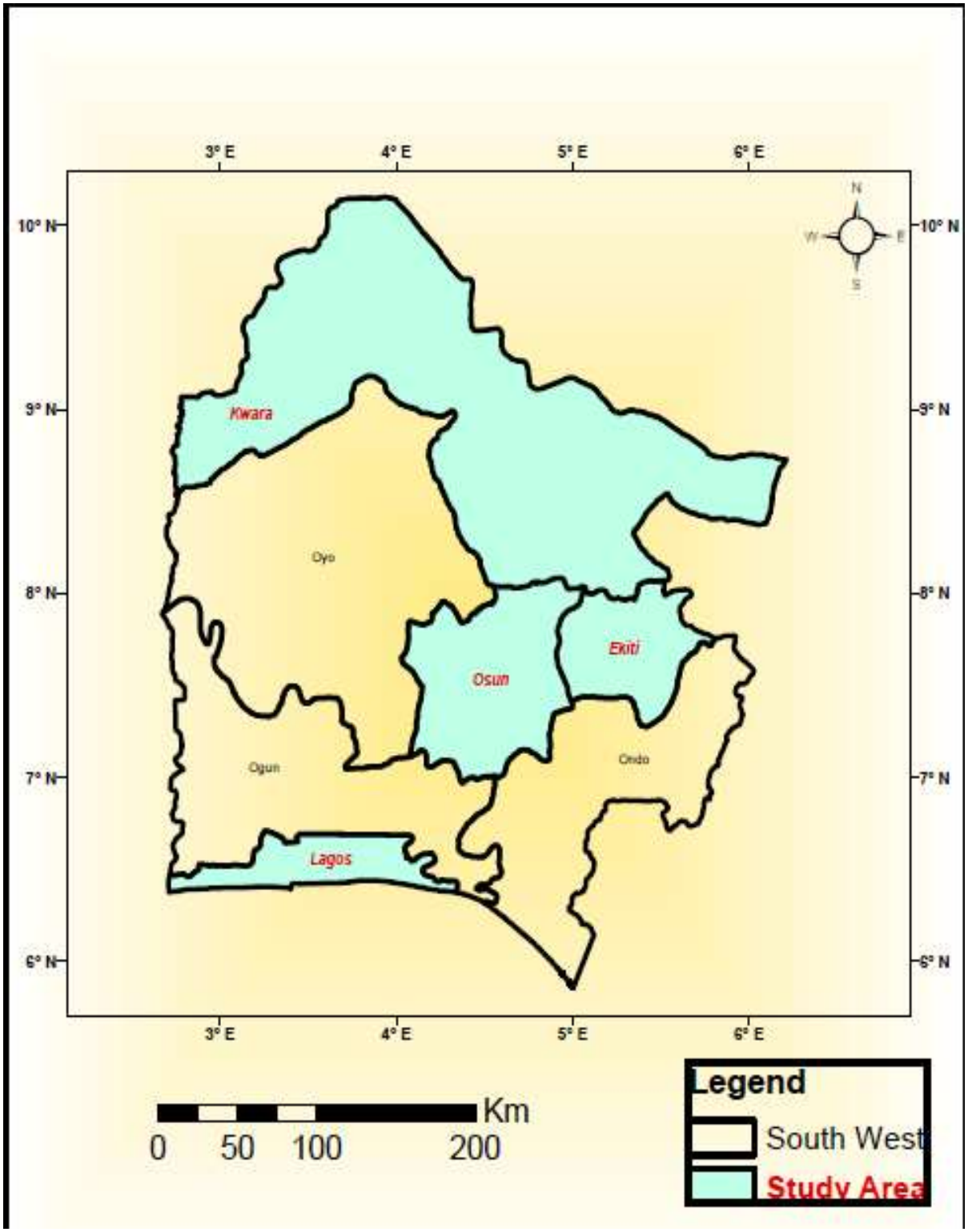

Figure 7: Map showing the Study Area; Southwestern, Nigeria.

3.2 Population of the study

This study focused mainly, on the MicroVeg project beneficiaries in southwestern Nigeria. MicroVeg Project beneficiaries were constituted by carefully selected indigenous vegetable farmers across the seven project states and four departments (states) covered in Nigeria and the Republic of Benin respectively. Some of these vegetable farmers benefited from the faced- off NiCanVeg project (2011-2014) which gave birth to MicroVeg project (2015-2018) even though the scope and coverage of the latter was wider than the former. In Nigeria, majority of the project beneficiaries solely grow the three selected high-premium indigenous vegetables in commercial quantity to make their living while some grow few other arable crops alongside the vegetables.

3.3 Sampling procedure and sample size

Multi-stage sampling procedure was used to select sample for the study. The stages are as detailed below:

First stage: Four of the seven project host states (Ekiti; Kwara; Lagos; Ogun; Ondo; Osun and Oyo States) for MicroVeg project in Nigeria were selected using stratified sampling by contiguity to give Ekiti; Osun, Lagos and Kwara States.

Second stage: Proportionate sampling of 40% of the 84 project sites distributed across the four selected states giving a total of 34 project sites (68 farm groups) as each project site habours an average of two farm groups.

Third stage: Proportionate sampling of 40% of the farm groups in the selected project sites giving a total of 28 farm groups;

Fourth stage: Systematic random sampling of 40% of the project beneficiaries proportional to size, from the selected 28 farm groups. Each farm group is constituted by twenty-five (25) farmers; forty percent of which is ten (10) farmers. This gave a total of 280 respondents in all. However, 3 of the interview schedules contained inadequate information for statistical analysis bringing the total sample size to 277 MicroVeg project beneficiaries.

Table 3.1: Summary of sampling procedure and sample size

Random Sampling of 4 out of 7 Project States.	**Number of Project Sites Across the 4 Selected States.**	**Random Sampling of 40% of the Project Sites.**	**Number of Farm Groups in the Selected Project Sites @ 2 Farm Groups/Project Site.**	**Random Sampling of 40% of Farm Groups in the Selected Project Sites**	**Beneficiaries' population in the Selected Farm Groups @ 25 farmers /Farm Group**	**Random Sampling of 40% of the Beneficiaries**	
Ekiti						**Interviewed**	**Analyzed**
	30	12	24	10	250	100	98
Kwara							
	17	**7**	14	6	150	60	59
Lagos	12	5	10	4	100	40	40
Osun	25	10	20	8	200	80	80
TOTAL	84	34	68	28	700	280	**277**

Source: Field survey; 2017.

3.4. Research design

This study employed cross-sectional survey and correlational design based on quantitative research method to examine household food security status and isolate the determinants of MicroVeg Project beneficiaries in southwestern Nigeria. Quantitative research method was utilized because the theme of the study, food security is an area that respondents, particularly farm families do not talk about freely in the presence of other people. Hence, it becomes very hard to collect meaningful qualitative data on the subject.

3.5. Data collection procedure

The study used quantitative research method. Semi-structured interview schedule was utilised to collect relevant quantitative data to address the study objectives. Data were collected on socioeconomic and enterprise characteristics, factors motivating respondents to grow indigenous vegetables, level of indigenous vegetables and selected food crops production, food consumption pattern, monthly food and non-food expenditure, household food security status indices and food coping strategies. Data collected were merged for statistical analysis in order to describe the data and draw necessary inference.

3.6. Validity and reliability of research instrument

Research instrument was subjected to face and content validity by experts in the Departments of Agricultural Extension and Rural Development and Agricultural Economics as well as scientists on MicroVeg project. Pre-test of the instrument was conducted with 30 respondents carefully selected among the project beneficiaries in Oyo State and a reliability coefficient of 0.76 was realized using the split-half method.

3.7. Measurement of variables

3.7.1. Independent variables

Socioeconomic characteristics: Socioeconomic variables considered relevant to the study were measured at the appropriate levels. These include:

Age: Age was measured in actual years of existence from the date of birth till date

Gender: Gender was measured as male or female

Marital status: Marital status was measured as single, married, separated, and widowed.

Religion: Measured as Christianity, Islam or Traditional faith,

Ethnicity: Measured as Yoruba, Igbo or Hausa,

Years of formal education: Measured in actual number of years spent in school

Household type: Measured as male or female headed

Household size: Measure as actual number of people living together and feeding from a common pot.

Household composition : Measured in terms of number of males and females and their respective age categories as youths under the working age (0 – 15 years), working class household members (16 – 59 years) and seniors (60 years & above).

Dependency ratio: Measured as ratio of non-working members of the household to all working members of the household.

Farm income: Measured in Naira as the income realized from vegetables and selected food crops grown per annum.

Non-farm income: Measured in Naira as the pooled income realized from salary, pension, artisanal engagements, trading and remittances.

Total Annual Income: This was measured as the sum of total farm and non-farm income realized by the farmers per annum. The variables measured at suitable levels, were analysed and described in frequencies, percentages, means and standard deviation as appropriate.

Enterprise characteristics: The enterprise characteristics covered in this study include:

Primary occupation: Measured as an open ended question in which case respondents were asked to state their primary occupation

Secondary occupation: Measured as an open ended question in which case respondents were asked to state their secondary occupation

Farming experience: Measured as an open ended question in which case respondents were asked to state the actual number of years they have been into farming

Vegetable growing experience: Measured as an open ended question in which case respondents were asked to state the actual number of years they have been into vegetable production

Membership of cooperative society: Measured with yes or no response options

Length of membership: Measured as an open ended question in which case respondents were asked to state the actual number of years they have been members of cooperative society

Means of farmland acquisition: Measured with five response options including inheritance, gift, lease, outright purchase, sharecropper while they were asked to specify other means.

Types and expanse of farmlandpossessed: Measured with three response options including homestead, wetland and main upland. This was measured in square meters because vegetables are minor crops

Sources of farm credit: Measured with nine response options including personal savings, family/friends, local group/cooperative, microfinance banks, commercial banks, religious bodies, NGOs, MicroVeg project, government programme.

Volume of farm credit accessed: Measured as an open ended question in which case respondents were asked to state the total amount of credit secured from the different listed sources, during rainy and dry seasons as informed by pre-test

Sources of vegetable seeds: Measured with eight response options including free from MicroVeg project, saved from last season's harvest, free seed from a neigbour, free seed from government program, purchased from another farmer, purchased from open market, purchased from agro dealer, purchased from ministry of agric.

Sources of other farm inputs: Measured with eight response options including free from MicroVeg project, free from a neigbour, free from government program, purchased from another farmer, purchased from open market, purchased from agro dealer, purchased from ministry of agric.

Sources of information: Measured for information items including sources of credit, vegetable seeds, fertilizer, insecticides and pesticides, land preparation, methods of cultivation, weather forecast, vegetable marketing and post-harvest technologies with

seven response options including MicroVeg project, extension staff, extension bulletin, other print media, radio, TV, NGO.

Sources of farm labour: Measured as self-labour, family labour, hired labour and sharecropper for land preparation, planting, fertilizer application, weeding, insecticide application, wetting, thinning, harvesting and washing.

Vegetables marketing outlet(s): Measured with four response options including wholesalers at farm gate, retailers at farm gate, wholesalers at the market and retailers at the market. The variables measured at suitable levels, were analysed and described in frequencies, percentages, means and standard deviation.

Factors motivating respondents to grow indigenous vegetables: Different factors account for farmers' interest in growing particular crops was measured on a 3-point Likert-type scale: doesn't motivate, motivate and highly motivate which were assigned scores of 0, 1 and 2 respectively, with ten response options including family inheritance, short production cycle, community value attached to vegetables, previous supports received by vegetable farmers, recognition derived from vegetable production, high rate of returns on investment, adequacy of income from vegetable production, regularity of income from vegetable production, little initial capital investment required and government support policies on vegetables.

Level of indigenous vegetables and selected food crops production: This was measured in kilograms and reported as such. The indigenous vegetables covered by the MicroVeg project are Telfeira occidentalis, Solanum macrocapon and Amaranthus viridis. Production was measured in terms of quantity of seeds planted, land area planted, frequency of planting, number of harvest times per planting and quantity of output per harvest during both rainy and dry seasons.

Food consumption pattern: The frequency and quantity consumed of different food items per week was measured in the appropriate units. The food items measured included roots and tubers and by-products (yam, cocoyam, potatoes, yam flour, cassava flour etc.); cereals and confectionaries (maize, sorghum, millet, rice, wheat, bread etc.); legumes (cowpea, melon, soybeans, groundnut, soybeans cheese etc.,); meat, fish and animal products (beef, fish, chicken, pork, bush meat, dried meat/kunndi, dried & wet cow skin, eggs etc.); fruits & vegetables (pawpaw, orange, banana, plantain, onions,

okra, tomatoes, pepper (atarodo, tatase, bawa), leafy vegetables); milk & beverages (milo, bournvita, coffee, Lipton); cooking fats and oil (palm oil, vegetable/groundnut oil), flavour and condiments (salt, locust bean, maggi); non-alcoholic and alcoholic drinks (zobo, kunnun, soymilk and alcoholics).

Monthly food and non-food expenditure: This was measured in terms of amount expended (in Naira) on food and other items of spending including vegetable farm maintenance, other crop farms maintenance, children education, health care services, social involvement and savings on monthly basis.

Coping strategies: Probed on a 3-point Likert-type scale: never utilized, occasionally utilised and utilised frequently assigned scores of 0, 1 and 2 respectively. The twelve response options given included borrowed money to purchase food/procured food on credit, reduced the number of meals, mother ate less, father ate less, children ate less, modified cooking method, substituted commonly purchased food items with cheaper ones, sold/mortgaged assets, borrowed food items from neighbours, engaged in work for food programmes, children involved in business activities, children suspended school to generate income. The scores were aggregated and weighted mean scores were utilized to rank the coping strategies in their order of importance.

3.7.2. Dependent variable

The dependent variable for this study, household food security was measured using adapted household food insecurity assessment scale (HFIAS)-FANTA 2 scale of USAID (2011) which is based on anxiety, fluctuations and quantity of food available to households at any point in time. FANTA 2 scale assesses of food insecurity with a set of generic questions asked on the basis of one-year recall. Bearing in mind the educational status of the subject of this research work, the recall period was taken down to one month as indicated on Table 3.2 below. The food insecurity score obtained was then reversed by subtracting the scores of individual respondents from the maximum obtainable score of 42 to get food security score. The mean of food security score obtained was utilized to categorize the MicroVeg project beneficiaries into food secured and food insecure house households. Households that fell below the mean score were categorized as being food secure while those whose scores fell into mean and above were categorized as being food insecure.

Table 3.2: Household Food Insecurity Assessment Scale

	Recall Period : 30 Days/ 4 Weeks	**Never (0)**	**Rarely (1)**	**Sometimes (2)**	**Often (3)**
		No Occurrence	**1-3 Days**	**4-6 Days**	**7 Days and above**
1.	Were there times you worry that food would run out before the household gets money to buy more				
2.	Food bought didn't last and there was no money to get more				
3.	You couldn't afford to eat balanced meals				
4.	Adult(s) cut size of meals or skipped meals				
5.	You ate less than what you felt you should eat				
6.	You were hungry but didn't eat				
7.	You lost weight				
8.	Adult(s) did not eat for a whole day				
9.	Relied on few kinds of low-cost food to feed child(ren)				
10.	Couldn't feed child(ren) balanced meals				
11.	Cut size of child(ren's) meals				
12.	Child(ren) were hungry				
13.	Child(ren) skipped meals				
14.	Child(ren) did not eat for a whole day				

Adapted from: Food & Technical Assistance FANTA 2 Scale (USAID, 2011)

3.8. Method of Data Analysis

To analyze the collected data, the study employed descriptive statistics, food insecurity index, reversed to food security index, Factor Analysis, Pearson Product Moment Correlation, Analysis of Variance and Multiple Regression Analysis. Descriptive statistics such as mean, standard deviation, frequency and percentage were used to describe socioeconomic and enterprise characteristics of respondents, level of indigenous vegetable and other food crops production, food consumption pattern, monthly food and non-food expenditure as well as explore coping strategies engaged to deal with food shortages in the study area while factor analysis was used to categorize and explain factors that motivate respondents to grow indigenous vegetables. Specifically, indigenous vegetable productivity was measured in terms of the quantity of vegetable harvested per unit of land (kg/m^2 and kg/Ha) for each of the three vegetables studied both in the rainy and dry seasons. Productivity was reported for each of the investigated vegetable species across both seasons while overall productivity was calculated as the sum of the productivity recorded for all the three vegetable species and reported both in kg/m^2 and kg/Ha. The selected other food crops cultivated that were investigated as informed by pre-test included maize, millet, sorghum, rice, wheat, cassava, yam, cocoyam, potatoes, cowpea, soybean, tomatoes, pepper and okra. Quantities produced, consumed and balance put for sale were all measured in kilograms and same were reported.

The dependent variable, household food security status was analyzed using the adapted FANTA scale of USAID (2011). FANTA scale measures food insecurity. However, respondents' food insecurity scores were reversed to food security scores by deducting each respondent's score from the maximum obtainable food insecurity score of 42 representing 14 response items multiplied by 3 being the highest point on the measurement scale (See Appendix II).

Food security line was therefore drawn on the mean of the households' food security score to classify sampled households into food secure or insecure households.

Food Security Line = Mean of Food security Score

Households that fell beneath the line (< Mean) were considered food secure

Households that fell on and above the line (≥ Mean) were adjudged food insecure.

Pearson Product Moment Correlation (PPMC) was employed to establish the relationship between selected socioeconomic and enterprise characteristics as well as indigenous vegetable output and household food security. T-test was used to test for difference in vegetable output/hectare during rainy and dry seasons while Analysis of Variance (ANOVA) was engaged to test for differences in household food security among beneficiaries across the four sampled project states. Lastly the contribution of explanatory variables to household food security was determined using multiple regression analysis while including similar variables as Ngema *et al*. (2018), Sani and Kamaw (2019) and Cheteni *et al*. (2020) in the model.

Model specification for Multiple Regression Analysis

Multiple regression analysis was engaged to isolate the determinants of household food security among MicroVeg project beneficiaries, the model used is specified below:

$Y = \beta_0 + \beta_1 X1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14}$

Y= Householdfood Security Status (Actual food security score of each respondent)

$\mathbf{X_1}$ = Age of respondent in years.

$\mathbf{X_2}$ = Gender of Household Head (0 = male, 1 = female).

$\mathbf{X_3}$ = Years of formal education

$\mathbf{X_4}$ = Household Size

$\mathbf{X_5}$ = Dependency Ratio/Household Composition

$\mathbf{X_6}$ = Farming experience.

$\mathbf{X_7}$ = Vegetable growing experience

$\mathbf{X_8}$ = Total farm credit

$\mathbf{X_9}$ = Total farm size

$\mathbf{X_{10}}$ = Vegetable farm size

$\mathbf{X_{11}}$ = Total vegetable output

$\mathbf{X_{12}}$ = Total vegetable income

$\mathbf{X_{13}}$ = Total farm income

$\mathbf{X_{14}}$ = Total non-farm income

Variables included in the model were informed by Dawit and Zeray (2017), Francis-Granderson *et al*. (2018) and Mutea *et al*. (2019)

Table 3.3: Multiple regression variables showing a-priori expectations

Variable	Variable Description	Types of Measure	Expected Outcome	Reference
	Dependent variable			
Household food security status	Food security score determines the status of each household	Food security score in actual number		
Age	Age of respondent	Actual number of years	+/-	Francis-Granderson *et al.* (2018)
Gender	Gender of household head	Dummy (0=Male; 1=Female)	+/-	Francis-Granderson *et al.* (2018)
Years of formal education	Total number of years spent in school	Continuous	+	Francis-Granderson *et al.* (2018)
Household size	Number of household members	Continuous	+/-	Mutea *et al.* (2019)
Dependency ratio	Ratio of non-working members to working members in the household	Continuous	-	Dawit and Zeray (2017)
Farming experience	Actual number of years spent in farming	Continuous	+	Adegbola *et al.*(2019)
Vegetable growing experience	Actual number of years spent growing vegetables	Continuous	+	Adegbola *et al.*(2019)
Total farm credit	Total amount of farm credit secured in Naira	Continuous	+	Dawit and Zeray (2017)
Total farm size	Actual farm expanse owned in Ha	Continuous	+	Dawit and Zeray (2017)
Vegetable farm size	Actual farm expanse committed to vegetable production	Continuous	+	Mutea *et al.* (2019)
Total vegetable output	Actual vegetable output in Kg	Continuous	+	Henri-Ukoha *et al.* (2013)
Total vegetable income	Total amount of money (Naira) realized from vegetable sales	Continuous	+	Mutea *et al.* (2019)
Total farm income	Total amount of money (Naira) realized from vegetable and other crops sales	Continuous	+	Mutea *et al.* (2019)
Total non-farm income	Total amount of money (Naira) realized from vegetable and other crops sales	Continuous	+	Mutea *et al.* (2019)

Source: Field survey, 2017.

Table 3.4: Summary of Analysis of objectives of the study

Objectives	Meaning	Data Requirement	Analytical tool
1.Describe the socioeconomic and enterprise characteristics of respondents	To find out the basic socioeconomic and enterprise characteristics of respondents	Age; gender; marital status; years of formal education; household size, household composition; income; years of vegetable farming experience; membership of cooperative society; religion, means of farmland acquisition; farm size; source(s) of information; frequency of vegetable production per annum: during rainy and dry seasons; quantity of vegetable seeds planted; quantity of vegetable harvested; main source(s) of vegetable seeds; main source(s) of farm credit; main source(s) of farm labour; herbicides; insecticides, source(s) and total of farm and non-farm income etc.	Frequency; Percentage; Mean, Standard deviation Bar charts Pie charts

2. Identify the factors that motivate respondents to grow vegetables	To find out the main factors that motivate respondents to grow indigenous vegetables	An array of factors including personal interest; family inheritance; short production cycle; community value attached to vegetables; adequacy of income from vegetable production; regularity of income from vegetable production; high rate of returns on investment; little initial capital investment required; previous supports received by vegetable farmers; Government support policies on vegetables and recognition derived from vegetable production were probed on a 3-point scale: doesn't motivate (0), motivate (1) as well as highly motivate (2).	Frequency; Percentage; Mean. Factor Analysis
3. Examine the level of indigenous vegetables and selected food crops production	To find out the of level of indigenous and selected food crops produced by respondents	Quantities (kg) of indigenous vegetables and selected food crops produced per annum (rainy and dry season). Productivity was measured in kg/m^2 and kg/ha for each of the three studied indigenous vegetables and overall productivity was measured as the sum total of the productivity of all the three vegetables.	Frequency; Percentage; Mean, Standard deviation
4.Examine food consumption pattern of respondents	To find out quantity consumed and frequency of consumption of the listed food items	Quantity consumed and frequency of consumption of roots and tuber; legumes; cereals and confectionaries; fruits and vegetables; meat and animal products; cooking fats and oil; beverages and condiments.	Frequency; Percentage; Mean; Standard Deviation

5. Analyze monthly household food and non-food expenditure of respondents.	To find out the amount expended monthly by respondents, on selected food and non-food items of spending.	Amount expended monthly, on feeding, vegetable farms, other food crops farms, children education, health care services, social involvements and savings.	Frequency; Percentage; Mean, Standard Deviation
6. Examine household food security of respondents	To find out household food security status of respondents	Food security line drawn at the mean of food insecurity scores derived from adapted FANTA Scale	Food Security Index (FSI) got from reversed food insecurity scores Food Security Line: Mean of Food security score < FSL = Food secure ≥FSL= Food insecure
7. Identify the coping strategies utilized by respondents in response to food shortages.	To find out the various coping strategies in practice among respondents to respond to food shortages.	Borrowing money to buy food/ got food on credit; Reduced number of meal; Mother ate less; Father ate less; Children ate less; Substituted commonly bought foods with cheaper kind; Modified cooking method Mortgage/ sold asset; Went for food for work programme; Children involved in business activities; Children suspended school to generate income were measured on a 3-point scale: Never utilized (0), Occasionally utilized (1) and Frequently utilized (2).	Frequencies; Percentages; Weighted mean scores.

Source: Field survey; 2017.

Table 3.5: Summary of Analysis of hypotheses of the study

Hypothesis	Meaning	Data Requirement	Analytical tool
1. Test of relationship between selected socioeconomic and enterprise characteristics of respondents and household food security.	To find out the extent to which the respondents' selected socioeconomic and enterprise characteristics influence their food security status.	Socioeconomic and Enterprise variables including age, years of education, household size, dependency ratio, farming experience, vegetable growing experience, farm size, vegetable farm size, farm credit, farm income and non-farm credit, household food security	PPMC
2. Test of relationship between total indigenous vegetables output and household food security of respondents.	To find out the extent to which the respondents' level of vegetable production influence their food security status.	Total indigenous vegetables output (Kg) Food Security Status	PPMC
3. Test of difference in indigenous vegetables production during rainy and dry seasons	To find out the differences that exists in total vegetable produced (kg) during rainy and dry seasons	Total indigenous vegetables output (kg) during rainy and dry seasons	t-test

4. Test of difference in household food security of respondents across the four selected MicroVeg project states.	To find out the differences that exists in the food security status of project beneficiaries across the four selected project states.	Food security index/status of respondents and Head Count Ratio across the four selected project states	ANOVA
5. Test of contribution of independent variables to household food security of respondents.	To isolate the specific explanatory variables that determines the food security status of respondents.	Selected independent variables shall be fitted into the specified regression equation.	Multiple Regression

Source: Field Survey; 2017

CHAPTER FOUR
RESULTS AND DISCUSSION

This chapter presents, explicates and discusses the results of the data collected and analysed in this study. These findings are reported under nine sub-sections in accordance with specific objectives and hypotheses of the study as follows:

1. Socioeconomic and enterprise characteristics of MicroVeg project beneficiaries in the study area.
2. Factors motivating respondents to cultivate indigenous vegetables;
3. Level of indigenous vegetables and selected food crops production among respondents;
4. Food consumption pattern of respondents' households;
5. Households' food and non-food expenditure of respondents;
6. Households' food security of respondents;
7. Coping strategies adopted by respondents to reduce food insecurity at times of food shortage.
8. Test of Hypotheses
9. Determinants of household food security

4.0. Presentation and discussion of findings

The presentation and discussion of findings are as follows:

4.1: Socioeconomic and enterprise characteristics of MicroVeg project beneficiaries

This section presents the personal and enterprise characteristics of indigenous vegetable farmers who are beneficiaries of the MicroVeg project in Nigeria.

4.1.1. Age: Table 4.1 reveals that majority (79.4%) of the sampled farmers were within the age range of 20-59 years, while few (21.6%) were 60 years and above. Mean age was 46.2 ± 14.05 years. This suggests that higher proportions of the respondents are still youthful, relatively agile and productive because they were within the working class age bracket as conceived by MicroVeg project in relation with the definition of United Nations (2018). Aidoo *et al.* (2013) and Sumari *et al.* (2018) found similar age profile among farmers in Ghana and Tanzania, respectively. This active age profile holds promises for continued indigenous vegetable production all things being equal.

4.1.2. Gender: Table 4.1 indicates that 72.9% of the respondents were male, while 27.1% were female. Crop production terrain in Nigeria and Africa at large is dominated by men. The distribution of respondents in this study indicates that a sizable number of the sampled vegetable farmers were female even though a vast majority were male. This may be partly because vegetables are regarded as minor crops that require less energy sapping operations and more importantly MicroVeg project is targeted towards achieving 50% gender inclusion in indigenous vegetables production in Nigeria. The findings of Sakyi (2012), Aidoo *et al.* (2013), Olajide (2014), Yilangai *et al.* (2015) and Sumari *et al*. (2018) among others affirmed the male dominance in crop production. Male and female farmers differ in their access to productive resources most especially farmland. FAO (2010) emphasized the desire to fill the gender hole in access to productive resources, education, extension and financial services.

4.1.3. Marital status: Table 4.1 reveals that most (88.0%) of the sampled respondents were married. Marital responsibilities prompt commitment among farmers in their farm production. Married farmers are availed the opportunity to secure sizeable farm labour for different operations, from family sources as evident in Table 4.8 where 37.9%, 33.2%, 31.4%, 29.6% and 28.9% of the sampled respondents utilised family labour for harvesting, wetting, planting, weeding and washing of harvested vegetables respectively. Agbo *et al.* (2015) affirmed that family labour is established as the primary source of labour supply in small holder production. Aidoo *et al.* (2013) found similar trend in the marital status of their sampled respondents in their study on household food security in Ghana.

4.1.4. Religion: Table 4.1 reveals that almost two thirds (65.7%) of the vegetable farmers were Christians, 33.9% practiced Islam, while just 0.4% was a traditionalist. Religion is not expected to influence household food security status of respondents all things being equal.

4.1.5. Ethnicity: Table 4.1 reveals that majority (74.0%) of the vegetable farmers belonged to the Yoruba ethnic group. This ethnic spread could be mainly due to the geopolitical zones that house the states benefitting from MicroVeg project from which the study sample was drawn: all the six states (Ekiti, Lagos, Ogun, Ondo, Osun and Oyo) in the southwest zone are dominated by the Yoruba ethnic group and Kwara state drawn from the north central zone has the presence of relatively diverse ethnic groups. Ethnicity affects food choices which may in turn affect nutrition security of the vegetable farmers.

4.1.6. Years of formal education: Table 4.1 also indicates that 10.8% of the sampled indigenous farmers had no formal education, while 89.2% had varied years of formal education. Mean years of formal education was 10±5.8 years meaning that majority of MicroVeg project farmers attended secondary school, at the least. Considerable literacy level is expected to influence respondents' degree of innovativeness, hence household food security. Agbo *et al.* (2015) and Ndegwa (2016) found similar trend in years of formal education among sampled vegetable farmers in the southeastern Nigeria as well as eastern and central Kenya, respectively.

4.1.7. Educational qualification: Furtherance to years of formal education,Table 4.1 shows that few (11.6%) of the respondents had no certificate, while 36.8% had secondary school leaving certificate. Most (88.4%) of the respondents had varying degrees of formal education which should have considerable effect on household food security. Aidoo *et al.* (2013) found a similar result Ghana, while Zakari *et al*., (2014) found a contrary result among sampled farmers in Niger.

4.1.8. Household type: Table 4.2 shows that most (92.0%) of the sampled respondents had male headed households. Household type has great implications on household food security. Typically, male headed households seem to fare better than the female headed households. This may be simply, because men are usually stronger and can better

withstand energy sapping farm operations and other income generating activities than the women folk. Sakyi (2012), Aidoo *et al.* (2013), Tefera and Tefera (2014) and Zakari *et al.* (2014) found majority of their sampled farmers as having male headed households in South Africa, Ghana, Southern Ethiopia and Southern Niger, respectively.

Table 4.1: Distribution of MicroVeg project beneficiaries based on socioeconomic and enterprise characteristics

Variable description	Frequency	Percentage	Mean
Age			
20-29	27	9.7	
30-39	63	22.7	
40-49	84	30.3	**46.2 ± 14.1**
50-59	43	15.5	
60-69	43	15.5	
70-79	17	6.1	
Gender			
Male	202	72.9	
Female	75	27.1	
Marital status			
Single	23	8.3	
Married	244	88.1	
Separated	01	0.4	
Widowed	09	3.2	
Religion			
Christianity	182	65.7	
Islam	94	33.9	
Traditional religion	01	0.4	
Ethnicity			
Hausa	28	10.0	
Igbo	44	16.0	
Yoruba	205	74.0	
Years of formal education			
0	30	10.8	
1-6	77	27.8	
7-12	100	36.1	**10.0±5.8**
13-18	59	21.3	
19-24	05	1.8	
25-30	06	2.2	
Educational qualification			
No formal education	32	11.6	
Primary education	76	27.4	
Secondary education	102	36.8	
OND/NCE	42	15.2	
HND/B.Sc	18	6.5	
Postgraduate qualifications	07	2.5	
Total	**277**	**100.0**	

Source: Field survey, 2017.

4.1.9. Household size: As shown in Table 4.2, over half (57.4%) of the vegetable farmers had 5-8 members in their households, while few (8.3%) had more than 12 members. Mean household size was 7.0±3.8 persons. Higher household size might translate to higher use of family labour, depending on the age composition of the family members. Results on table 4.5 established that respondents access appreciable farm labour from family sources. This result is in tandem with the findings of Sakyi (2012), Tefera and Tefera (2014), Zakari *et al.* (2014), Agbo *et al.* (2015), and Ndegwa (2016) among farm families in South Africa, Southern Ethiopia, Southern Niger, Nigeria and Kenya, respectively.

4.1.10. Dependency ratio: As presented in Table 4.2, majority (67.15%) of the sampled respondents had household dependent ratio ranging from 0.00 to 1.00. The mean of dependency ratio was found as 0.968±1.003. This implies that each working member of the sampled households is responsible for just about one non-working member. That is each working age person is expected to cater for a dependant. This ratio is anticipated to have positive influence on household food security. Beyene and Muche (2010) and Tefera and Tefera (2014) found much higher dependency ratios among farming households in Central and Southern Ethiopia, respectively. Bigsten *et al.* (2002) asserted that large sized households, mainly constituted by non-productive members are at higher risks of being food insecure as a result of high burden levied on active labour members.

4.1.11. Farming experience: Table 4.2 shows that 31.1% of the sampled indigenous vegetables farmers had 2 to 12 years of farming experience and 34.3% had farming experience ranging from 13 to 23 years of farming experience. Mean years of farming experience was 20.4±12.7 years. This connotes that the farmers are highly seasoned having been in the farming business for over two decades. Similarly, Olajide (2014) found a similar result among crop farmers in Nigeria. However, Agbo *et al.* (2015) found a much lower average years of farming experience among sampled vegetable farmers in the Southeastern Nigeria. Experience contributes to farmers' ability to improve on their farm activities (Oladele, 2008 cited by Olajide, 2014).

4.1.12. Vegetable growing experience: Table 4.2 further reveals the vegetable growing experience of the farmers. Over half (50.2%) of the farmers had only grown vegetables within the last one decade, while 27.4% and 15.9% had vegetable growing experiences spanning 11-20 years and 21-30 years of vegetable growing experience,

respectively. Mean years of vegetable growing experience was 14.5±10.6 years. This implies that the farmers have grown indigenous vegetables as a means of livelihood for over a decade and are expected to have been well ingrained in the business terrain over the time. Noteworthy here is the fact that the respondents' farming experience supersedes their vegetable growing experience which suggests that they later switched to vegetable production probably because of the faster and more regular rate of returns from vegetables when compared with other arable crops. Both farming and vegetable growing experiences have implications for household food security.

4.1.13. Primary occupation: As reflected inFigure 8below, majority (74.0%) of the vegetable farmers were primarily engaged in farming. This is expected to translate to effectiveness and efficiency in their farm businesses. Adenegan *et al.*(2013) affirmed that off farm labour supply and activities result in farm inefficiency. Olajide (2014), Zakari *et al*. (2014) and Yilangai (2015) found majority of their sampled respondents in Nigeria, Niger and north central Nigeria as full-time farmers.

4.1.14. Secondary occupation: As presented in Figure 9, 60.3% and 20.6% of the respondents had farming and artisanal engagements as their secondary occupation, respectively. Farmers usually generate additional income from one or more off-farm activities, to cushion the effect of occasional crop failure and take care of their expenses during the off-season. Farmers source income from both on-farm and off-farm activities (Babatunde (2008) cited by Olajide (2014). Ndegwa (2016) found that few of his sampled vegetable farmers in Kenya generated additional income from off-farm activities.

4.1.15. Membership of cooperative society: Figure 10 reveals that almost two thirds (64.3%) of the sampled respondents were members of one or more cooperative societies**.** Cooperative membership grant farmers, readily available farm credits at bearable interest rates. Hence, they are able to duly execute time bound farm operations. Also, co-operators gain social capital from membership and are therefore availed opportunities to other fringe benefits such as fairer prices negotiation from collective farm input purchases and produce marketing, among others. Tekleword and Kohlin (2010) affirmed that membership of organizations is a form of social capital, which also acts as a forum for sharing experience and exchanging information about market behaviour.

Table 4.2: Distribution of MicroVeg project beneficiaries based on other socioeconomic and enterprise characteristics n = 277

Variable description	Frequency	Percentage	Mean
Household type			
Male headed	255	92.0	
Female headed	22	8.0	
Household size			
1-4	56	20.2	
5-8	159	57.4	
9-12	39	14.1	**7.0±3.8**
13-16	12	4.3	
17-20	11	4.0	
Dependency ratio of households			
0.00 -1.00	186	67.15	
1.01-1.20	69	24.91	
1.21 – 1.30	12	4.33	
1.31 – 1.40	06	2.17	**0.968±1.003**
1,41 – 1.50	02	0.72	
1.51 – 1.60	01	0.36	
1.61 – 1.70	01	0.36	
Farming experience (Years)			
2-12	89	31.1	
13-23	95	34.3	
24-34	57	20.6	
35-45	25	9.0	**20.4±12.7**
46-56	05	1.8	
57-67	06	2.2	
Vegetable growing experience (Years)			
1-10	139	50.2	
11-20	76	27.4	
21-30	44	15.9	**14.5±10.6**
31-40	12	4.3	
41-50	06	2.2	
Total	**277**	**100.0**	

Source: Field survey; 2017.

4.1.16. Length of cooperative membership: As indicated in Figure 11, 43.0% of the vegetable farmers had been members of cooperatives for between 1 and 10 years, while a few (15.2%) had been co-operators for between 11 and 20 years. Mean length of cooperative membership was 9.8±8.6 years. The longer a farmer has been a co-operator, the better are the membership benefits accruable to him or her.

4.1.17. Means of farmland acquisition: Figure 12 reveals that less than half (46.2%) of the indigenous vegetable farmers inherited their farmland, while 42.6% leased their farmland. Land ownership status greatly influences farmers' commitment as well as scale of operation. Ojeleye (2015) found that majority of the farmers in Northern Nigeria inherited their farmlands, while high proportions of sampled farmers in South Africa and Kenya operated on communal and out rightly purchased farmlands, respectively as found by Sakyi (2012) and Ndegwa (2016).

4.1.18. Vegetable marketing outlets: Figure 13 shows that close to two thirds (63.9%) and almost half (47.3%) of the respondents sold their vegetable outputs to wholesalers at the farm gate and market, respectively. This result reveals that farmers rely heavily on the wholesalers (middlemen) as off-takers of their vegetable produce. Olajide (2014) found most of sampled crop farmers having middlemen as their major marketing channel. Heavy reliance on middlemen exposes farmers to farm gate prices and lowers their bargaining power thereby reducing the profits accruable to them and subsequently farm income. Nwankwo *et al* (2009) observed that marketing problems and activities of organised middlemen may limit farmers' income.

4.1.19. Type and expanse of farmland possessed: Concerning the expanse ofhomestead land possessed by the vegetable farmers, Table 4.3reveals that 21.7% had 100-1000m^2,while mean homestead land possessed by the farmers was 1741.9±2248.9 m^2. Also, 35.7% of the respondents had 200-4000m^2 expanse of wetland and mean was 7541.7±9388.7m^2. As for upland, 38.3% had 8000-28000m^2, while the mean of upland possessed by respondents was 19,797.9±31,656.5 (Table 4.3). As for the total farm size possessed, Table 4.3shows further that 73.3% of the vegetable farmers had 250-20000m^2 of farmland altogether with the mean of 21,026.91±34,343.12m^2 which is equivalent to over 2 hectares.

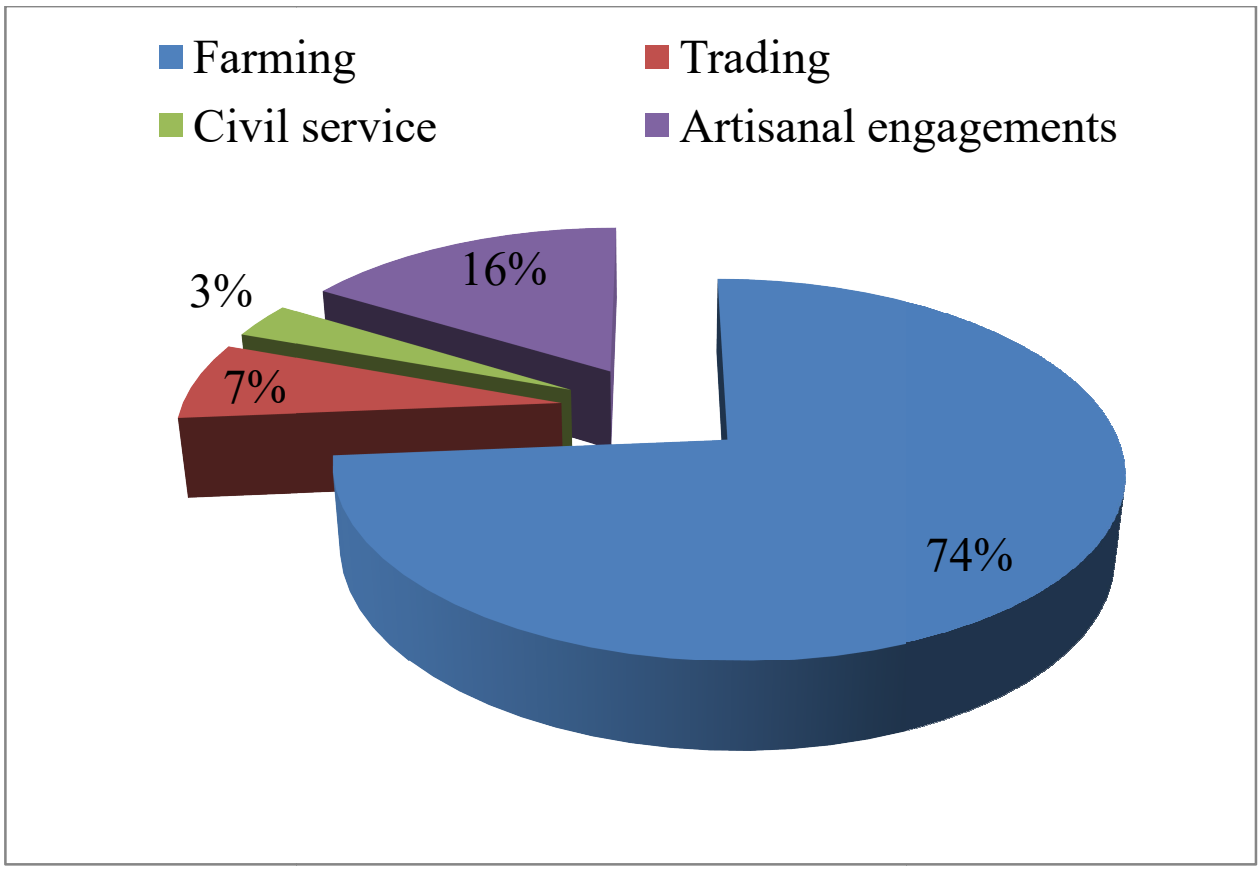

Figure 8: Distribution of MicroVeg project beneficiaries based on primary occupation

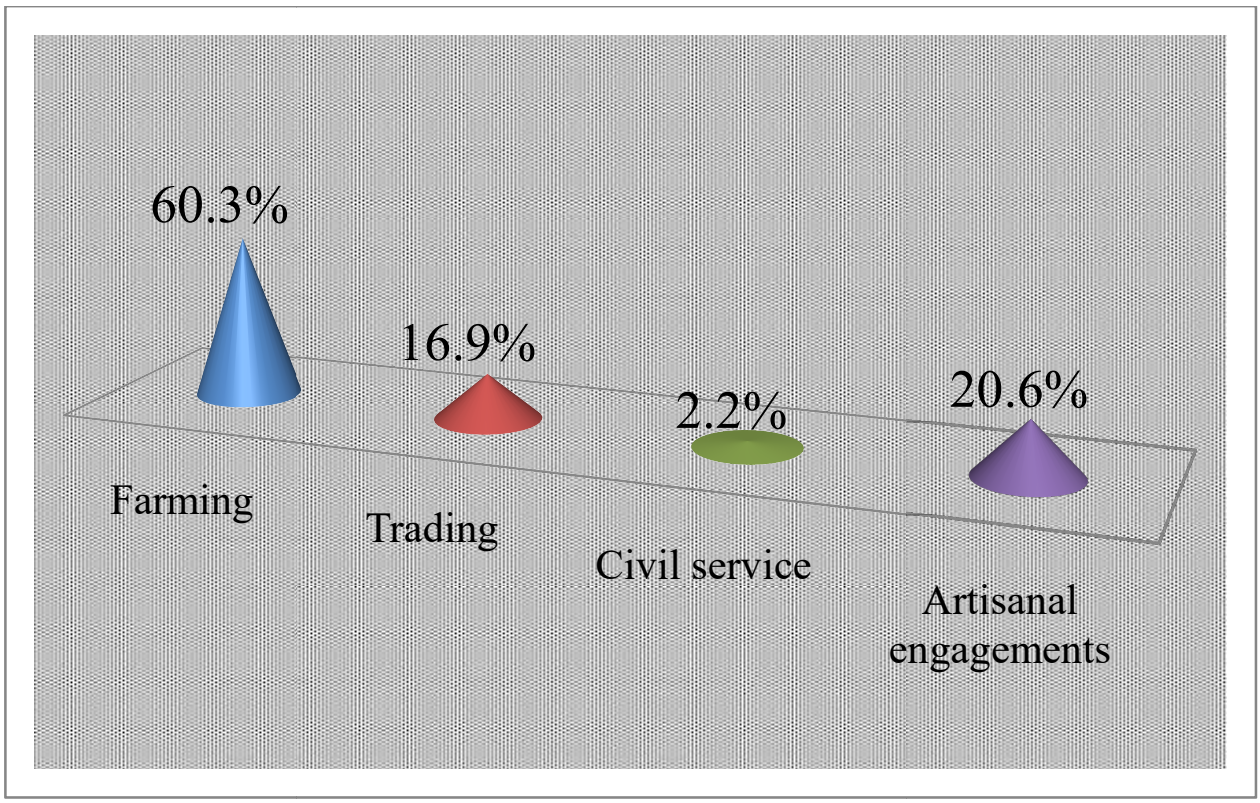

Figure 9: Distribution of MicroVeg project beneficiaries based on secondary occupation

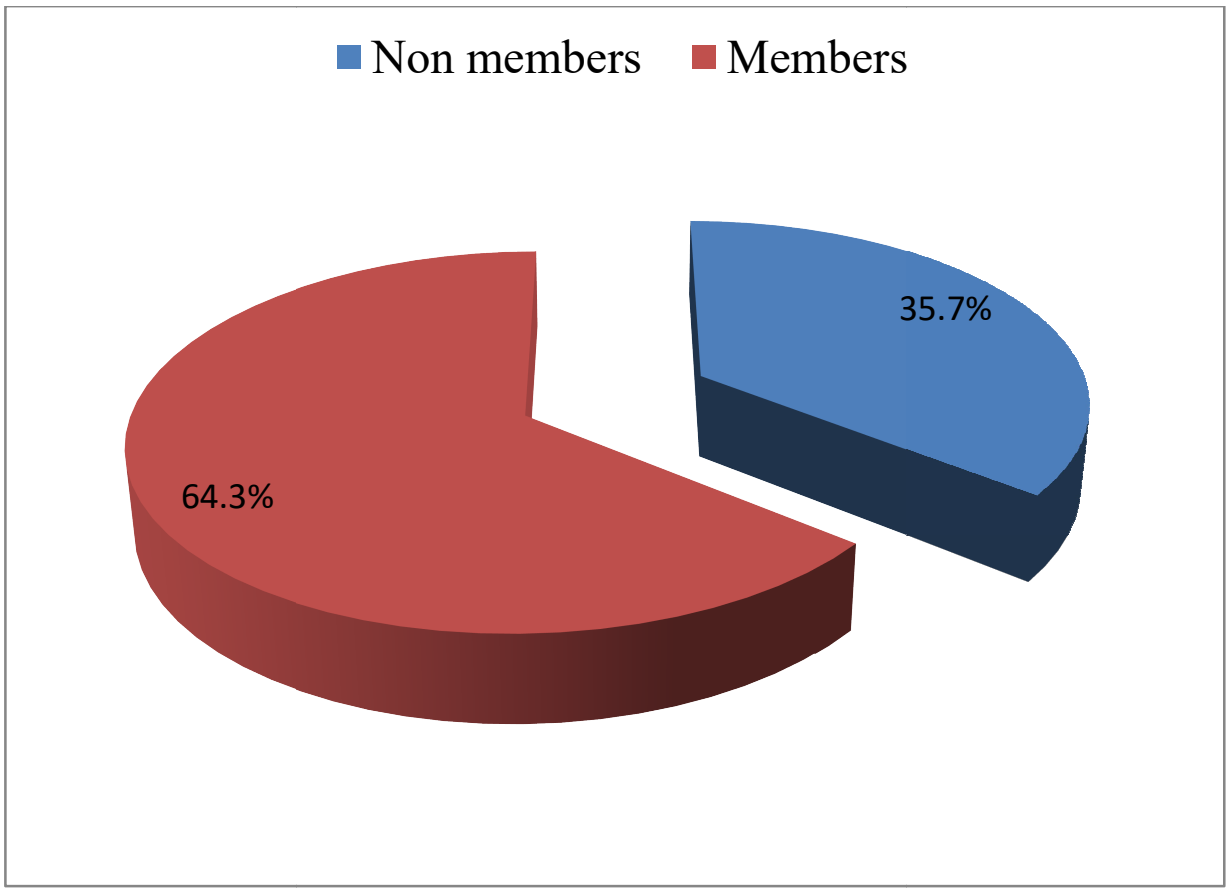

Figure 10: Distribution of MicroVeg project beneficiaries based on cooperative membership

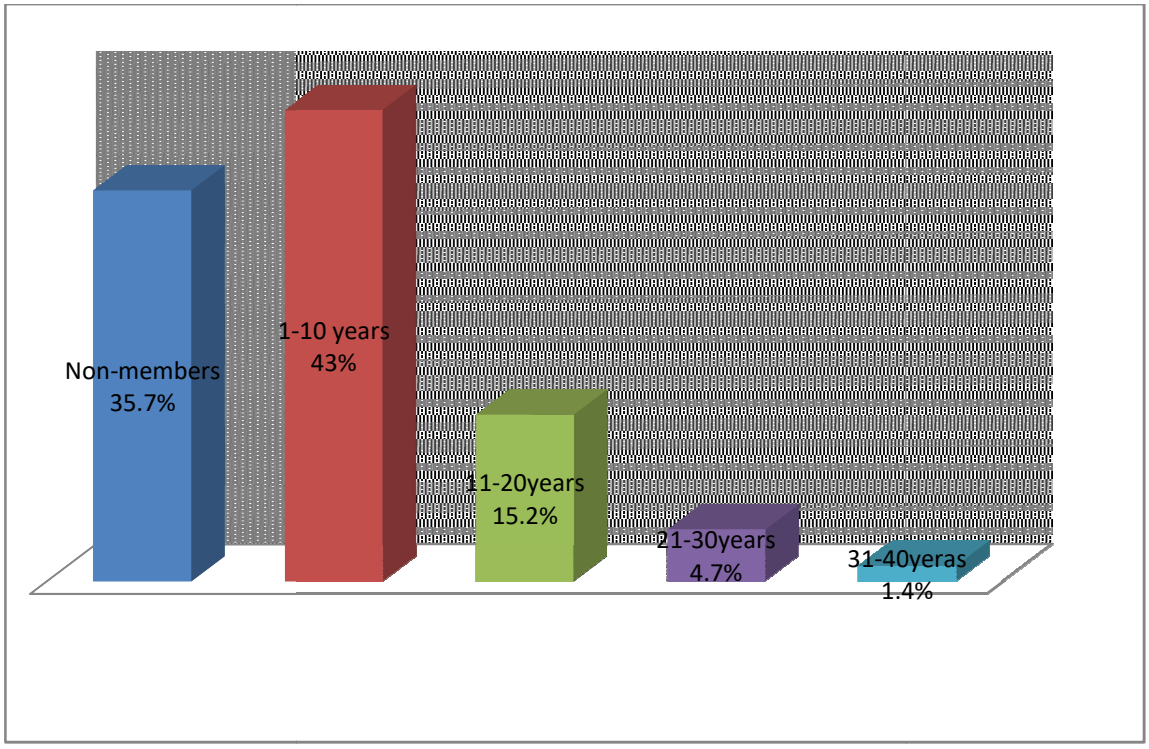

Figure 11: Distribution of MicroVeg project beneficiaries based on length of cooperative membership **Mean= 9.8±8.6 years**

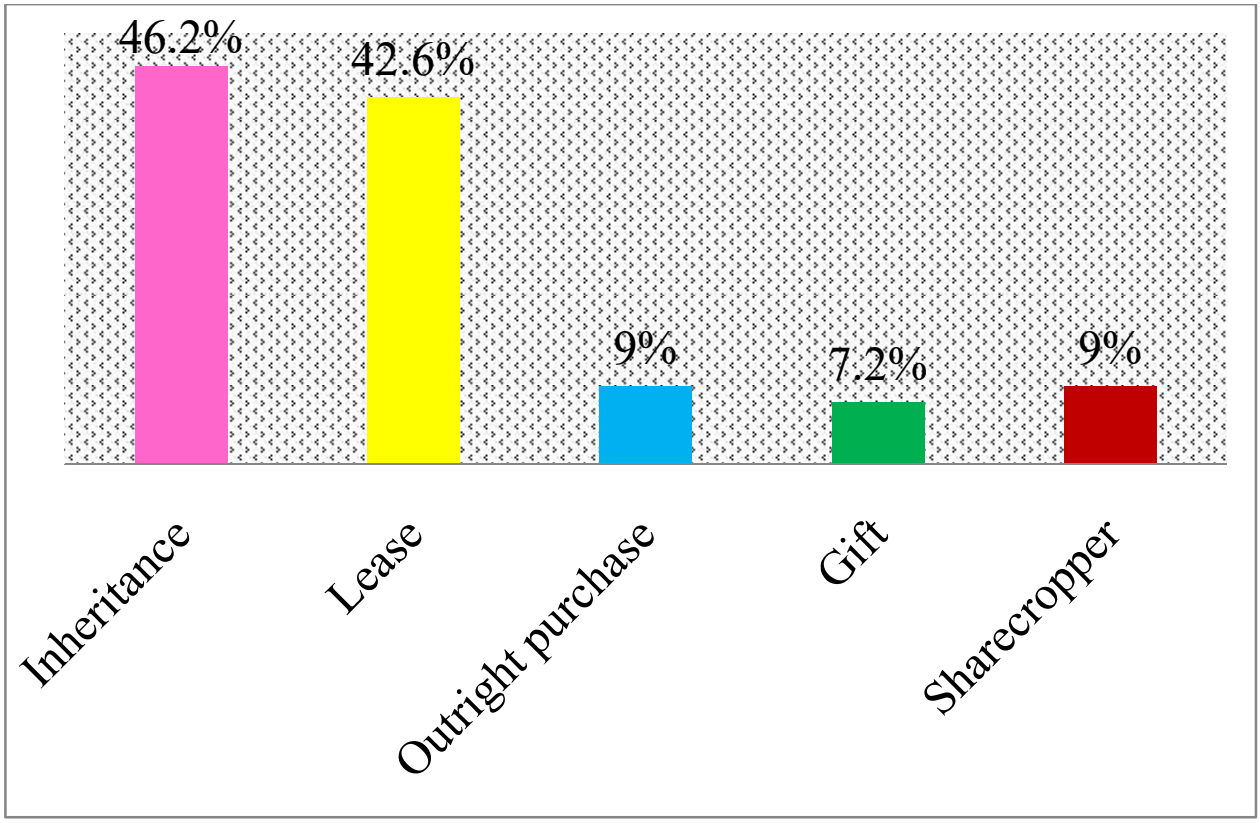

Figure 12: Distribution of MicroVeg project beneficiaries based on means of farmland acquisition

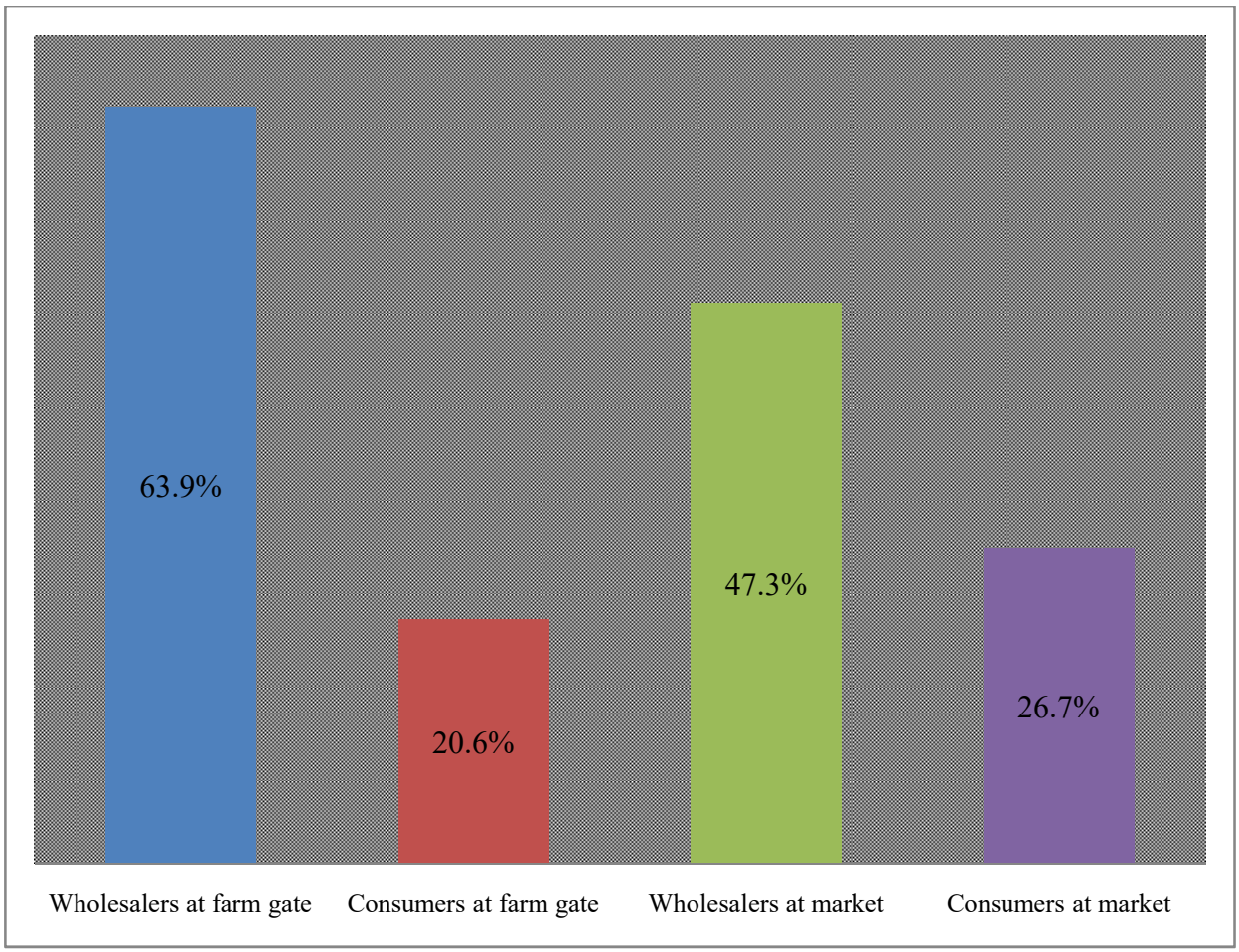

Figure 13: Distribution of MicroVeg project beneficiaries based on vegetable marketing channels

Table 4.3: Distribution of MicroVeg project beneficiaries based on type and expanse of farmland possessed (n=277)

Variable description	Frequency	Percentage	Mean
Homestead land (m^2) n=95			
100-1000	60	21.7	
1100-2000	13	4.7	
2100-3000	03	1.1	**1741.9±2248.9**
3100-4000	14	5.1	
4100-5000	01	0.4	
5100-6000	04	1.4	
Wetland (m^2) n=183			
200-4000	99	35.7	
4100-7900	07	2.5	
8000-11900	41	14.8	
12000-15800	12	4.3	
15900-19700	07	2.5	**7541.7±9388.7**
19800-23600	05	1.8	
23700-27500	04	1.4	
31300-35100	-	-	
35200-39000	-	-	
39100-42900	04	1.4	
43000-46800	03	1.1	
Main Upland (m^2) n=216			
<8000	74	26.7	
8000-28000	106	38.3	
29000-49000	20	7.2	
50000-70000	05	1.8	**19,797.9±31,656.5**
71000-91000	03	1.1	
92000-112000	02	0.7	
113000-133000	06	2.2	
Total farm size (m^2) n=277			
250-20000	203	73.3	
20050-39800	35	12.6	
39850-59600	20	7.2	
59650-79400	07	2.5	
79450-99200	02	0.7	
99250-119000	01	0.4	**21,026.9±34,343.1**
119050-138800	03	1.1	
138850-158600	03	1.1	
158650-178400	00	0.0	
178450-198200	00	0.0	
198250-218000	00	0.0	
218050-237800	03	1.1	

Source: Field survey, 2017. **Mean of total farmland** = 2.1±3.4Ha. 1Ha taken as 10,000 m^2

4.1.20. Scale of total farmland holding: Total farm size possessed hence respondents' scale of production is indicated in table 4.4. The table indicates that almost half (46.9%) of respondents were marginal farmers having less than 1 hectare of farmland, while just few (16.6%) were large scale farmers with 3 hectares and above . Mean total farm size was 2.1±3.4Ha. This might be indicative of the fact that vegetable cultivation demands less expanse of land compared with other arable crops. Similarly, more than half of sampled vegetable farmers in India were marginal farmers (Mishra and Ghadei, 2015). Also, Agbo *et al.* (2015) and Ndegwa (2016) found the mean farm size of vegetable farmers as 1.32Ha and 1.17Ha in Eastern Nigeria and Kenya, respectively

4.1.21. Sources and volume of farm credit available: Table 4.5 presents different sources and volume of farm credit available to respondents during rainy and dry seasons. Most (83.0%) of the indigenous vegetable farmers sourced their farm credit from personal savings. As for the average volume of credit accessed from the different sources in the last one year, Table 4.4 reveals that 79.1% and 57.4% of the respondents secured ₦110,600 and ₦108,894 from personal savings while a few (8.7%) and (5.4%) secured ₦207,083 and ₦199,333 from microfinance banks during the last rainy and dry seasons, respectively. This result buttresses the fact that farmers rarely patronise formal credit houses even though they can secure reasonable volume of credit therein. This result is in tandem with that of Okwoche *et al.* (2012) and Olajide (2014) who found that informal credit sources are more popular among farmers in Nigeria. According to Eze and Ibekwe (2007) cited by Agbo *et al.* (2015), poor credit access is one of the major problems faced by small scale farmers in Nigeria. Oftentimes, farmers resort to getting meagre credit from informal sources due to their inability to meet the requirements (collaterals and guarantors) of the formal credit houses which can guarantee them large volume of credit. Thus, they are limited in their scope of production. Agbo *et al.* (2015) found that majority of sampled vegetable farmers in Southeastern Nigeria got credit from informal sources (friends and relatives, neighbours, cooperative societies/farm associations and money lenders). Nigerian crop farmers ranked personal savings, cooperatives and friends/family first, second and third as the most prominent sources of credit available to them (Olajide, 2014).

Table 4.4: Distribution of MicroVeg project beneficiaries based on scale of farmland holding

Farm size (Ha)	Frequency	Percentage	Ownership status
< 1.0	130	46.9	Marginal
1-1.9	56	20.2	Small
2-2.9	45	16.3	Medium
≥ 3.0	46	16.6	Large
Mean= 2.1Ha			

Source: Field survey, 2017. Categorization based on Mishra and Ghadei (2015)

Table 4.5: Distribution based on sources and volume of credit available to MicroVeg project beneficiaries n≠277

Variable description	Frequency	Percentage
Sources of credit		
Personal savings	230	83.0
Family and friends	46	16.6
Local groups and cooperatives	46	16.6
Microfinance banks	30	10.8
Commercial banks	12	4.3
Volume of credit available to farmers (₦)	**Rainy season**	**Dry season**
Personal savings	**Freq. Percentage**	**Freq. Percentage**
1,000-50,000	110 39.7	86 31.0
51,000-100000	42 15.2	32 11.6
101,000-150,000	23 8.3	12 4.3
151,000-200,000	16 5.8	06 2.2
201,000-250,000	11 4.0	08 2.9
251,000-300,000	03 1.1	06 2.2
301,000-350,000	01 0.4	01 0.4
351,000-400,000	01 0.4	03 1.1
401,000-450,000	03 1.1	01 0.4
451,000-500,000	04 1.4	02 0.7
501,000-550,000	-	01 0.4
551,000-600,000	05 1.8	01 0.4
Mean	**110,600±138,888**	**108,894±166,621**
Family and friends		
5,000-50,000	13 4.7	10 3.6
51,000-100,000	03 1.1	02 0.7
101,000-150,000	01 0.4	01 0.4
151,000-200,000	- -	01 0.4
201,000-250,000	01 0.4	-
251,000-300,000	03 1.1	-
301,000-350,000	-	02 0.7
Mean	**89,880±105,881**	**114,486±205,760**
Local groups and cooperatives		
1,000-150,000	37 13.4	20 7.2
151,000-300,000	04 1.4	01 0.4
301,000-450,000	- -	- -
451,000-600,000	03 1.1	- -
Mean	**127,981±192,278**	**123,571±250,040**
Microfinance banks		
1,000-100,000	16 5.8	07 2.5
101,000-200,000	04 1.4	06 2.2
201,000-300,000	- -	- -
301,000-400,000	01 0.4	- -
401,000-500,000	03 1.1	02 0.7
Mean	**207,083±305,122**	**199,333±200,551**
Commercial banks		
45,000-200,000	01 0.4	02 0.7
201,000-356,000	01 0.4	- -
357,000-512,0000	01 0.4	-
Mean	**248,333±183,052**	**85,000±21,213**

Source: Field survey, 2017. *MR

Multiple responses (MR): Respondents at liberty pick more than one response option)

4.1.22. Total farm credit secured by vegetable farmers: Table 4.6 indicates that 58.5% of the sampled vegetable farmers had access to a total farm credit ranging from₦1,000-₦200,000 per annum. Mean total farm credit secured during both rainy and dry seasons combined was ₦139,391.5±260,929.8**.** This reflects that farmers had limited access to farm credit which may incapacitate them to expand the scope of their farm operation.

4.1.23. Sources of farm input: As shown in Table 4.7, the most important source of inputs among MicroVeg project beneficiaries was open market for Telfeira seeds (38.6%), Solanum seeds (31.8%), Amaranthus seeds (47.7%), fertiliser (47.7%) and insecticides (48.8%).

Notable proportions of respondents also procured fertiliser (40.4%) and insecticides (44.0%) from agro dealers. This result reveals that open market is the most prominent input purchase point and this raises questions on the viability and performance of the seeds procured among other inputs. Results also reveal that almost half of the respondents secured insecticide from open market being the closest accessible purchase points to them. Forty-four percent procured insecticides from agro-dealers while just 14.1% sourced insecticides from MicroVeg project. This result implies that vegetable farmers utilized insecticides a lot on their vegetable farms to maintain good quality vegetable produce at all times.

4.1.24. Sources of information: Sources of different information items available to the indigenous vegetable farmers in relation to their enterprise are presented in Table 4.8. The Table reveals that the most important source of information on farm credit sourcing (33.2%) and weather forecast (34.7%) was radio, while farmers' source of information on land preparation (40.1%), methods of vegetable cultivation (50.9%), availability of vegetable seeds (43.7%), availability of fertilizer and insecticides (37.9%), vegetable marketing outlets (30.0%) and post-harvest technologies (28.2%) was MicroVeg project. Farmers continuously seek information towards improved production performances, in virtually all the aspects of their farm operations. Results reveal the most prominent source of information among the farmers as MicroVeg project. This can be attributed to the fact that the project provides timely and readily available information to farmers in form of fact sheets, bulletins, radio jingles, training workshops etc. in local languages on all the aspects of their farm operations.

Table 4.6: Distribution based on total volume of credit secured by MicroVeg project beneficiaries during both rainy and dry seasons

Total farm credit (Naira)	**Frequency**	**Percentage**	**Mean**
No response	67	24.2	
1,000-200,000	162	58.5	
201,000-400000	24	8.7	
401,000-600,000	12	4.3	
601,000-800,000	03	1.1	**₦139,391.5±260,929.8**
801,000-1,000,000	02	0.7	
1,001,000-1,200,000	04	1.4	
1,201,000-1,400,000	00	0.0	
1,401,000-1,600,000	03	1.1	
Total	**277**	**100.00**	

Source: Field survey, 2017.

Table 4.7: Distribution of MicroVeg project beneficiaries based on sources of farm inputs (*MRT n≠277)

Sources of inputs	Telfeira seed		Solanum seed		Amaranthus seed		Fertilizer		Insecticide	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Saved from last harvest	55	19.9	61	22.0	85	30.7	-	-	-	-
Free from MicroVeg project	65	23.5	65	23.5	82	29.6	65	23.5	39	14.1
Free from a neighbour	15	5.4	14	5.1	19	6.9	15	5.4	10	3.6
Free from Govt. program	02	0.7	02	0.7	02	0.7	05	1.8	02	0.7
Purchased from another farmer	21	7.6	18	6.5	29	10.5	14	5.1	12	4.3
Purchased from open market	107	38.6	88	31.8	132	47.7	132	47.7	134	48.4
Purchased from agro dealers	50	18.1	42	15.2	56	20.2	112	40.4	122	44.0
Purchased from Min. of Agric.	03	1.1	05	1.8	07	2.5	10	3.6	12	4.3

Source: Field survey, 2017.

4.1.25. Sources of farm labour: Table 4.8 also presents the sources of labour available to the vegetable farmers, for different farm operations. As shown in the table, hired labour was the leading labour sources for land preparation (87.7%) and weeding (79.9%). Self-labour was supplied for fertilizer application (73.6%), insecticide application (72.2%), wetting (69.7%), thinning (67.9%), harvesting (73.3%) and washing (60.3%). These were augmented with family labour by 31.4%. 26.4%, 23.1%, 33.2%, 23.5% 37.9% and 28.9% of the respondents for planting, fertiliser application, insecticide application, wetting, thinning, harvesting and washing, respectively. In summary, majority of the sampled respondents engaged hired labour for less technical energy intensive operations mainly land preparation and weeding, while they supplied self-labour augmented with family labour, to undertake technical operations: planting, fertilizer and insecticide application, wetting, thinning, harvesting as well as washing. Agbo *et al.,* (2015) asserted that family labour is widely accepted as the main source of labour in small holder production. Agricultural operations are time bound and family members are expected to supply timely labour on the farm thereby mitigating possible crop failure to climate variations, which might be occasioned by unavailability or untimely supply of labour. Reliance on family and friend for farm labour guarantees harmonious working relationship (which usually coexists between family and friends) and this improves farmers' level of risk management (Olajide, 2014). Ojo (2005) found that family labour usually dominates labour supply in agricultural production, while Okwoche *et al*, (2012) affirmed that heavy dependence on hired labour increases total production costs.

4.1.26. Annual farm income of MicroVeg project beneficiaries and sources: Table 4.9 shows that more than two-thirds (68.6%) of the MicroVeg project beneficiaries realised an annual income ranging from ₦10,000 to ₦500,000 from indigenous vegetables production, while a few (2.17%), (1.08%) and (0.36%) realised ₦1,974,000-₦2,464,000, ₦2,465,000-₦2,955,000 as well as ₦3,938,000-₦4,428,000 and ₦4,429,000-₦4,919,000 per annum from indigenous vegetables production. The mean annual farm income from indigenous vegetables production was ₦551,786.6±₦803,481.5. Table 5.8 also shows that almost half (49.5%) of the respondents earned ₦10,000 to ₦500,000 per annum from selected food crops

production while very few (1.1%) realised an annual income ranging from ₦1,974,000-₦2,464,000 from selected food crops production. The mean annual farm income from selected food crops production was ₦313,058.3±₦1120158.0. The result clearly indicates that farmers realise higher income from indigenous vegetable production than other crops comparing the two means. This reflects the fact that the farmers committed almost half of their total farmland to indigenous vegetable production solely as evident on means in tables 4.2 and 4.14. Concerning total annual farm income, more than half (52.0%) of the respondents earned ₦10,000-₦500,000 per annum, while a few (2.9%) earned a total annual farm income of ₦4,429,000-₦4,919,000. The mean total annual farm income of respondents was ₦864,844.90±₦1147850.0 constituting 72.1% of the farmers' total annual income (46.0% from vegetables and 26.0% from selected crops). This result reflects that the bulk of respondents' income comes from farming. Similarly, sampled vegetable farmers in North-Central Nigeria got most of their annual income from farming (Yilangai *et al*., 2015).

Table 4.8: Distribution of MicroVeg project beneficiaries based on sources of information and farm labour utilized

Variable description	Sources of Information									
	MicroVeg Project		Extension workers		Radio		T.V		NGOs	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Credit sources	77	27.8	63	22.7	92	33.2	34	12.3	12	4.3
Availability of vegetable seeds	121	43.7	67	24.2	81	29.2	25	9.0	05	1.8
Availability of fertilizer & insecticide	105	37.9	67	24.2	84	30.3	25	9.0	06	2.2
Land preparation	111	40.1	65	23.5	60	21.7	24	8.7	07	2.5
Methods of cultivation	141	50.9	74	26.7	67	24.2	26	9.4	06	2.2
Weather forecast	48	17.3	46	16.6	96	34.7	53	19.1	08	2.9
Vegetable marketing outlets	83	30.0	58	20.9	53	19.1	19	6.9	04	1.4
Post-harvest technologies	78	28.2	46	16.6	40	14.4	15	5.4	06	2.2
	Sources of Farm Labour									
Farm Operations	Self		Family		Hired		Sharecropper			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Land preparation	152	54.9	75	27.1	243	87.7	13	4.7		
Planting	207	74.7	87	31.4	178	64.3	07	2.5		
Weeding	172	62.1	82	29.6	213	76.9	04	1.4		
Fertilizer application	204	73.6	73	26.4	123	44.4	-			
Insecticide application	200	72.2	64	23.1	131	47.3	-			
Wetting	193	69.7	92	33.2	138	49.8	01	0.4		
Thinning	188	67.9	65	23.5	123	44.4	-			
Harvesting	203	73.3	105	37.9	156	56.3	01	0.4		
Washing	167	60.3	80	28.9	115	41.5	-			

Source: Field survey; 2017. n≠277 *MR (Multiple responses: Respondents are allowed to pick more than one response option)

Table 4.9: Distribution of MicroVeg project beneficiaries based on farm income and sources

Vegetable income/annum (₦)	Frequency	Percentage	Mean	% of TAI
10,000-500,000	190	68.6		
501,000-991,000	49	17.7		
992,000-1,482,000	17	6.1		
1,483,000-1,973,000	04	1.4		
1,974,000-2,464,000	06	2.2		
2,465,000-2,955,000	03	1.1	**₦551,786.6**	**46.0**
2,956,000-3,446,000	-	-	**±₦803481.5**	
3,447, 000-3,937,000	04	1.4		
3,938,000-4,428,000	03	1.1		
4,429,000-4,919,000	01	0.4		
Other food crops income/annum (₦)				
10,000-500,000	137	49.5		
501,000-991,000	23	8.3		
992,000-1482,000	07	2.5		
1483,000-197300	01	0.4	**₦313,058.3**	**26.1**
1974,000-2464,0000	03	1.1	**±₦1120158.0**	
2465,000-2955,000	01	0.4		
2956,000-3446,000	01	0.4		
Total annual farm income (₦)				
10,000-500,000	144	52.0		
501,000-991,000	67	24.2		
992,000-1482,000	30	10.8		
1483,000-197300	12	4.3		
1974,000-2464,0000	04	1.4		
2465,000-2955,000	04	1.4	**₦864,844.9**	**72.1**
2956,000-3446,000	05	1.8	**±₦1147850.0**	
3447, 000-3937,000	02	0.7		
3938,000-4428,000	01	0.4		
4429,000-4919,000	08	2.9		
Total	**277**	**100.0**		
Mean of Total Annual Income:		**₦1,199,393.48±₦1,567,195.7**		

Source: Field survey, 2017. **TAI means** Total Annual Income

4.1.27. Annual Non-farm income of MicroVeg project beneficiaries and sources: As presented in Table 4.10, MicroVeg project beneficiaries earned varying amounts of additional/secondary income from different off-farm sources. The Table indicates that 9.75% of respondents had an annual off-farmincome of ₦10,000 to ₦500,000 from trading with a mean of ₦136,191.30±₦540951.9. The table further reveals that 12.3% of the respondents earned ₦10,000 to ₦500,000 from artisanal engagements per annum with a mean of ₦90,958.84±₦398359.5. Of the 12.64% respondents that enjoyed remittances (including returns from grown children and entitlement from inherited cash crop plantations), 10.47% of the respondents enjoyed an annual remittance of ₦10,000 to ₦500,000, while 2.17% enjoyed ₦501,000-₦991,000 remittance per annum with a mean of ₦34,963.90±₦125351.7. Sizeable proportions of sampled rural households in South Africa enjoyed remittances pensions and old age grant and this had relationship with lower levels household food insecurity (Sakyi, 2012).Table 4.9 also reveals that 4.7% of the respondents earned ₦10,000 to ₦500,000 salary per annum with a mean of ₦36,911.05±₦164439.3. As for pension, 2.2% of the respondents earned ₦501,000-₦991,000 per annum, while 1.1% earned an annual pension of ₦992,000-₦1,482,000 with a mean of ₦35,523.47±₦177258.2 (Table 19). Summarily, 24.9% of the respondents earned ₦10,000-₦500,000 as their total annual off-farm income, while a few (1.1%) earned a total annual off-farm income of ₦4,429,000-₦4,919,000 with a mean of ₦334,548.6±₦702350.8 constituting 27.9% of the farmers' total annual income. The proportions of off-farm income generated from trading, artisanal engagements, salary, pension and remittances were 11.4%, 7.6%, 3.1%, 3.0% and 2.9%, respectively. In all, 45.1% of the respondents had 27.9% of their total annual income from off-farm sources. Aidoo *et al*. (2013) found that majority of the sampled farming households in Ghana had access to off-farm income sources.

Table 4.10. Distribution of MicroVeg project beneficiaries based on non-farm income and sources **(n=277)**

Income (Naira)	Frequency	Percentage	Mean	% of TAI
Trading				
10,000-500,000	27	9.75		
501,000-991,000	05	1.81		
992,000-1482,000	02	0.72		
1483,000-1,973,000	03	1.08		
1974,000-2464,000	04	1.44		
2465,000-2955,000	-	-	**₦136,191.30**	**11.4**
2956,000-3446,000	01	0.36	**±₦540951.9**	
3447, 000-3937,000	-	-		
3938,000-4428,000	-	-		
4429,000-4919,000	02	0.72		
Artisanal Engagements				
10,000-500,000	34	12.27		
501,000-991,000	11	3.97		
992,000-1482,000	-	-		
1483,000-1973000	02	0.72		
1974,000-2464,0000	-	-	**₦90,958.84**	**7.6**
2465,000-2955,000	01	0.36	**±₦398359.5**	
2956,000-3446,000	-	-		
3447, 000-3937,000	-	-		
3938,000-4428,000	-	-		
4429,000-4919,000	01	0.36		
Remittance				
10,000-500,000	29	10.47	**₦34,963.90**	**2.9**
501,000-991,000	06	2.17	**±₦125351.7**	
Salary				
10,000-500,000	13	4.69		
501,000-991,000	06	2.17	**₦36,911.05**	**3.1**
992,000-1482,000	01	0.36	**±₦164439.3**	
1483,000-197300	01	0.36		
Pension				
10,000-500,000	04	1.44		
501,000-991,000	06	2.17	**₦35,523.47**	**3.0**
992,000-1482,000	03	1.08	**±₦177258.2**	
Total off-farm income				
10,000-500,000	69	24.91		
501,000-991,000	27	9.75		
992,000-1482,000	11	3.97		
1483,000-197300	09	3.25		
1974,000-2464,0000	04	1.44		
2465,000-2955,000	01	0.36	**₦334,548.60**	**27.9**
2956,000-3446,000	01	0.36	**±₦702350.8**	
3447, 000-3937,000	-	-		
3938,000-4428,000	-	-		
4429,000-4919,000	03	1.08		
Mean of TAI	₦1,199,393.9±₦1,567,195.7			**100.0**

Source: Field survey, 2017. **TAI means** Total Annual Income

4.1.28. Total annual income of MicroVeg project beneficiaries: Table 4.11 presents the total annual income of respondents. More than one-third (37.91%) of the respondents earned total income of ₦10,000-₦500,000 per annum, while a few (1.81%) earned total annual income of ₦4,920,000-₦5,410,000. The mean total annual income earned by MicroVeg project beneficiaries was ₦1,199,393.5±₦1,567,195.7 (USD 3331.65). This amount is considerably high and appreciable when compared with what is obtainable among other farming households within and outside Nigeria. Hence, respondents are expected to enjoy reasonable standards of living including appreciable level of household food security. Sakyi (2012), Ndegwa (2016), Tefera and Tefera (2014) found the total annual income of sampled farm families in South Africa, Kenya and Ethiopia as 19,303Rands (USD 1331.91) 47,292K/Sh. (USD 468.19) and 3100.43 birr (USD 108.51) respectively.

4.1.29. Perceived adequacy of annual income: Results of respondents' perceived adequacy of their level of annual income is presented in Table 4.12. More than one third (37.6%) of the indigenous vegetable farmers borrowed money to meet their expenses, 32.9% used previous savings to meet current expenses, 31.8% had their income simply respond to their expenses, 28.9% saved a little of their income, while 32.9% reported that their income built their savings.

Table 4.11: Distribution of MicroVeg project beneficiaries based on total annual income

Total income/annum (₦)	**Frequency**	**Percentage**	**Mean**
10,000-500,000	105	37.91	
501,000-991,000	68	24.55	
992,000-1,482,000	42	15.16	
1,483,000-1,973,000	22	7.94	
1,974,000-2,464,000	12	4.33	
2,465,000-2,955,000	04	1.44	**₦1,199,393.48**
2,956,000-3,446,000	09	3.25	**±₦1,567,195.7**
3,447, 000-3,937,000	03	1.08	
3,938,000-4,428,000	04	1.44	
4,429,000-4,919,000	03	1.08	
4,920,000-5,410,000	05	1.81	
Total	**277**	**100.00**	

Source: Field survey, 2017.

Table 4.12: Distribution of MicroVeg project beneficiaries based on perceived adequacy of income earned

Variable description	Frequency	Percentage
Borrowed money to meet expenses	104	37.55
Used previous savings to meet expenses	91	32.85
Income simply responded to expenses	88	31.77
Income saves a little	80	28.88
Income built savings	91	32.85

Source: Field survey, 2017. ***MRT n≠277**

4.2: Factors motivating MicroVeg project beneficiaries to grow indigenous vegetables

Table 4.13 shows the results of varimax factor rotation pattern with the measures that were loaded on each of the three factors extracted. Of the eleven variables listed, the loading which gives Eigen value of greater than one were three in number. Results in Table 4.14 show that factors loaded explained 63.3% of variance in all while unknown factors explained the remaining 36.7% of variance. The contributions of each of the highly loaded factors to motivate MicroVeg project beneficiaries to grow indigenous vegetables are also shown as follows: Factor 1 – Personal and socioeconomic capital influence was mostly associated with farmers' motivation to grow indigenous vegetables with 40.16% contribution. This was followed by factor 2 – Profitability and cash-flow influence (14.94%) and lastly factor 3 – family background and incentive influence (8.24%).

Results in Tables 4.15 to 4.17 reveal the three identified and named factors with the variables that were highly loaded on each of the five factors. The factors include:

Factor 1: Personal and socioeconomic capital influence

Results in Table 4.15 show that this factor was defined by eleven measures of loading and all of them were positively loaded. These were personal interest (L = 0.178), family inheritance

(L = 0.131), short production cycle (L = 0.253), previous support received by vegetable farmers (L = 0.347), community value attached to vegetable production (L = 0.253), recognition derived from vegetable production (L = 0.324), high rate of investment turn-over (L = 0.339), adequacy of income from vegetable production (L = 0.326), regularity of income from vegetable production (L = 0.315), little initial capital required for vegetable production (L = 0.272) and government support policy on vegetable production (L = 0.221). The factor was named based on criteria one, four, six, eight and nine. This finding implies that MicroVeg Project beneficiaries are motivated to grow indigenous vegetables for personal interest coupled with social and economic capital gains. In the same vein, Mariyono (2020) found out that Indonesian farmers grew vegetables for economic motive comprising of income generation, experience and their cropping pattern. They also grew vegetables due to fast harvesting as well as personal preference.

Table 4.13: Results of varimax rotated factors showing correlation coefficient of highly loaded variable with components significant factors motivating MicroVeg project beneficiaries to grow indigenous vegetables

	Factors		
Variables (x)	**1**	**2**	**3**
Personal interest	0.178	0.220	0.392
Family inheritance	0.131	-	0.844
Short production cycle	0.253	0.327	-
Community value attached to vegetable production	0.313	-	-
previous support received by vegetable farmers	0.347		
Recognition derived from vegetable production	0.324	-	-
High rate of investment turn-over	0.339	0.295	-
Adequacy of income from vegetable production	0.326	0.282	-
Regularity of income from vegetable production	0.315	0.337	-
Little initial capital required for vegetable production	0.272	0.266	0.108
Government support policy on vegetable production	0.221	-	0.176

Source: Computed from field survey, 2017.

Table 4.14: Result of principal component analysis showing the initial eigen values and percentage variation in factors motivating MicroVeg. Project beneficiaries to grow indigenous vegetables

Component Number	Factor Label Names	Eigen value	Percentage variance	Cumulative percentage
1	Personal and socioeconomic capital influence	4.819	40.16	40.16
2	Profitability and cash-flow influence	1.793	14.94	55.11
3	Family background and incentive influence	1.012	08.24	63.34

Source: Computed from field survey, 2017.

Table 4.15: Factor analysis showing variables contributing to personal and socioeconomic influence factor

Contributing variables	**L**	**L^2**	**λ**
Personal interest	0.178	0.032	
Family inheritance	0.131	0.017	
Short production cycle	0.253	0.064	
previous support received by vegetable farmers	0.347	0.120	
Community value attached to vegetable production	0.313	0.098	
Recognition derived from vegetable production	0.324	0.105	0.879
High rate of investment turn-over	0.339	0.115	
Adequacy of income from vegetable production	0.326	0.106	
Regularity of income from vegetable production	0.315	0.099	
Little initial capital required for vegetable production	0.272	0.074	
Government support policy on vegetable production	0.221	0.049	
Eigen value	4.819		
Percentage of variance cumulative	40.16		

L = Loading for factors
L^2 = Square of loading factors
λ = Latent root for the factor (summation of the square of loading)
Source: Computed from field survey, 2017.

Factor 2: Profitability and cash-flow influence factor

As revealed in Table 4.16, factor 2 was identified by eleven measures of loading out of which six were positively loaded. The positive measures included personal interest (L = 0.220), short production cycle (L = 0.327), high rate of investment turn-over (L = 0.295), adequacy of income from vegetable production (L = 0.282), regularity of income from vegetable production (L = 0.337) and little initial capital required for vegetable production (L = 0.266).

Criteria three, five and six were considered to name the factor. Findings show that respondents were motivated to grow indigenous vegetables owing to little initial capital requirement for start-up in relation to high rate of returns on investment in addition to a more regular inflow of cash-inflow from vegetable sales for as long as harvesting of produce lasts compared. A similar study reported that farmers were motivated to grow cabbage in Indonesia to fulfil needs for existence, relatedness and growth which were defined by an array of relevant criteria (Rahayu, 2018).

Factor 3: Family background and incentive influence factor

Table 4.17 shows that factor 3 was described by eleven factors of loading of which only four were positively loaded. These factors include personal interest (0.392), family inheritance (0.844), little initial capital requirement for vegetable production (0.108) and Government support policies on vegetable production (0.176). The factor was named by criteria two and four. The findings suggests that majority of the sampled MicroVeg project beneficiaries were engaged in indigenous vegetable production as an inherited and ancestral agribusiness venture and are also encouraged to stay in the business as a result of some support policies on vegetable production in the study area. Hence, efforts should be geared towards continued creation of enabling environment to support indigenous vegetable production via incentives and subsidies on inputs and easily accessible off-takers of vegetable produce at friendly prices to the farmers.

Table 4.16: Factor analysis showing variables contributing to profitability and cash-flow influence factor

Contributing variables	**L**	**L^2**	**λ**
Personal interest	0.220	0.048	
Short production cycle	0.327	0.107	
High rate of investment turn-over	0.295	0.087	0.507
Adequacy of income from vegetable production	0.282	0.080	
Regularity of income from vegetable production	0.337	0.114	
Little initial capital required for vegetable production	0.266	0.071	
Eigen value	1.793		
Percentage of variance cumulative	14.94		

L = Loading for factors
L^2 = Square of loading factors
λ = Latent root for the factor (summation of the square of loading)
Source: Computed from field survey, 2017.

Table 4.17: Factor analysis showing variables contributing to family background and incentive influence factor

Contributing variables	**L**	**L^2**	**Λ**
Personal interest	0.392	0.154	
Family inheritance	0.844	0.712	0.910
Little initial capital required for vegetable production	0.108	0.012	
Government support policies on vegetable production	0.176	0.031	
Eigen value	1.012		
Percentage of variance cumulative	8.240		

L = Loading for factors

L^2 = Square of loading factors

λ = Latent root for the factor (summation of the square of loading)

Source: Computed from field survey, 2017.

4.3.Level of indigenous vegetables and selected food crops production among MicroVeg Project Beneficiaries

4.3.1.Season of vegetable production: Most (83.4%) of the sampled farmers grew vegetables during both rainy and dry seasons, 14.4% during rainy season only while just a few (2.2%) cultivate vegetables during the dry season only (Table 4.14). Farmers are known to cultivate vegetables during rainy, dry or both seasons depending on the availability of irrigation facilities. However, few of MicroVeg project beneficiaries grow vegetables during either of rainy or dry seasons only.

4.3.2.Total farmland under vegetable production: As revealed in table 4.15, more than two thirds (68.2%) of the respondents were small scale indigenous vegetable growers while less than one third (31.8%) were large scale growers. Mean of total farmland was 21,026.9m^2/2.1Ha (Table 4.2) while the mean of total farm size under vegetable production was 10,314.67m^2/1.03Ha which implies that the farmers committed almost half of their total farmland to indigenous vegetable production having realized its economic potentials.

Table 4.18: Distribution of MicroVeg project beneficiaries based on season of vegetable production

Season	Frequency	Percentage
Rainy only	40	14.4
Dry only	06	2.2
Both seasons	231	83.4
Total	**277**	**100.0**

Source: Field survey, 2017.

Table 4.19: Distribution of MicroVeg project beneficiaries based on total farmland area under vegetable production

Scale of production	**Frequency**	**Percentage**
Small (< Mean)	189	68.23
Large (≥ Mean)	88	31.77
Total	**277**	**100.00**
Mean	**10,314.67m^2 (Equivalent to 1.03Ha)**	

Source: Field survey, 2017.

4.3.3.Vegetable output and productivity: Table 4.16 reveals that 60.7% and 49.8% of the vegetable farmers planted Telfeirain the last raining and dry seasons with average yields of 2.8kg/m^2 and 1.1 kg/m^2, respectively**.** More than half(50.5%) and 41.5% grew Solanum in the last raining and dry seasons with average yields of 1.1kg/m^2 and 0.7kg/m^2, while 81.6% and 69.3% planted Amaranthus in the last raining and dry seasons with an average yield of 0.9kg/m^2 and 0.7kg/m^2, respectively. The average land area committed to Telfeira, Solanum and Amaranthus in the last raining season was 5,176.9m^2, 4,005.18m^2, and 6,114.8m^2, respectively while that of dry season was 5,898.84m^2, 4,433.43m^2 and 6,200.61m^2, respectively. The mean outputs of the three vegetables in the last raining and dry seasons were 14,662.8kg and 6,259.8kg (Telfeira), 4,199.4kg and 3,062.6kg (Solanum) and 5,698.3kg and 4,101.5kg (Amaranthus). In the overall, majority (71.8%) of the respondents recorded low indigenous vegetables productivity relative to the average productivity recorded by all respondents. Sequel to the project packages embodied in the technology capsule disseminated to MicroVeg project farmers, the average yield of indigenous vegetables achieved is highly outstanding. For instance, smallholder farmers in Eastern and Central Kenya recorded an average yield of 9,680.3kg/Ha in Telfeira production (Ndegwa, 2016) which is just about a half of the yield figure recorded by MicroVeg project beneficiaries in Nigeria.

Table 4.20: Distribution of MicroVeg project beneficiaries based on vegetable output and productivity (n≠277)

Vegetable	Proportion of growers		Mean of land area (m^2)	Mean output (Kg)	% of total		Yield Kg/m^2	Yield Kg/Ha
Telfeira	**Freq.**	**Percent**						
Rainy season	168	60.65	5176.92	14662.80	70.07		2.83	28,197.69
Dry season	138	49.82	5898.84	6259.75	29.93		1.06	10,609.75
Total	***MR**		**11075.76**	**20922.55**	**100.00**		**1.89**	**18,849.14**
Solanum								
Rainy season	140	50.54	4005.18	4199.38	57.82		1.05	10,498.45
Dry season	115	41.52	4433.43	3062.62	42.18		0.69	6,960.50
Total	***MR**		**8438.61**	**7262.00**	**100.00**		**0.86**	**8,645.24**
Amaranthus								
Rainy season	226	81.59	6114.82	5698.33	58.14	0.93		9,341.52
Dry season	192	69.31	6200.61	4101.45	41.86	0.66		6,615.24
Total	***MR**		**12315.43**	**9799.78**	**100.00**	**0.80**		**7,967.30**
Overall productivity	**277**	**100.0**	**19450**	**22901.12**	**100.00**	**1.18**		**17029.58**

Source: Field survey; 2017. ***MR:** Multiple Responses

4.3.4. Level of selected food crops production

Majority (76.2%) of the sampled vegetable farmers who grew maize realized an average output of 2,332.00kg (Table 4.17). More than half (54.2%) grew 12,443.50kg of cassava, 38.3% grew 3,772.88kg of yam, 34.7% grew 1,073.49kg of okra, 33.6% grew 1,161.83kg of tomatoes, 31.4% grew 810.34kg of pepper, 21.7% grew 2,060.92kg of cocoyam, 18.1% grew 14,510.4% of rice, while a few (14.8%) grew 2,043.78kg of potato.

4.3.5. Consumption and balance of selected food crops grown by MicroVeg project beneficiaries

Table 4.17 further reveals that respondentsconsumed 8.6% (200.4kg) of their average maize produce (2,332.0kg) in the last growing season leaving a balance of 2,131.6kg put for sale. Of the 12,443.5kg of cassava produced, 18.2% (2,340.8kg) was consumed, while a balance of 10102.7kg was sold. About 21.2% (800.38kg) of the average yam produced (3,772.88kg) was consumed, 5.8% (62.11kg) of the average okra produced (1,073.5kg) was consumed, 7.7% (89.7kg) of the 1161.83kg of tomatoes grown was consumed, 9.1% (73.4kg) of pepper produced (810.3kg) was consumed, 19.0% (391.4kg) of the cocoyam grown (2,060.9kg) was consumed, 6.3% (911.0%) of rice produced (14,510.4%) was consumed, while 6.8% (139.2kg) of potato grown (2,043.8kg) was consumed by respondents. The quantities of food crops gifted to family, friends and neighbours were embedded in the consumption figures while the balances were sold to generate additional farm income. Noteworthy here, is the fact that bulk of the food crops cultivated are sold to generate additional farm income, while the crops having highest proportions of their harvests consumed included yam (21.2%), cocoyam (19.0%) and cassava (18.2%).

Table 4.21: Distribution of MicroVeg project beneficiaries based on selected food crops production, consumption and balance

Crops	Proportion of growers		Mean outputs (kg)	Percentage
	Freq.	**Percent**		
Maize	211	76.2		
Production			2332.0	100.0
Consumption			200.4	**8.6**
Balance			2131.6	91.4
Rice	50	18.1		
Production			14510.4	100.0
Consumption			911.0	**6.3**
Balance			13599.4	93.7
Cassava	150	54.2		
Production			12443.5	100.0
Consumption			2340.8	**18.2**
Balance			10102.7	81.8
Yam	106	38.3		
Production			3772.9	100.0
Consumption			800.4	**21.2**
Balance			2972.5	78.8
Cocoyam	60	21.7		
Production			2060.9	100.0
Consumption			391.4	**19.0**
Balance			1669.5	81.0
Potato	41	14.8		
Production			2043.8	100.0
Consumption			139.2	**6.8**
Balance			1904.6	93.2
Tomatoes	93	33.6		
Production			1161.8	100.0
Consumption			89.70	**7.7**
Balance			1072.1	92.3
Pepper	87	31.4		
Production			810.3	100.0
Consumption			73.4	**9.1**
Balance			737.0	91.0
Okra	96	34.7		
Production			1073.5	100.0
Consumption			62.11	**5.8**
Balance			1011.4	94.2

Source: Field Survey, 2017. ***MRT**

4.4. Food consumption pattern of MicroVeg project beneficiaries

4.4.1. Roots, tubers and by-products

Table 4.18 reveals that almost all (95.3%) of MicroVeg project beneficiaries' households consumed 18.3Kg of yam per week on the average, 76.9% consumed 4.9Kg of yam flour, while 63.2% of the sampled households consumed an average of 5.5Kg of cassava flour (Lafun) on weekly basis.

4.4.2. Cereals and confectionaries (Kg)

Asshown in Table 4.18 also, most (88.5%) of respondents consumed an average of 6.0Kg of maize per week, 94.2% consumed 6.0Kg of rice, while 83.0% of the respondents consumed an average of 2.7Kg of bread in their households, on weekly basis

4.4.3. Legumes (Kg)

Table 4.18 further reveals that 57.8% of the respondents consumed an average of 4.6Kg of cowpea, while 63.2% consumed 1.6Kg of groundnut on weekly basis.

4.4.4. Fish, meat & tissue and eggs (Kg)

Table 4.18 also shows that almost all (91.3%) of the respondents consumed 1.9Kg of fish weekly on the average, 80.9% consumed 1.4Kg of beef, while most (80.1%) of the respondents consumed an average of 1.2Kg of eggs per week.

4.4.5. Fruits and vegetables (Kg)

As indicated in Table 4.19, most (82.3%) of the sampled MicroVeg project beneficiaries consumed an average of 7.6Kg of pawpaw (Carica papaya), 93.5% consumed 2.9Kg of orange (Citrus X sinensis), all (100.0%) the sampled respondents consumed 2.8Kg of tomatoes (*Solanum lycopersicum*), 99.6% consumed 1.6Kg of pepper (*Capsicum chinense & Cayenne pepper*), while 93.5% consumed an average of 5.8Kg of leafy vegetables weekly.

4.4.7. Flavour and condiments (g)

As indicated in Table 4.19 also, all (100.0%) of the respondents consumed an average of 256.7g of salt per week, 70.8% consumed 850.0g of locust bean while 89.5% consumed 53.1g of seasoning cubes (Maggi) on the average, weekly.

4.4.8. Cooking fats and oil (l)

Table 4.19 further indicates that all (100.0%) of the respondents consumed an average of 2.0litres of palm oil weekly, while 91.7% consumed 1.38litres of vegetable oil per week, on the average.

Table 4.22: Distribution of MicroVeg project beneficiaries based on household food consumption pattern: roots & tubers and by-products, cereals & confectionaries, legumes and fish, meat & tissue and eggs.

Food items	Proportion of households		Mean qtty. consumed/week
	Frequency	Percentage	
Roots & tubers and by-products (Kg)			
Yam	264	95.3	18.3
Cocoyam	152	54.9	11.6
Potato	127	45.9	12.8
Yam Flour	213	76.9	4.9
Cassava Flake/Gaari	252	91.0	5.9
Cassava Flour/Lafun	175	63.2	5.5
Cereals and confectionaries (Kg)			
Maize	245	88.5	6.1
Millet	33	11.9	4.6
Sorghum	37	13.4	4.2
Rice	261	94.2	6.0
Wheat	101	36.5	3.2
Bread	230	83.0	2.7
Legumes (Kg)			
Cowpea	160	57.8	4.6
Melon	211	76.2	1.2
Soybeans	53	19.1	1.6
Groundnut	175	63.2	1.6
Fish, meat & tissue and eggs (Kg)			
Fish (Fresh & dried)	253	91.3	1.9
Beef	224	80.9	1.4
Chicken	127	45.8	1.5
Bush meat	106	38.3	1.1
Dried meat/Tinko/Kundi	83	30.0	0.2
Dried Cow Skin/ Ponmon	93	33.6	0.5
Wet Cow skin/Ponmon	173	62.5	1.1
Cow Cheese/Wara Maalu	90	32.5	0.2
Soybean cheese/Wara Soya	74	26.7	0.3
Eggs	222	80.1	1.2

Source: Field survey, 2017.

4.4.9. Non-alcoholic and alcoholic drinks (Cl.)

As indicated in Table 4.19 also, 65.3% of the sampled MicroVeg project beneficiaries consumed 181.0Cl of soft carbonated drinks on the average per week, while 16.6% consumed 372.4Cl of alcoholic drinks weekly, on the average. Generally speaking, the leading food items consumed were yam, maize and cowpea as inferred from Tables 4.17 and 4.18 above. Meludu and Ajibade (2009) found almost all the sampled rural households in Oyo , Nigeria consumed cereals mainly (maize and rice) as well as yam regularly in large quantities while they also consumed beef, dairy product, fish, poultry and poultry products regularly but in very minute quantities. The study also found significant relationships between income and animal protein consumption while education influenced carbohydrate and vitamin consumption. Surveys conducted by Nigerien Government revealed that 80.0% of daily caloric consumption of Nigeriens was supplied by cereals in 2005 and 70% was recorded in 2006 with an average daily meal of 2.6 times and average meat/fish intake of 2-3 days/week (Zakari *et al.,* 2014).

Table 4.23: Distribution of MicroVeg project beneficiaries based on food consumption pattern: fruits & vegetables, milk & beverages, flavour & condiments, cooking fat & oil and non-alcoholic & alcoholic drinks.

Food items	Proportion of households		Mean Quantity consumed/week
	Frequency	Percentage	
Fruits and vegetables (Kg)			
Pawpaw	228	82.3	7.6
Orange	259	93.5	2.9
Banana	239	86.3	3.8
Plantain	221	79.8	4.6
Onions	259	93.5	1.2
Okra	206	74.4	1.7
Tomato	277	100.0	2.8
Pepper-Atarodo&Sounbo	276	99.6	1.6
Pepper-Tatase/Bawa	275	99.3	1.2
Leafy vegetables	259	93.5	5.8
Milk and beverages (g)			
Evaporated & powdered milk	194	70.0	470.0
Milo/Bournvita	220	79.4	211.4
Lipton	89	32.1	10.8
Flavour and condiments (g)			
Salt	277	100.0	256.7
Locust bean	196	70.8	850.0
Maggi	248	89.5	53.1
Cooking fats and oil (L.)			
Palm Oil	277	100.0	2.0
Vegetable Oil	254	91.7	1.4
Non-alcoholic & alcoholic drinks	**(Cl.)**		
Soft carbonated drinks	181	65.3	181.0
Zobo/Kunnun/Soymilk	90	32.5	190.0
Alcoholic drinks	46	16.6	372.4

Source: Field survey, 2017.

4.5. Household food and non-food expenditure of MicroVeg Project Beneficiaries

Table 4.20 presents respondents' monthly expenditure on feeding and five other spending items of spending as well as savings.

Feeding

The table indicates that the respondents expended an average of ₦28,592.1±₦25,142.7 on feeding, representing 14.62% of their total monthly expenditure. This is somewhat low pointing to the fact that large chunks of farmers' expenditure goes to non-food items of spending. Conversely, Obayelu *et al.* (2010) found that rural households in north central, Nigeria spent as high as 66.04% of their expenditure on food. Singh M. (2018) found out that major share of expenditure (74.56%) was made on food while only 25.44% was spent on non-food items among sampled households in India. The study also found decreasing trend of expenditure on food items and increasing trend in non-food items with increase in size of farm holdings and ultimately positive contribution in the economy. Umeh and Asogwa (2012) found household income as a significant determinant of food and non-food expenditure among rural dwellers in Nigeria. The study also found that increase in income decreased food expenditure but increased non-food expenditure. Manza and Garba (2019) reported that their rural households spent ₦4778.60±₦3578.72 on food expenditure.

Vegetable farm maintenance

Table 4.20 also indicates that an average of ₦32,859.8±₦64,086.8 representing 16.8% of total monthly expenditure was spent on vegetable farms. This implies that farmers spend more to maintain their vegetable farms monthly, than what they spend on feeding. Rural households in Kaduna State, Nigeria spent an average of ₦1714.41±₦6202.37 to maintain their farms (Manza and Garba, 2019).

Other food crops farm maintenance

As for other crops farms, an average of ₦40,770.7±₦58,206.6 representing 20.8% of total monthly expenditure was expended monthly. Farmers spend more maintaining other crop farms than vegetable farms even though they generate more income from vegetables. This is probably because mechanical operations requiring huge amount of money are carried out on other crops farms and the maturity periods of such crops are longer than that of vegetables.

Children education

On children education, an average of ₦33,568.8±₦36,189.2 which represents 17.2% of their average monthly expenditure (Table 4.20) was expended. A reasonable proportion of farmers' income is expended on children education. This reflects respondents' level of education as most (88.4%) had varying degrees of formal education while years of formal education averaged 10 years (Table 4.1). Generally speaking, high value is placed on education in the study area. Therefore, they take their children education seriously and that's the more reason why children involvement in business activities and children suspending school to generate income for the family were the least engaged coping strategies at times of food shortages (Table 4.22). It was reported that rural households spent an average of ₦13,826.32±₦14,984.99 on education on monthly basis in North-western, Nigeria (Manza and Garba, 2019). This reflects the fact the Northerners place value on education than the Southerners.

Health care services

Table 4.20 also shows that an average of ₦7,285.56±₦10,750.0 representing just 3.72% of total monthly expenditure was spent on health care services. The amount is considerably low probably because farming households rely more on herbal concoctions whose ingredients are mainly sourced freely, for treating most of their ailments. Conversely, Manza and Garba (2019) reported that rural households expended just ₦340.99±₦1421.65 monthly, on health care services in Kaduna state. This suggests that northerners rely more on traditional medical services.

Social engagements

Table 4.20 further indicates that an average of ₦13,569.0±₦37,601.0 representing 6.94% of total monthly expenditure was expended on social engagements. Contrarily, rural households in Kaduna State spent a meagre ₦499.19±₦1661.79 on social involvements, on monthly basis (Manza and Garba, 2019). Farmers gain symbiotic social capital from their engagement in mutual social activities. This factor usually prompts their involvement and financial commitments towards such causes.

Savings

Lastly, respondents saved an average of ₦38959.03±₦73739.8 representing 19.92% of total monthly expenditure which is considerably high and attests to the fact that most (83.0%) of the sampled respondents sourced farm credit from personal savings (Table 4.5).

4.6. Household food security of MicroVeg Project Beneficiaries

As presented in Table 4.21, over half (51.3%) of the sampled indigenous vegetable farmers' households were food secure, while 48.7% were food insecure. This may be due to the farmers' access to production support packages via MicroVeg project, which empower them to produce indigenous vegetables throughout the year round. This avails respondents steady access to timely and regular income from indigenous vegetable production unlike other arable crop farmers whose production and subsequently income, is highly seasonal leaving them with lean seasons characterized by prolonged periods of food shortages. Famine Early Warning System Network (FEWSNET) (2007) affirmed that food security is constrained for many households in Nigeria while larger proportions of the food insecure Nigerians are found in the rural areas. Sanusi *et al*. (2006), Tefera and Tefera (2014) and Aidoo *et al.,* (2013) found much lower proportions of sampled rural households as being food secure in Ibadan and Lagos, Nigeria, Ethiopia and Ghana, respectively.

4.7. Coping strategies utilized to cope with household food shortage

Table 4.22 indicates that modified cooking method ranked 1st as the most important strategies utilized during occasional food shortages. This was closely followed by commonly purchased food items being substituted with cheaper ones and reduced number of meals ranking 2nd and 3rd respectively. The Table further reveals that respondents mortgaged or sold assets and had their children suspended school to generate income ranking 11th and 12th as the least important strategies in use to cope with food shortage. This implies that the most frequently engaged coping strategies to deal with food shortage included modified cooking method, substituting commonly purchased food items with cheaper ones and reduced number of meals. Tefera and

Tefera (2014) found the leading coping strategies engaged by sampled rural households in Southern Ethiopia as reduced size of meal, reduced number of meal and borrowing grains from relatives while most of the sampled farming households in Kaduna State, Nigeria bought food items from the market, eat less preferred food and borrowed money/food to cope with food shortages (Ojeleye, 2015).

Table 4.24: Distribution of MicroVeg project beneficiaries based on monthly expenditure pattern **(n=277)**

Items of Spending	Mean Monthly Expenditure(₦)	% of Total Mean
Feeding	₦28592.1±₦25142.7	14.6
Vegetable farm	₦32859.8±₦64086.8	16.8
Other crops farm	₦40770.7±₦58206.6	20.8
Education	₦33568.8±₦36189.2	17.2
Health care services	₦7285.6±₦10750.0	3.7
Social engagement	₦13569.0±₦37601.0	6.9
Savings	₦38959.0±₦73739.8	19.9
Total Mean	**₦195604.9±₦305716.0**	**100.0**

Source: Field survey, 2017.

Table 4.25: Distribution of MicroVeg project beneficiaries based on household food security

Household food security status	Frequency	Percentage
Food insecure	135	48.74
Food secure	142	51.26
Total	**277**	**100.0**

Source: Field survey, 2017.

Table 4.26: Distribution of MicroVeg project beneficiaries based oncoping strategies utilized at times of food shortage

Coping strategies	Never utilized (0)	Occasionally utilized (1)	Frequently utilized (2)	Weighted Score	Rank
Modified cooking method	95	156	26	208	1st
Substituted commonly bought food items with cheaper ones	101	145	31	207	2nd
Reduced number of meals	101	152	24	200	3rd
Borrowed money to buy food /got food on credit	112	140	25	190	4th
Mother ate less	112	154	11	176	5th
Father ate less	116	147	14	175	6th
Children ate less	158	116	03	122	7th
Borrowed food items from neighbours	196	76	05	86	8th
Went for work for food programmes	201	67	09	85	9th
Children involved in business activities	204	66	07	80	10th
Mortgaged/sold assets	217	51	09	69	11th
Children suspended school to generate income	248	27	02	31	12th

Source: Field survey, 2017. **(n=277)**

4.8. Test of Hypotheses

4.8.1. Correlation analysis between selected socio-economic and enterprise characteristics and household food security among MicroVeg project beneficiaries

Table 4.23 reveals significant positive relationship between dependency ratio ($r = 0.185$, $p = 0.041$) and household food security. This may be due to the presence of more independent than dependent members in the sampled households with a ratio of 1:0.78. This suggests that every working class among sampled respondents' household is expected to cater for less than one dependent. As such, respondents are more or less faced with the financial burden of catering for their personal needs. On the contrary, Sakyi (2012) found dependency ratio as a negative determinant of household food accessibility among sampled rural households in the Limpopo province of South Africa. Both farm ($r = 0.090$, $p = 0.035$) and non-farm ($r = 0.010$, $p = 0.048$) incomes were significantly related to household food security. This may be simply because the bulk of the respondents' food needs are met through purchases as they grow more of indigenous vegetables and less of food crops. Likewise, Beyene and Muche (2010), Aidoo *et al.* (2013) and Tefera and Tefera (2014) found non-farm income as positive predictor of food security among rural households in Central Ethiopia, Ghana and Southern Ethiopia respectively, while Zakari *et al.* (2014) found lack of money as negative determinant of food security in southern Niger.

4.8.2. Test of relationship between indigenous vegetables output and household food security among MicroVeg project beneficiaries.

Results of analysis in Table 4.24 reveals significant relationship between indigenous vegetables output and household food security ($r = 0.141$, $p \leq 0.050$) among MicroVeg project beneficiaries. This implies that people who cultivated more of indigenous vegetables have better access to food in their household. Hence, they tend to achieve household food security. This may be due to the regularity of income from vegetables owing to short production cycle thereby availing farmers undisrupted economic access to food. In the same vein, Sakyi (2012) found positive relationship between household cultivation of vegetables and access to food among rural households at the Limpopo province of South Africa.

Table 4.27: Test of relationship between selected socio-economic and enterprise characteristics and household food security among MicroVeg project beneficiaries

Variables	r-value	t-value	Probability
Age	0.015	8.940	0.053
Educational level	0.004	0.840	0.750
Household size	-0.031	0.940	0.712
Dependency ratio	0.065	6.740	0.041**
Farming experience	0.012	1.38	0.714
Vegetable growing experience	0.005	1.450	0.647
Years of co-operative membership	0.054	0.840	0.718
Farm credit	0.011	0.811	0.934
Farm size	0.053	7.940	0.054
Vegetable farm size	0.135	6.99	0.052
Farm income	0.090	7.410	0.035**
Non-farm income	0.010	7.150	0.048**

Source: Computed from field survey data, 2017. ** mean significant at 5% level

Table 4.28: Test of relationship between indigenous vegetables output and household food security

Variable	r - value	Probability
Total indigenous vegetable output (kg) * household food security	-0.141	0.049**

Source: Computed from field survey data, 2017.

4.8.3. Test of difference in indigenous vegetables production during rainy and dry seasons

Table 4.25 reveals the average outputs of indigenous vegetables as 15645.0±11548.7kg/Ha and 7,222.6±3,840.9kg/Ha for rainy and dry seasons, respectively. Hence, significant difference exists between the level of vegetable production and outputs during rainy and dry seasons among the sampled Micro-Veg project beneficiaries as determined by t-test of difference in means at ($r = 0.147$; $p = 0.005$). Thus, the null hypothesis of no significant difference in the level of vegetables production and output among sampled Micro-Veg project beneficiaries was rejected. This result implies that respondents' vegetable outputs vary across the two planting seasons as the mean vegetable output of rainy season doubles that of dry season. This suggests that respondents rely more on rainfed farming even though they were assisted with irrigation facilities and are able to grow vegetables fairly, during the dry season. However, the irrigation facilities seemed inadequate to support massive production of vegetables during the dry season. This is in spite the fact that vegetables command better market worth during dry season than rainy season. Most crop production systems are rainfed in the African framework hence rainfall has remained a crucial determinant of agricultural production (Ogundari, 2008).

4.8.4. Test of difference in household food security among MicroVeg project beneficiaries across the sampled states

Analysis of variance result presented in Table 4.26 reveals no significant difference ($F=2.26$; $p=0.080$) in household food security across the four selected project states. This implies that project beneficiaries across the four sampled states had similar level of household food security. This is simply because despite the fact that indigenous vegetables command different prices across the four sampled states, the effect is negated by varying costs of living.

Table 4.29: Test of significant difference (t-test) in the level of indigenous vegetables production and outputs during rainy and dry seasons among MicroVeg project beneficiaries

Season	Mean output (Kg)	r value	P value
Rainy	15645.1±11548.7	0.147	0.005
Dry	7222.6±3840.9		

Source: Computed from field survey data, 2017.

Table 4.30: Test of difference (Analysis of Variance) in household food security of MicroVeg project beneficiaries across the selected states

Source of variation	Sum of squares	Degree of freedom	Mean sum of squares	F-value	P-value
Between groups	375.530	3	125.177	2.26	0.082
Within groups	15112.217	273	55.356		
Total	15487.747	276	56.115		

Source: Computed from field survey data, 2017.

4.9. Determinants of household food security of MicroVeg project beneficiaries

The result in Table 4.28 indicates that age (β= 0.162, p=0.036), dependency ratio (β= 0.350 p=0.007), total farm size (β= 0.073, p=0.000), vegetable farm size (β= 3.384, p=0.000) and total vegetable income (β= 6.100, p=0.047) significantly determined household food security among MicroVeg project beneficiaries. Age significantly determined respondents' household food security probably because older farmers have higher number of their household members in the working age group who generate additional income to support food expenditure. Also, aged household heads have access to remittances and pension as evident in this study. Also, aged farmers with sizeable household members are able to secure appreciable farm labour from family sources thereby generating additional income for the family during both the production season and off-seasons Similarly, Beyene and Muche (2010) and Tefera and Tefera (2014) found age as a positive determinant of food security among farming households in Central and Southern Ethiopia, respectively, while Sakyi (2012) equally found age as positive determinant of food accessibility among rural households in South Africa. Dependency ratio positively determined household food security probably because there were more independent members than dependents in the sampled households. On the contrary, Sakyi (2012) found dependency ratio as a negative determinant of household food access in the Limpopo province of South Africa. Also, total farm size predicted household food security simply because an appreciable number of the sampled respondents grow other food crops apart from vegetables part of which they consume and the excesses are put for sale to generate additional farm income. Vegetable farm size equally predicted household food security probably because vegetables constitute the major crop grown from which bulk (63.89%) of their farm income is generated. Similarly, Aidoo *et al.* (2013) and Tefera T. and Tefera F. (2014) found farm size as a positive predictor of food security among farming households in Ghana and Ethiopia respectively while Sikwela (2008) established negative relationship between farm size and food security in Zimbabwe. Total vegetable income predicted respondents' household food security because 46.0% of their total annual income is accounted for by the proceeds from vegetable sales. Contrarily, Aidoo *et al.* (2013) and Tefera and Tefera (2014) found non-farm income as positive predictor of

food security among rural households in Ghana and Southern Ethiopia, respectively. However, Muhammad and Sidique (2019) found the main factors affecting household food security among households in Nigeria as the number of years of education of the household head, the amount of food and non-food expenditures, land size and location.

Table 4.31: Result of Regression Analysis for determinants (predictors) of household food security

Variables	Beta	t-value	P-value
Constant	7.121	0.584	0.599
Age	0.162	8.100	0.036**
Gender	-11.946	0.949	0.360
Years of formal education	0.217	0.111	0.922
Household size	0.058	0.100	0.910
Dependency ratio	0.350	8.974	0.007**
Farming experience	0.776	1.17	0.264
Vegetable growing experience	0.969	1.429	0.177
Total farm credit	8.780	0.764	0.461
Total farm size	0.073	18.250	0.000*
Vegetable farm size	3.384	11.510	0.000*
Total vegetable output	0.018	0.462	0.643
Total vegetable income	6.100	3.696	0.047**
Total farm income	2.260	0.441	0.667
Total non-farm income	3.730	1.174	0.106

R^2 = 0.568, Adjusted R^2 = 0.475, F value = 1.642** **Source:** Computed from field survey data, 2017.

4.10. Test for multicollinearity among variables included in multiple regression analysis

The VIF (variance inflation factor) used by many researchers to check on the degree of collinearity was engaged to check for multicollinearity among the variables included in the regression model. As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation. In the case of this study, the mean VIF of all the variables considered was found as 1.51 which is far less than 10. Hence, multicollinearity was not found. This result is presented in Table 4.32.

4.11. Correlation matrix for the variables included in multiple regression analysis

A correlation matrix was conducted among the variables included in the multiple regression model used to isolate the determinants of household food security among MicroVeg project beneficiaries in the study area. The correlation between two variables in the same model should ordinarily not exceed 0.5. Meanwhile, a slightly higher correlation was expectedly, found between vegetable growing experience and farm experience with a value of 0.587. However, this is negligible since the variable inflation factor (VIF) values of the two variables spans between 1 and 2 with an overall mean of VIF of 1.51 for all the variables considered. Same explanation goes for the correlation value of 0.638 found between total farm size and total vegetable income whose VIF spans between 1 and 1.4 in this case. All the other variables' correlation values fall within the acceptable limit. Hence, the variables included in the model can be said to be appropriate to a reasonable extent. This result is presented in Table 4.33.

Table 4.32: Test for multicollinearity among variables included in multiple regression analysis to test for determinants (predictors) of household food security

Variables	VIF	1/VIF	Mean of VIF
Dependency ratio	2.17	0.46	
Farming experience	2.09	0.48	
Total vegetable output	1.78	0.56	
Years of formal education	1.68	0.59	
Vegetable growing experience	1.65	0.61	
Household size	1.51	0.66	
Age	1.49	0.67	**1.51**
Total vegetable income	1.37	0.73	
Total farm income	1.33	0.75	
Vegetable farm size	1.30	0.77	
Total farm credit	1.21	0.83	
Total non-farm income	1.20	0.84	
Total farm size	1.16	0.86	
Gender	1.15	0.87	

Source: Computed from field survey data, 2017.

Table 4.33: Result of correlation matrix among variables included in Multiple Regression Analysis to test for determinants (predictors) of household food security

Variables	Age	Gender	YOFE	HHS	DR	FE	VGE	TFC	TFS	TVFS	TVO	TVI	TFI	TNFI
Age	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-
Gender	0.084	1.000	-	-	-	-	-	-	-	-	-	-	-	-
YOFE	-0.211	-0.188	1.000	-	-	-	-	-	-	-	-	-	-	-
HHS	0.227	-0.012	-0.080	1.000	-	-	-	-	-	-	-	-	-	-
DR	-0.320	-0.152	0.559	-0.495	1.000	-	-	-	-	-	-	-	-	-
FE	0.487	-0.142	-0.189	0.233	-0.251	1.000	-	-	-	-	-	-	-	-
VGE	0.211	-0.093	-0.042	0.220	-0.157	0.587	1.000	-	-	-	-	-	-	-
TFC	-0.033	0.012	0.084	0.074	-0.026	-0.032	0.069	1.000	-	-	-	-	-	-
TFS	-0.061	-0.132	0.171	0.101	0.030	0.087	0.113	0.129	1.000	-	-	-	-	-
TVFS	0.071	-0.116	0.058	0.030	-0.037	0.031	0.067	0.001	0.094	1.000	-	-	-	-
TVO	0.060	0.005	0.053	0.017	-0.022	0.092	0.213	0.306	0.088	0.339	1.000	-	-	-
TVI	-0.161	-0.097	0.038	0.023	0.024	-0.049	0.106	0.302	0.125	0.117	0.318	1.000	-	-
TFI	-0.156	-0.133	0.062	0.106	-0.016	-0.033	0.089	0.207	0.266	0.091	0.208	0.638	1.000	-
TNFI	-0.016	-0.088	0.037	0.046	-0.042	-0.038	-0.010	0.228	0.067	0.003	0.005	0.152	0.340	1.000

KEYS

Source: Computed from field survey data, 2017.

YOFE: Years of formal education **HHS:** Household size **DR:** Dependency ratio
FE: Farming experience **VGE:** Vegetable growing experience **TFC:** Total Farm Credit
TFS: Total farm size **TVFS:** Total vegetable farm size **TVO:** Total Vegetable Output
TVI: Total Vegetable Income **TFI:** Total farm income **TNFI:** Total non-farm income

4.12. WRAP-UP OF THE STUDY

Majority of the indigenous vegetable farmers who were beneficiaries of the IDRC-GAC sponsored MicroVeg project 107983 in the study area were male (73.0%) with mean age of 46.2 years, married (88.1%) having an average household size of 7 persons. Respondents' years of formal education, farming experience and vegetable growing experience averaged 10.0, 20.4 and 14.5 years, respectively. Despite the fact that 74.0% of the respondents were primarily engaged in farming, almost half (46.9%) were marginal farmers having less than one hectare of farmland, while mean of farmland was 2.1Ha. Most (83.0%) of the project beneficiaries sourced an average annual farm credit of ₦139,391.50 from personal savings. Majority of the indigenous vegetable farmers sourced different items of technical information mainly, from MicroVeg project, extension workers and radio, 47.3% sold their vegetable outputs to wholesalers at the farm gate with average annual income from indigenous vegetables being ₦551,786.60.

Farmers were motivated to grow indigenous vegetables for personal and socioeconomic influence factor ($\lambda = 0.88$), profitability and cash-flow influence factor ($\lambda = 0.51$) and family background and incentive influence factor ($\lambda = 0.91$), while the mean of total farmland under vegetable production was 1.03 Ha and the mean outputs of the three vegetables covered by the project, in the last raining and dry seasons were 14662.80kg and 6259.75kg (Telfeira) 4199.38kg and 3062.62kg (Solanum) and 5698.33kg and 4101.45kg (Amaranthus). The most widely cultivated other food crops were maize, cassava and yam. Monthly expenditure on feeding, vegetable farm maintenance, other crops farm maintenance, education, health care services, social engagement and savings averaged ₦28592.06, ₦32859.78, ₦40770.66, ₦7285.56, ₦13569.00 and ₦38959.03, respectively. The study found 51.3% of the sampled households as being food secure. Modified cooking method topped the list of coping strategies engaged at times of food shortages. Vegetable production differs significantly during rainy and dry seasons (t calculated (3.26) t tabulated (2.58), $p = 0.05$) but no significant difference existed in respondents' household food security across the four selected project states. Dependency ratio ($r=0.065$, $p\leq0.041$), indigenous vegetables output ($r=0.141$, $p\leq0.049$), farm income ($r=0.090$, $p\leq0.035$) as

well as non-farm income (r=0.010, p≤0.048) were significantly related to household food security. Significant predictors of household food security among MicroVeg project beneficiaries in southwestern Nigeria were found as age (β=0.162, p≤0.036), dependency ratio (β=0.350, p=0.007), total farm size (β= 0.073, p=0.000), vegetable farm size (β=3.384, p=0.000) and indigenous vegetables income (β=6.100, p=0.000).

CHAPTER FIVE

5.0. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Major Findings

Food insecurity remains one of the top developmental challenges in Sub-Saharan Africa including Nigeria. This is in spite of the interventions of the concluded Millennium Development Goals and current Sustainable Development Goals both of the United Nations and targeting the eradication of extreme poverty and hunger as foremost. Nigeria, one of the countries with the highest population in sub-Saharan Africa occupies a strategic position for interventions aimed at addressing chronic food insecurity. One of such numerous development projects of intervention is the IDRC-GAC sponsored MicroVeg project 107983 whose cardinal objectives are to achieve economic and food security of rural farming households in West Africa via synergizing fertilizer micro-dosing with indigenous vegetables production innovations.

This study identified the determinants of household food security among MicroVeg project beneficiaries who are largely indigenous vegetables farmers, in southwestern Nigeria. Four-stagesampling procedure was used. Four states (Ekiti, Kwara, Lagos and Osun) were randomly selected based on contiguity. Thereafter, five, seven, ten and twelve project sites constituting 40% were randomly selected proportionate to size, from Lagos, Kwara, Osun and Ekiti states, respectively after which 40% of farm groups were selected from which 40% of project beneficiaries were randomly sampled giving a total of 28 farm groups and 277 project beneficiaries in all. Interview schedule was used to elicit information on respondents' socioeconomic and enterprise characteristics, motivating factors for growing vegetables, indigenous vegetables productivity, food consumption pattern, monthly household food and non-food expenditure, coping strategies and household food security.

Data were subjected to descriptive and inferential statistical analysis. MicroVeg project beneficiaries were categorised on the basis of their household food security status and the variables that determined household food security were isolated. Major findings of the study are highlighted below:

The study found that majority of the indigenous vegetable farmers in the study area were male (73.0%) and 88.1% were married with average household size of 7 persons. Mean age was 46.2 years, while the average years of formal education was 10 years. Majority (74.0%) were primarily engaged in farming with means of farming and vegetable growing experiences of 20.4 and 14.5 years, respectively. Almost half (46.9%) of the project beneficiaries were marginal farmers having less than one hectare of farmland, while mean of farmland was 2.1Ha. Most (83.0%) of the project beneficiaries sourced an average annual farm credit of ₦139,391.50 from personal savings. Majority of the indigenous vegetable farmers sourced different items of technical information mainly, from MicroVeg project, extension workers and radio. About two-thirds and almost half (47.3%) of the project beneficiaries sold their vegetable outputs to wholesalers at the farm gate. Annual income from indigenous vegetables, annual farm income, annual off-farm income and total annual income of project beneficiaries averaged ₦551,786.60, ₦864,844.90, ₦334,548.60 and ₦1,199,393.48 (USD 3,331.65) respectively. The study also established that farmers' proclivity to grow indigenous vegetables was mainly borne out of personal and socioeconomic influence factor ($\lambda = 0.88$), profitability and cash-flow influence factor ($\lambda = 0.51$) and family background and incentive influence factor ($\lambda = 0.91$). Mean of total farmland under vegetable production was 1.03 Ha. The mean outputs of the three vegetables in the last raining and dry seasons were 14,662.80kg and 6,259.75kg (Telfeira) 4,199.38kg and 3,062.62kg (Solanum) and 5,698.33kg and 4,101.45kg (Amaranthus). The most widely cultivated other food crops were maize, cassava and yam of which limited proportions of outputs were retained for domestic consumption while the balances were put for sale to generate additional farm income. Respondents' monthly expenditure on feeding, vegetable farm maintenance, other crops farm maintenance, education, health care services, social engagement and savings averaged ₦28,592.06, ₦32,859.78, ₦40,770.66, ₦7,285.56, ₦13,569.00 and ₦38,959.03,

respectively. The study found 51.3% of the sampled households as food secure Modified cooking method, substituting commonly bought food items with cheaper ones and reduced numbers of meals ranked 1st, 2nd and 3rd as the leading strategies engaged at times of food shortages.

The study established significant relationships between household food security and dependency ratio (r=0.065, p≤0.041), indigenous vegetables output (r=0.141, p≤0.049), farm income (r=0.090, p≤0.035) as well as non-farm income (r=0.010, p≤0.048). Vegetable production differs significantly during rainy and dry seasons (t calculated (3.26) t tabulated (2.58), p = 0.005) while no significant difference existed in respondents' household food security across the four selected project states. Significant predictors (determinants) of household food security among MicroVeg project beneficiaries in southwestern Nigeria were found as age (β=0.162, p≤0.036), dependency ratio (β=0.350, p=0.007), total farm size (β= 0.073, p=0.000), vegetable farm size (β=3.384, p=0.000) and indigenous vegetables income (β=6.100, p=0.000).

5.2. Conclusion

The following conclusions were drawn based on the major findings of the study:

i. Bearing in mind that younger farmers usually have high aspirations, strength and vigour to supply productive farm labour and ability to innovate, the age profile of respondents holds high hopes for continuous production of indigenous vegetables in the country. Readily accessible and properly monitored farm credit at little or no interest rates would enable farmers to increase their level of vegetable production. Farmers currently source farm credit mainly from personal savings and are as such, incapacitated to expand their scale of production. MicroVeg project beneficiaries shall be better off if they are adequately linked with high value markets and are also encouraged to explore the advantages of value-addition. Currently, they depend largely on middlemen as off-takers of their vegetable produce. Hence, they are faced with the menace of farm gate pricing considering the high perishability of vegetables.

ii. More than half (51.26%) of the sampled respondents' households were food secure. Further efforts need be made via self-help and/or other intervention

projects to enable more farmers cross the food security line on a sustainable basis.

iii. Relationships were found between household food security and each of dependency ratio, indigenous vegetables output, farm income, as well as non-farm income.

iv. Vegetable production differs significantly during rainy and dry seasons while there was no significant difference in respondents' household food security across the four sampled project states. Despite documented evidences that vegetables command better market value during the dry season, the level of vegetable production still differs significantly, during rainy and dry seasons. This reflects continued reliance of project beneficiaries on rain-fed farming, despite being provided with irrigation facilities.

v. Lastly, the significant predictors (determinants) of household food security among MicroVeg project beneficiariesin southwestern Nigeriawere found as age, dependency ratio, total farm size, vegetable farm size and indigenous vegetables income.

5.3. Recommendations

i. Value addition and export attraction options should be explored with continued intervention from future development projects, to enhance continued large-scale production of indigenous vegetables given that MicroVeg project beneficiaries in Nigeria are still very active going by their mean age of 46.2 years.

ii. Given the reality that MicroVeg project is already faced-off, concerted efforts should be made by the project donor, indigenous vegetable growers associations, Non-governmental organizations and other concerned authorities to continue to work with the project beneficiaries particularly in securing well-monitored low interest farm credit, in a bid to sustain the benefits and legacies of the project.

iii. Farmers should also be continuously exposed to high value market options the likes of Shoprite and Farmers' Shop to guarantee them good

worth for their vegetable produce and improve their farm income on a sustainable basis.

iv. The project beneficiaries should be encouraged and supported to form formidable groups to pull resources together to secure adequate irrigation facilities required to take full advantages of dry season vegetable farming. It is well researched and documented in literature that vegetables command higher market value during dry season

v. Lastly, there is need for training and retraining of project beneficiaries and farm families at large, on the significance of food and nutrition security such that many more households could strive to reach and exceed the food security line.

5.4 Contributions to knowledge

i. The study established that more than half (51.26%) of the sampled MicroVeg beneficiaries' households were food secured. This proportion is significantly higher than what is commonly obtainable in literature among farm families across Sub-Saharan, Africa.

ii. The study established the fact that enhanced farmers' income does not automatically improve household food security as project beneficiaries channelled larger chunks of their income into non-food expenditure more importantly children's education and savings at the expense of household food security.

iii. The finding above negates the socioeconomic status theory which believes that higher income often translates to improved household food security status. Farmers do not channel additional income to consumption of good quality diet in right combination and quantity at all times.

iv. No significant difference existed in household food security of MicroVeg Project Beneficiaries across the four selected States. The study established that though indigenous vegetables commanded different premiums across the four states, the effect was negated by varied cost of living.

v. The study found out that the least utilized coping strategy to deal with food shortage was found as children suspending school to generate income owing to the strong value placed on education in Southwestern, Nigeria. This is a deviation from the common narrative in extant literature that farmers often resort to child labour to meet their financial needs.

vi. The determinants of household food security among MicroVeg Project Beneficiaries in southwestern Nigeria were found as age, dependency ratio, total farm size, indigenous vegetables farm size and income from indigenous vegetables.

5.5 Suggestions for further studies: Further researches on farming households should undertake comparative analysis of the determinants of household food security between beneficiaries and non-beneficiaries of development projects of intervention that bothers on food and nutrition security.

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APPENDIX I

Department of Agricultural Extension and Rural Development

Faculty of Agriculture and Forestry

University of Ibadan

Dear respondent,

This interview schedule is meant to elicit relevant information needed to conduct a PhD research on the topic: ***Determinants of Household Food Security among MicroVeg Project Beneficiaries in Nigeria.*** All information provided shall be used for research purpose ***only*** and same shall be treated with utmost confidentiality.

Thank you.

State……LGA……

Community……..Project site……

Farm Group…….Respondents' number.……...

Section A.

Socioeconomic and enterprise characteristics of respondents

1.Gender: Male ( ) Female ( ).

2. Age: actual age in years……..

3. Marital Status: Single ( ) Married ( ) Separated ( ) Divorced ( ) Widowed ( ).

4. Religion: Islam ( ) Christianity ( ) Traditional religion ( ).

5. Ethnicity: Yoruba ( ) Igbo ( ) Hausa ( )

6. Years of Formal Education ……

7. Educational Qualification: No formal education ( ) Primary education ( ) Secondary education () OND/NCE ( ) HND/B.Sc ( ) Postgraduate ( ) Others; specify……

8. Household type: Male headed household ( ) Female headed household ( )

9. Household size: Male……Female…….. Total…….

10. Household composition: Members below 16years Male …….Female ……

Household members between 16 and 59 years Male……..Female……

Household members above 59 years Male……..Female…….

11. What is yourprimaryoccupation?.....

12. What is yoursecondaryoccupation?.....

13. How long have you been farming?.....

14. How long have you been growing vegetables?.....

15. Do you belong to any cooperative society? Yes ( ) No ( )

16. If yes, how long have you been a member? ……

17. How did you acquire your current farmland? a. Inheritance ( ) b. Gift ( ) c. Lease ( ) d. Purchase ( ) Sharecropper ( ) others; specify ……..

18. Which of these types of farmland do you own/have access to and what are their various sizes?

Types of Land	**SIZE**
Homestead Land (Feet by Feet)	
Wetland (Feet by Feet)	
Main Upland (Acres)/ (Feet by Feet)…… Please, indicate	

19. What is your main source of cash/farm credit? Personal savings ( ) Family/Friends ( ) Microfinance Bank ( ) Commercial bank ( ) Local group/cooperative ( ) Religious Bodies ( ) NGOs ( ) MicroVeg project ( ) Government programme ( ) Others; specify ------ Differentiate states

20. Kindly state the amount of cash (in Naira) received from the following source(s) during the last growing season.

Sources	**Amount Received in Naira (₦)**	
	Raining season	**Dry season**
MicroVeg Project		
Personal Savings		
Local Group/Cooperative		
Family and Friends		
Microfinance Bank		
Commercial Bank		
NGOs		
Government Program		
Others; specify……		

21. What is/are your main source of vegetable seeds?

Sources	**Ugu/Agbaroko**	**Efo-Igbagba**	**Efo-Tete**
Free from MicroVeg project			
Saved from last season's harvest			
Free seed from a neighbor			
Free seed from government programme			
Purchased from another farmer			
Purchased from market			
Purchased from Agro dealer			
Purchased from Min. of Agric.			
Others; specify ……			

22. What is/are your main source of these other inputs? (fertilizers, herbicides & insecticides)?

Sources	**Fertilizers**	**Herbicides**	**Insecticides**
Free from MicroVeg Project			
Free from a Neighbour			
Free from Government Program			
Purchased from Ministry of Agric.			
Purchased from another farmer			
Purchased from Open market			
Purchased from Agro dealer			
Others; specify……..			

23. Kindly indicate the source(s) of extension services available to you on the following.

Info. about:	**MicroVeg Project**	**Extension Staff**	**Extension Bulletin**	**Other Print Media**	**Radio**	**T.V**	**NGO**	**Others**
Credit Sources								
Available Veg. seeds								
Fertilizer, herbicides & insecticides								
Land Preparation								
Methods of Cultivation								
Weather Forecast								
Vegetable Marketing								
Post-harvest technologies								

24. What is/are the main source(s) of farm labour used on your vegetable farm?

Operations	**Self**	**Family**	**Hired**	**Sharecropper**	**Others, specify.**
Land Preparation					
Planting					
Weeding					
Fertilizer Application					
Insecticide Application					
Wetting					
Thinning					
Harvesting					
Washing					

25. How do you market your vegetable produce? a. To wholesalers at farm gate ( ) b. To retailers at farm gate ( ) c. To wholesalers at the market ( ) d. To retailers at the market ( )

e.Others; specify( )

……

Kindly state your actual income (in Naira) in the last growing season, frequency and sources.

Income Sources	**Daily**	**Weekly**	**Monthly**	**Yearly**
Vegetable farm				
Other crops farm				
Civil service				
Artisanal Engagements				
Pension				
Trading				
Remittance(s) received				
Others; specify				

27. How sufficient do you perceive the income mentioned above for you?

a. You needed to borrow to meet your expenses ( ) b. You used previous savings to meet expenses ( )

c. Your income simply responds to your expenses ( ) d. Your income saves a little ( )

e. Your income allowed you to build your savings ( )

f. Others, specify ……

SECTION B

Factors motivating beneficiaries to grow vegetables

Which of the following factors motivate you to grow indigenous vegetables?

Factors	**Doesn't motivate (0)**	**Motivate (1)**	**Highly motivate (2)**
Personal interest			
Family inheritance			
Short production cycle			
Community value attached to vegetables			
Previous supports received by vegetable farmers			
Recognition derived from vegetable production			
High rate of investment turn-over			
Adequacy of income from vegetable production			
Regularity of income from vegetable production			
Little initial capital investment required			
Government support policies on vegetables			
Others, specify…….			

SECTION C

Level of Indigenous Vegetables and Other Food Crops Production

29. Kindly state the quantity planted; frequency of production and quantity harvested of the following vegetables during the last **raining** season.

Variables	**Telfeira/Ugu**	**Efo-Igbagba**	**Efo-Tete**
Quantity of seed planted (**grams**)			
Land area planted (**man feet**)			
Month of the year cultivation commenced			
Freq. of planting (**No of Times**)			
Number of harvest times per planting			
Quantity of output per harvest (Number of loaded bunches)			
Number of market sized bunches in the loaded bunches mentioned above			

30. Kindly state the quantity planted; frequency of production and quantity harvested for the following vegetables during the last **dry** season.

Variables	**Telfeira/Ugu**	**Efo-Igbagba**	**Efo-Tete**
Quantity of seed planted (**grams**)			
Land area planted (**man feet**)			
Month of the year cultivation commenced			
Freq. of planting (**No of Times**)			
Number of harvest times per planting			
Quantity of output per harvest (Number of loaded bunches)			
Number of market sized bunches in the loaded bunches mentioned above			

31. Kindly indicate the other food crops grown by you as well as the quantity harvested and consumed during the last growing season from the table below:

Food Crops Grown	**Quantity Harvested (Kg)**	**Estimated Quantity Consumed (Kg)**
Maize		
Millet		
Sorghum		
Rice		
Wheat		
Cassava		
Yam		
Cocoyam		
Potatoes		
Cowpea		
Soybean		
Tomatoes		
Pepper		
Okra		
Others, specify……		

SECTION D

Food Consumption Pattern of MicroVeg project beneficiaries

32. Kindly state the quantity of the following food items you consume per week.

FOOD ITEMS	**Quantity consumed per week**
a. **Roots and Tubers** Yam (Tubers)	
Cocoyam **(**Tubers)	
Potato (Tuber)	
Yam Flour (Congo)	
Cassava Flour/Gaari (Congo)	
Cassava Flour/Lafun (Congo)	
Others; Specify……	
b. **Cereals** Maize (Congo)	
Millet (Congo)	
Sorghum (Congo)	
Rice (Congo)	
Wheat (Congo)	
Bread (Loaves)	
Others; specify	
d. **Legumes**	
Cowpea (Congo)	
Melon (Congo)	
Soybeans (Congo)	
Groundnut (Congo)	
Others; specify……	

e. **Fruits and Vegetables**	**Quantity consumed per week**
Pawpaw (number)	
Orange (number)	
Banana (number)	
Plantain (number)	
Onions (number)	
Okra (Portion)	
Tomato (Portion)	
Pepper-Atarodo (Portion)	
Pepper-Tatase/Bawa (Portion)	
Leafy vegetables (Market sized bunches)	
Others; specify.	
f. **Meat and Animal Products**	
Beef (Kg)/₦	
Chicken (Kg)/₦	
Fish (Kg)/₦	
Pork (Kg)/₦	
Bush meat (Kg)/₦	
Dried meat/Tinko/Kunndi(Kg)/₦	
Dried Cow Skin(Kg)/₦	
Wet Cow skin (Ponmon)	
Fresh milk (tin)	
Eggs (number)	
Cow Cheese (Wara Maalu) (Kg)/₦	
Soybean Cheese (Wara Soya) (Kg)/₦	
Others; specify	

g. **Cooking Oil**	**Quantity consumed per week**
Palm Oil (Litre)	
Vegetable Oil (Litre)	
Others; Specify	
Beverages	
Tea: Milo/Bournvita (Cups)	
Coffee (Cups)	
Lipton (Cups)	
Non-alcoholic/Soft drinks (Bottles)	
Zobo/Kunnun/Soymilk (Bottles)	
Alcoholics (Bottles)	
Others; Specify…….	
Condiments	
Maggi (Pieces)	
Salt (Pieces)	
Locust bean (Wrap)	
Others; Specify	

SECTION E

Food and Non-food Expenditure of MicroVeg Project Beneficiaries

Kindly state your estimated monthly expenditure on the following items of spending.

Items	Monthly Expenditure (₦)
a. Feeding	
b. Farming enterprise (Vegetables)	
c. Farming enterprise (Other Crops)	
d. Children education	
e. Health care services	
f. Social involvement	
g. Savings	
Others; specify……..	

SECTION F: Food Security Status Assessment (FANTA Scale)

Kindly provide answers to the following questions

	Recall Period : 30 Days/ 4 Weeks	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
		No Occurrence	1-3 Days	4-6 Days	7 Days & Above
1.	Were there times you worry that food would run out before the household gets money to buy more				
2.	Food bought didn't last and there was no money to get more				
3.	You couldn't afford to eat balanced meals				
4.	Adult(s) cut size of meals or skipped meals				
5.	You ate less than what you felt you should eat				
6.	You were hungry but didn't eat				
7.	You lost weight				
8.	Adult(s) did not eat for a whole day				
9.	Relied on few kinds of low-cost food to feed child(ren)				
10.	Couldn't feed child(ren) balanced meals				
11.	Cut size of child(ren) meals				
12.	Child(ren) were hungry				
13.	Child(ren) skipped meals				
14.	Child(ren) did not eat for a whole day				

Max Obtainable Marks= 42; Min = 0

SECTION G

Coping Strategies in Use among MicroVeg Beneficiaries

Are there times you have critical shortage of available food in your household? Yes/No?

If you faced food shortage in the past 12 months, what coping strategies did you engage and in what frequencies?

Coping Strategies in Use	***Never Utilized (0)***	***Occasionally Utilized (1)***	***Frequently Utilized (2)***
Borrowed money to buy food/got food on credit			
Reduced the number of meals			
Mother ate less			
Father ate less			
Children ate less			
Modified cooking method			
Substituted commonly bought food items with cheaper ones			
Mortgaged/sold assets			
Borrowed food items from neighbours			
Went for work for food programmes			
Children involved in business activities			
Children suspended school to generate income			

APPENDIX II

S/N	FANTA (Food Insecurity) Score	Reversed FANTA (Food Security) Score
1.	32	10
2.	31	11
3.	30	12
4.	26	16
5.	17	25
6.	40	02
7.	41	01
8.	28	14
9.	28	14
10.	27	15
11.	33	09
12.	17	25
13.	42	00
14.	32	10
15.	31	11
16.	32	10
17.	42	00
18.	35	07
19.	42	00
20.	42	00
21.	42	00
22.	26	16
23.	26	16
24.	28	14
25.	40	02
26.	34	08
27.	37	05
28.	27	15
29.	31	11
30.	23	19
31.	30	12
32.	33	09
33.	32	10
34.	36	06
35.	35	07
36.	14	28
37.	14	28
38.	25	17

39.	24	18
40.	29	13
41.	29	13
42.	28	14
43.	37	05
44.	33	09
45.	42	00
46.	28	14
47.	40	02
48.	31	11
49.	34	08
50.	42	00
51.	42	00
52.	38	04
53.	42	00
54.	38	04
55.	40	02
56.	40	02
57.	40	02
58.	40	02
59.	39	03
60.	28	14
61.	33	09
62.	39	03
63.	33	09
64.	31	11
65.	36	06
66.	36	06
67.	30	12
68.	30	12
69.	42	00
70.	40	02
71.	42	00
72.	41	01
73.	28	14
74.	31	11
75.	38	04
76.	38	04
77.	37	05
78.	16	26
79.	42	00

80.	26	16
81.	42	00
82.	39	03
83.	36	06
84.	22	20
85.	36	06
86.	34	08
87.	36	06
88.	38	04
89.	25	17
90.	32	10
91.	39	03
92.	42	00
93.	28	14
94.	28	14
95.	34	08
96.	37	05
97.	22	20
98.	22	20
99.	20	22
100.	42	00
101.	30	12
102.	42	00
103.	18	24
104.	37	05
105.	39	03
106.	27	15
107.	40	02
108.	13	29
109.	24	18
110.	42	00
111.	42	00
112.	40	02
113.	38	04
114.	39	03
115.	23	19
116.	21	21
117.	37	05
118.	33	09
119.	42	00
120.	40	02

121.	20	22
122.	32	10
123.	19	23
124.	36	06
125.	27	15
126.	23	19
127.	35	07
128.	37	05
129.	30	12
130.	29	13
131.	29	13
132.	20	22
133.	32	10
134.	42	00
135.	31	11
136.	30	12
137.	24	18
138.	24	18
139.	30	12
140.	42	00
141.	40	02
142.	33	09
143.	42	00
144.	38	04
145.	21	21
146.	38	04
147.	25	17
148.	31	11
149.	32	10
150.	34	08
151.	35	07
152.	40	02
153.	9	33
154.	31	11
155.	28	14
156.	36	06
157.	40	02
158.	42	00
159.	34	08
160.	30	12
161.	36	06

162.	40	02
163.	42	00
164.	31	11
165.	24	18
166.	35	07
167.	42	00
168.	37	05
169.	31	11
170.	27	15
171.	22	20
172.	42	00
173.	35	07
174.	12	30
175.	34	08
176.	29	13
177.	30	12
178.	29	13
179.	30	12
180.	32	10
181.	31	11
182.	30	12
183.	31	11
184.	30	12
185.	30	12
186.	33	09
187.	29	13
188.	28	14
189.	30	12
190.	30	12
191.	29	13
192.	42	00
193.	30	12
194.	30	12
195.	30	12
196.	14	28
197.	30	12
198.	31	11
199.	32	10
200.	27	15
201.	22	20
202.	42	00

203.	42	00
204.	22	20
205.	30	12
206.	35	07
207.	31	11
208.	36	06
209.	19	23
210.	42	00
211.	38	04
212.	38	04
213.	42	00
214.	38	04
215.	34	08
216.	14	28
217.	38	04
218.	31	11
219.	39	03
220.	42	00
221.	24	18
222.	34	08
223.	30	12
224.	21	21
225.	36	06
226.	36	06
227.	20	22
228.	28	14
229.	35	07
230.	24	18
231.	21	21
232.	22	20
233.	29	13
234.	20	22
235.	30	12
236.	39	03
237.	34	08
238.	36	06
239.	36	06
240.	32	10
241.	33	09
242.	27	15
243.	22	20

244.	38	04
245.	41	01
246.	42	00
247.	23	19
248.	42	00
249.	16	26
250.	30	12
251.	27	15
252.	36	06
253.	28	14
254.	24	18
255.	27	15
256.	33	09
257.	35	07
258.	28	14
259.	12	30
260.	32	10
261.	38	04
262.	12	30
263.	26	16
264.	25	17
265.	24	18
266.	29	13
267.	33	09
268.	28	14
269.	20	22
270.	29	13
271.	28	14
272.	30	12
273.	27	15
274.	39	03
275.	32	10
276.	42	00
277.	16	26

Plate 1:*Telfeira occidentalis* (Fluted Pumpkin)

Source: https://sabiagrik.com/fluted-pumpkin-ugu-farming-guide-making-six-figures/

Plate 2:*Solanum macrocarpon*
Source: Marco Schmidt https://commons.wikimedia.org/w/index.php?curid=11197051

Plate 3:*Amaranthus viridis*

Source: Forest and Kim Star Environmental Bugwood.org