IMPACT OF POLICIES, STRATEGIES AND AGRICULTURAL INSTITUTIONS ON FOOD SECURITY AND POVERTY STATUS OF VEGETABLE FARMERS ALONG THE BLUE NILE BANKS, GEZIRA STATE, SUDAN (2017)

Mohamed O. A. Bushara
University of Gezira, Sudan
E-mail: mbushara56@gmail.com

ABSTRACT

Having clear picture on food security status and its major determinants helps policy makers and planners to introduce new policies that enhance food security. The study was aimed to evaluate the impact of policies, strategies and institution on food security and poverty status of the vegetables farmers in Gezira State with reference to the Blue Nile farmers. To achieve these objectives stratified random sampling technique was used to select the respondents from five localities lays along Blue Nile, so 150 farming households were interviewed. Food security Policy and strategy were collected by the mean of questionnaire targeting key line institutions. Poverty indices were calculated using expenditure as welfare indicator,Gini coefficient was applied. The results showed that the majority 75% of the respondents were above expenditure poverty line (7196)SDG. Moreover, the results showed that the poverty gap index was equal to five percent. Kamlin, Medani, East Gezira reported the higher expenditure distance from the poverty line (6 percent). The severity of poverty in the state is estimated to be two percent, likewise the severity of poverty in East Gezira was found to have a higher percentage (three percent). According to Gini coefficient the income distribution estimated at 0.46 while that for expenditure distribution is estimated at 0.31, these results showed a higher degree of inequality. The results showed that the poorest 20% of the population earned 0.06% of the total income while the richest 20% earned 45% of the total income. About 50.7% from the respondents use borrowing from others as one of their coping strategies. About 78%of policy makers said that there was organized team from all institutions dealing with food security and nutrition issue, all policy makers in the state said there was strategy concerning the food security and nutrition issues.

2217

The study recommended that the cash transfer needed to lift the poor out of poverty that each poor person needs five percent of the value of the poverty line.

Keywords: Impact of policy; food security; vegetavle farmers

1. INTRODUCTION

1.1. Back Ground

Sudan sits at the crossroads of Sub-Saharan Africa and the Middle East, Egypt and Libya, bordering it to the north, Central African republic , Chad to the west, Eritrea and Ethiopia to the east and South Sudan to the south, Its capital, Khartoum lies at the confluence of the White and Blue Niles, and its main port on the Red Sea. Although mostly desert, it has fertile land, mountains, and livestock.

The country has been beset by conflict for most of its independent history. Under the terms of a peace agreement in 2005, its southern states seceded, forming the Republic of South Sudan in 2011.The secession of South Sudan induced multiple economic shocks. The most important and immediate was the loss of the oil revenue that accounted for more than half of Sudan's Government revenue and 95% of its exports. This has reduced economic growth and resulted in double-digit consumer price inflation, which, together with increased fuel prices, triggered violent protests in September 2013.

Away from oil, agriculture and livestock are essential to Sudan's economic diversification and could contribute to medium-term macroeconomic stability. These sectors presently contribute approximately 35%–40% of Gross Domestic Product (GDP) but could contribute significantly more with greater investment and better governance. Sudan now recognizes the need for greater attention to agriculture and livestock, as reflected in its Interim Poverty Reduction Strategy Paper (I-PRSP) and the Five-year Program for Economic Reforms approved by its parliament in December 2014.

Sudan remains a highly-indebted country that has accumulated sizeable external arrears and has been in non-accrual status with the World Bank Group (WBG) since 1994. At the end of 2015, its external debt amounted to $50 billion (61% of GDP) in nominal terms, about 84% of which was in arrears (WorldBank, 2018).

1.2. The Structure of the Sudanese Agriculture:

Agriculture plays an important role in Sudan economy. It supplies food for the people, employment opportunities and provides the industrial sector with raw materials. Sudan is

2218

considered as one of the three countries in the world that could contribute in the international food security. Pre-secession, Sudan has cultivable arable land estimated at 86 million hectares. Post-secession that has been diminished by no less than 35% of the total. However less than 20% of the total are utilized under three major farming sub-sectors: the irrigated, the semi-mechanized rainfed and the agro-pastoral traditional rain- fed .The agricultural sector has an important role to play in achieving food Security by increasing food production and providing employment opportunities in the rural area (Mohamed, 2011).

1.2.1. The Irrigated Sub-Sector:

The area in this sector was estimated at a million hectare .It is major Schemes are Gezira,Rahad, New-Helfa and Suki. The sub-sector contributes an average of 21% of the total value of agricultural production, 100% of wheat and 25% of sorghum produced in the country. Although its contribution to sorghum production is low relative to the rain- fed sub-sector, it is more stable. In years of drought, it plays an important role in meeting the consumption requirements (Mohamed, 2011).

1.2.2. The Mechanized Rain-fed Sub-Sector:

This system is concentrated in Gadaref, Blue Nile, Upper Nile, White Nile, Sinnar, and Southern Kordofan states. Annual area covered is on average about 14 million feddans, with average holdings size of 1000 feddans. The main crops grown in this sector are sorghum and sesame. Mechanized farming accounts for about 65% of the sorghum, 53% of the sesame, 5% of the millet, and almost 100% of sunflower produced in Sudan. Historically, this sub- sector has been a source of sorghum exports as well as meeting internal needs particularly in urban areas (ElSiddig, 2003).

1.2.3. The Traditional Rain-fed Sub-Sector:

This system includes nomadic, transhumance (moving with livestock and growing short-maturity subsistence crops), and sedentary agriculture which also includes a significant number of livestock. Although there is some rain-fed traditional farming in every state, the system is most prevalent in the States of Kordofan, Darfur, Sinner, and the Blue and White Niles. The total cropped area in this system varies from 12 to 21 million feddan which varies annually with variation in rainfall. Crops grown are sorghum, sesame and cotton in clay soils, millets and groundnuts in sandy soils; the sector is also a major producer of gum Arabic and livestock (Abdalla & Abdel Nour, 2001).

2219

1.3.   Vegetables production in Sudan:

Sudan has a great potential to produce good quality fruits and vegetables. This is because of its large areas of fertile soil, abundant amount of water from rivers, rains and underground water, suitable wide range of climate which allow variability of crops.The Sudanese horticultural sub sector comprises two branches, namely, the vegetable and fruit sub systems. Most of the production units within the horticultural sub sector, especially those for fruit production, lie along the banks of the river Nile and its tributaries.

However, the irrigated schemes occupy increasing areas for vegetable production. The majority of the crops within these sub systems are produced under irrigation by private producers, in addition to some horticulture output produced under rain fed conditions in south Kordufan, Darfur and Blue Nile states. The size of the holdings within the horticultural sub sector that lie along the banks of the Nile system ranges between 1-50 feddans, while the size of the horticultural holdings within the irrigated schemes ranges between 5-20 feddans.

Moreover, few large-scale vegetables production units of over 2000 feddans were established by the national and multinational companies, such as the Arab authority for agricultural development and investment (Mohamed, 2016).The importance of the horticultural sub-sector rests on a number of elements including the volume and value of the cultivated products, in addition to their economic impact on the economy and the welfare of the producers' and the labours and other stakeholders involved in the sub-sectors activities, as well as, their nutritional effects on the population.

The cultivated crops within the horticultural subsector include a wide range of vegetables and fruits. These crops are cultivated in different climatic zones with varying soil characteristics and varying levels of water availability. Similarly, the employed cultivation practices and production technologies are varying from climatic one zone to the other, while the intensity of cultivation of the various crops in each zone is dependent on the comparative advantage available for each crop (Mohamed, 2016).

1.3.1. *The major cultivated horticultural crops*

As it is already known the horticultural crops are divided into the vegetables and fruits crops, in addition to other groups of crops including the floricultural crops, the medicinal crops and the spices crops.

The major vegetable crops, which are cultivated in many places in Sudan, include tomato, sweet melon, green beans and okra, in addition to eggplant, onion and potato, as well

as cucumber. These vegetables are cultivated almost everywhere in Sudan presented in Table (1.1), However, the most important regions for vegetable production in Sudan are Khart oum State, Gezira State, Northern and River Nile states, in addition to Kassala, Blue Nile and White Nile states. Nevertheless, there are other regions where vegetable cultivation is also practiced to a lesser extent than the aforementioned states like the states of Kordofan region and the states of Darfur region (Mohamed, 2016).

Table 1: The major cultivated vegetable crops and their production centers, 2015, Sudan

Crop	Production regions (states)
Tomato	Khartoum, Northern, River Nile White Nile, Blue Nile,
Sweet melon	Khartoum, Northern, River Nile, White Nile.
Green beans	Khartoum, Northern, River Nile
Sweet pepper	Khartoum, Northern, River Nile
Eggplant	Khartoum, Northern, River Nile, Gezira
Okra	Khartoum, Northern, River Nile, White Nile, Sennar

Source: Mohamed (2016).

1.3.2. *The development of areas, outputs and yields of the vegetables crops*

Figure 1 presents the development of the areas of the main vegetables crops during the period (2005-2009) – (2014-2017). As it can be seen, it appears that the area of onion has increased markedly from about 110 thousand feddans in 2005 to reach about 208 thousand feddans in 2017 and the production increased from 688 thousand tons in 2005 to reach about 1538 thousand tons in 2017, the area of other crops and production also increased .
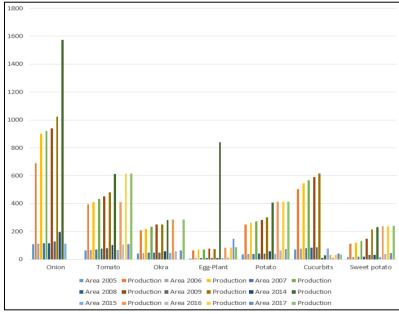

Figure 1: The area (000feddan) and production (000 tons) of common cultivated vegetables crops in Sudan from 2005 –2009,2014-2017.
Source" Ministry of Agriculture and Forest,2017

1.3.3. The consumption of horticultural crops in Sudan

Unfortunately, there is no reliable and published data about the consumption of horticultural crops in Sudan. However, the aforementioned expansion in the cultivated areas, out puts, and yields of the different horticultural products, coupled with the improvement in increasing awareness about the importance of fruits and vegetables in human nutrition, signifies that the per capita consumption of horticultural crops has increased. Nevertheless, it is expected that the increase in consumption of horticultural crops is more pronounced in the urban centers in comparison to the rural areas (Mohamed, 2016).

Some household-level studies have looked at the relationship between changes in household incomes and calorie and micronutrient deficiency (Abdulai & Aubert, 2004; Skoufias et al., 2009). Other studies e.g. (Haddad et al., 2003) have analyzed the effects of changes in incomes on child nutrition. Results of these studies show a positive relationship between growing incomes and nutrition outcomes. Fewer studies exist on the relationship between (agriculture) economic growth and nutrition improvement. However,a study by (Ecker et al., 2011) indicate that economic growth can contribute to a reduction of undernourishment.

They also indicate that agricultural growth reduces undernourishment, but at different growth rates. Unfortunate this study did not differentiate between different agricultural sub sector like fruit and vegetables. (Achterbosch et al., 2014; Shutes et al., 2014) has developed a comprehensive monitoring system for household food and nutrition security based on a range of different indicators related to the four different Food Security and Nutrition (FNS) pillars:

a) Food availability: The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid). This also includes reductions in postharvest losses.

b) Food access: Access by individuals to adequate resources for acquiring appropriate foods for a nutritious diet.

c) Utilization: Use of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security.

d) Stability: To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal

food insecurity). The concept of stability can, therefore, refer to both the availability and access dimensions of food security.

The fruit and vegetable sector and as such may be used also by development practitioners and policy makers with a direct interest and involvement in the fruits and vegetables sector and Food Security and Nutrition (FNS).

The development of the fruit and vegetable sector in developing countries has a positive impact on the FNS situation of the people in the sector and consumers in more than one way. The scale of fruit and vegetable production has increased over the past 10-15 years also in food insecure countries such as Ethiopia, Rwanda, Ghana, Uganda, Kenya, Indonesia and Viet Nam. The overall fruit and vegetable availability has improved in these countries, Access to food has improved simultaneously.

Fruits and vegetables producers become more food secure as a result of increased levels of income. This particularly applies to emerging commercial growers and male and female workers in the commercial fruits and vegetables sector. The production of fruits and vegetables by smallholder growers for the low-value domestic markets appears to be less attractive for increasing farm income levels (Joosten et al., 2015).

1.4.   Statement of the problem

Africa faces a number of critical challenges. According to (UNDP, 2002), the environment continues to deteriorate; social and economic inequality is increasing; and globalization is sweeping across the world, largely leaving Africa behind. Rapid changes in the global economy, in consumption patterns and in population and demographics are having a negative impact on the environment. In spite of the introduction of economic reforms in many Sub-Saharan African (SSA) countries, economic growth continues to be sluggish or negative, impacting heavily on the welfare of the people, especially the rural population.

In addition, major environmental disasters in the continent such as recurrent drought and floods have serious devastating socio-economic and ecological impacts. Poor land policies and management practices, which lead to land degradation and deforestation, contribute to increased flood disasters in some risk areas. A clear outcome of these processes is a significant decline in agricultural production, poverty and food insecurity (Hopwood et al., 2005).

Sudan is one of the Sub-Saharan African (SSA) countries suffering from severe problems of food insecurity among its population during the last decades. Oil production and exports have a positive impact on the economic growth and development. However, 50% to

60% of the population is suffering from poverty and food insecurity with a high variation among the regions. This condition is attributed to two specific reasons.

The first reason is the drastically declining in the role of agricultural sector, which supports the livelihood of 80% of the population. The second reason is that the increase in the economic growth and benefits from oil exports do not trickle down to the poor. In fact, Sudan has lost its self-sufficiency from cereal food grains due to the serious drought, desertification, civil war crises and inappropriate government policies.

The farm households in the dry land agricultural sector of Sudan experienced from severe food grain deficits and higher poverty rate. This could be one of the reasons that forced the farm households to adopt various coping strategies in order to secure their food. This situation has resulted in different coping mechanisms that were used to fulfill the food demand needs. Given, the large share spends on food items, the poor rural households' depended greatly on non-agricultural products and/or they adjusted their food consumption pattern.

Currently, this situation is aggravated by policy transformation and structure changes adopted by the government. These policies was encouraged the transformation of the crop production system from subsistence to commercial cropping patterns. Thus the majority of farmers have changed their production from food crops to cash crops. As a consequence, the farm household is distressed by higher food deficiency due to the low quantities of food produced.

Moreover, the low diversification in crop cultivation has affected the quality and quantity of food and cash crops produced.Accordingly, all these troubles have caused a greater reduction in the amount of crop production and income as well. Nowadays, the per capita income from crop production has fallen below the poverty line (Faki et al., 2009). The studies about vegetables farmers situation is scarcely so farmers of vegetables need assessment of their problem of food security in the state beside clear policies and strategies to solve it.

1.5. Research Questions

The general research questions of the study was stated as what is the status of household food security in the study area and what is the main coping strategy held by household?

- How are the incidence, depth and severity of food insecurity in the zones of the study area?

- Are there any FSN policies and strateges designed and assigned for Gezira state?

1.6. Research Objectives

The overall objective of this study is to evaluate the Food Security and poverty status of the vegetable's farmers in Gezira State with reference to the blue nile river farmers.This objective will be achieved by focusing on some specific and organizational objectives which are:

- To identify the incidence and extent of food insecurity and poverty situation at household level of vegetable farmers, in the study areas.

- To do an in-depth analysis of the major factors influencing food insecurity at household level of vegetable farmers in the study areas.

- To evaluate the food security situation in the state , using a module concerning the demand side (U.S. House Food Security Survey Module: Six – Item Short Form).

1.7. Hypothesis of the Study:

- H0: the vegetables farmers in Gezira State are food secured.

- H1: the vegetables   farmers in Gezira State are not Food Secured.

- H0 : there is FSN policy

- H1 : there is no FSN policy

1.8. Significance of the Study

This study tried to identify the degree of food insecurity of vegetable farmers, at household level and understand the factors that cause or influence the problem in the study area. The result of the study provides policy related information that helps to prioritize among the many possibilities depending on the relative extent of influences of its determinants. More specifically, it helps concerned bodies in their effort to formulate policies and develop intervention mechanisms that are tailored to the specific need of the study area. Furthermore, this study attempts to make further contribution to the previous studies and can be used as a source material for further studies because there is information gap about food security in the irrigated sectors.

2. LITERATURE REVIEW

The chapter on literature review is centered on eight sections related to food insecurity analysis with household as the central unit for measurement. The eight sections are presented

as follows; background, concept of food security, dimension of food security, determinants of food security, measurement of food insecurity Coping strategies as a food security indicator, State of Food Security and poverty in Sudan.

2.1.   Background

Food security is a situation in which both food supply and effective demand are sufficient to cover nutritional requirements (Mittal, 2006). In Sudan, as in most SSA countries, the share of agricultural production is not sufficient to provide for the needs of a family and it is contribution to family food security has clearly become insufficient to cover the basic needs.

People in many rural areas of the Sudan apply multiple livelihood strategies to secure food for their households and undertake other activities to generate income in order to be able to feed their family. Empirical evidence from a variety of different locations suggests that rural households do indeed engage in multiple activities and rely on diversified income portfolios; for instance, in SSA, a range of 30–50 percent reliance on non-farm income sources is common (Abdalla et al., 2013).

2.2.   Concepts of Food Security

Food security is an essential, universal measurement of household and personal welfare. Its absence demonstrated by food insecurity and hunger is detrimental to the wellbeing and also is potential antidotes to nutritional, health, and developmental problems. Food Security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 1996) .

The concept of food security is complex and requires to elaborate measures to accomplish. At first, the definition focuses on the daily consumption of food where distribution systems ensure a continuous availability of food. Secondly, the concept of access to sufficient and safe food includes the continuous physical availability of food, and thirdly, it implies the sustained economic ability to acquire food through the supply system.

This system includes food produced for own-consumption; food commercialization schemes; public distribution systems with subsidized prices; or institutionalized food aid. Social access refers to acceptable food products supplied for consumption by population groups based on their cultural preferences. Correspondingly, food insecurity refers to limited or uncertain availability and /or uncertain ability to acquire acceptable foods in socially acceptable ways (Bickel et al., 2000) Manifested through breakdown or inefficiency of food supply

2226

systems leading to food poverty and marked by the inability of the households to access their food requirements.

Hunger is a persistent predicament especially in developing countries, worsening people's wellbeing, productivity and often their continued existence (Smith et al., 2006). For instance, the 2007/2008 food price crisis and subsequent global economic recession, hav e pushed the number of hungry people to historical levels; exceeding one billion people worldwide (FAO, 2009).

However, world poverty and income inequality have unambiguously fallen over the last three decades (Sala-i-Martin, 2006), and thereby posing serious challenges in addressing food insecurity. In view of the above concepts, there is need to employ indicators that are suitable and reliable for identifying food insecure in the population. Accurate information on the extent of food insecurity is essential to anchor sound policy and decision-making platforms for eradicating hunger and malnutrition. Decisive steps towards assessing relative trend`s in food insecurity are paramount in order to understand the magnitude of food deficiencies and to identify the sections of population who are food insecure and their locations to enhance interventions (Waithaka, 2015)

Paradoxically, accurate data and information on the magnitude of food insecurity is hard to achieve especially in developing countries where it is needed most. In Kenya for instance, food insecurity information is generated through estimates based on unstructured observations of extension workers rather than formal statistical process and survey techniques, Population Dynamics and Food Security in Kenya, However, these aggregate estimates do not shed light on access to food by households, and therefore presents a major drawback in formulating food security policies. This puts the country on precarious position as far as addressing food insecurity problem is concerned (Waithaka, 2015).

According to (Maxwell, 1996) on discussion paper about measuring food security Defining and interpreting food security, and measuring it in reliable, valid and cost-effective ways, have proven to be stubborn problems facing researchers and programs intended to monitor food security risks and that Food security historically referred to the overall regional, national, or even global food supply and shortfalls in supply compared to requirements, but, with increased observation of disparities in the sufficiency of food intake by certain groups, despite overall adequacy of supply, the term has been applied more recently mostly at a local, household, or individual level (Leathers & Foster, 2004) and has been broadened beyond

2227

notions of food supply to include elements of access (Sen, 1982) vulnerability (Watts & Bohle, 1993) and sustainability (Chambers, 1989).

Most definitions of food security vary around that proposed by the World Bank (Reutlinger, 1986), major components of the most common definitions are summed up by Maxwell and Frankenberg as "secure access at all times to sufficient food for a healthy life" . In their exhaustive review of the literature on household food security, however, they note several caveats.

First, the household is the logical social unit through which to view the question of access to food, in spite of intra household inequities in the distribution of food (Bentley & Pelto, 1991). This demands not only a knowledge of overall household needs and consumption but also an understanding of intra household dynamics affecting procurement and distribution of food .Second, household food security should be considered a necessary but not sufficient condition for adequate nutrition.

Stated differently, food security at the household or even individual level is an "input," not an "outcome"—hence the distinction between food security and nutrition security (Babu & Pinstrup-Andersen, 1994). Third, food security must be understood in terms of the rationality and logic of the persons or social units involved. Acquiring food and the provision of adequate nutrition are among the most basic of human pursuits. Human beings are not simply passive victims of either adequate or inadequate nutrition (De Garine, 1972).

Summarizing the conceptual literature on food security, Maxwell and Franken Berger conclude: First, "enough" food is mostly defined ... with emphasis on calories, and on requirements ... for an active, healthy life rather than simple survival—although this assessment may, in the end, be subjective. Second, access to food is determined by food entitlements (Sen, 1982). Which are derived from human and physical capital, assets and stores, access to common property resources and a variety of social contracts at household, community and state levels, Third, the risk of entitlement failure determines the level of vulnerability and hence the level of food insecurity, with risk being greater, the higher the share of resources ... devoted to food acquisition. And finally, food insecurity can exist on a permanent basis (chronic) or on a temporary basis (transitory) or in cycles (Maxwell, 1996).

2.3.   Dimension of Food Security or (Pillars of sustainable Food Security)

Sustainable food security is a broad phenomenon that requires a wide range of factors which must be well considered in designing a strategy to that end. The major pillars of food

security that practitioners believed are critical to achieving its sustainability include food Availability, Access, Utilization and Stability (Aborisade & Bach, 2014).

2.3.1.   Availability of Food

Food availability is achieved when sufficient quantities of food are available to all individuals. It also refers to sufficient quantities of food available on a consistent basis. Food may be physically present in a country, region or local area because it has been grown, manufactured, imported and /or transported there as food aid. This addresses the "supply side" of food security and is determined by the level of food production, stock levels and net trade ,food availability may be constrained by inappropriate agricultural knowledge, technology, policies, inadequate agricultural inputs such as cultivable land, fertilizer, improved seeds, and family size, diseases, etc. (Hoddinott, 1999).

Availability of food is an essential factor to be considered in ensuring a sustainable food security system , According to (Barrett, 2001) even though aggregate food availability is insufficient to ensure either access to proper utilization of nutrients to achieve food security, aggregate availability is however, a necessary condition for food security. Food insecurity is inevitable within an economy lacking enough food to satisfy all of its population's nutritional need. (Lutz et al., 2002) pin pointed increase in population, poverty, education and gender inequalities as critical factors that reduce food production thereby leading to a decline in food availability and invariably resulting in food insecurity.

An earlier study by (Pingali et al., 2008) emphasized the effect of biofuel production on food availability and other pillars of food security. According to the study, Biofuels affect the availability of food by competing directly for commodities and with productive resources, the diversion of food crops for biofuel production lead to a consequent rise in food prices thereby creating growing concerns about food security since access to food is determined primarily by incomes and food price levels assessed the effect of changes in agro-ecological conditions such as changes in temperature and precipitation associated with continued emissions of greenhouse gases and the increase in atmospheric carbon dioxide (CO_2) concentrations on alteration in land suitability, potential yields, and food production.

2.3.2. Access to Food:

This is ensured when a household and all members of the household have enough resources to acquire food meeting the nutritional requirements and dietary needs of the household. An adequate supply of food at the national or international level does not itself

2229

guarantee household level of food security. Concerns about insufficient food access have resulted in a greater policy focus on incomes, expenditure, markets and prices in achieving food security objectives.

Pinstrup-Andersen (2009) Argued that food availability alone is not enough to determine food security; rather the individual access to available food should also be taken into consideration. According to the author, availability does not assure access, and enough calories do not assure a healthy and nutritional diet.If food security is to be a measure of household or individual welfare, it has to address access. The author believes that the same sentiment is shared by FAO in defining food security as situation when all people, at all times, have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life (Pinstrup-Andersen, 2009) .

Godfray et al. (2010) examined the role of price in determining access to food. According to these authors, patterns in global food prices are indicators of trends in the availability of food. Poor transport and market infrastructure raise the prices of inputs, such as fertilizers and water, and increase the costs of moving the food produced into national or world markets.

An earlier study by Kennedy and Peters (1992) pinpoint household income as a major factor in determining access to food (Kennedy and Peters, 1992).

Tusiime et al. (2013) established that armed political conflict has a detrimental effect on food security and household welfare: conflict induces food insecurity by reducing own food production and access to. Del Ninno et al. (2007) elucidated the significance of food aid, both for short-term emergency relief and as program food aid that helps address medium-term food "deficits", is often a major component of food security strategies in developing countries.

The study also reveals that numerous concerns have been raised, however, about the efficiency of food aid – supported programs in meeting their objectives. Problems identified include minimal impact on development, high cost of procurement of tied aid, and poor targeting. Moreover, along with food-assisted programs in general, food aid resourced programs often involve high administrative costs within-country (due in part to leakages) lack of timeliness (late arrival or even cancellation) and the high cost of delivery to the recipient country were also identified as part of criticisms of food aids.

These limitations notwithstanding, emergency food aid according to the study has often been effective in addressing short term relief needs. As against household food security,

2230

individual food security depends on various visible and invisible intra household factors such as gender and age. According to (Choudhary & Parthasarathy, 2007) overall household food security may not be a guarantee for individual food security .Often , food available to a household is not equally accessible to the men , women and children of the household .

2.3.3. Food Utilization

Barrett (2001) explained the importance of the dietary quality of available food. According to the author "utilization reflects concerns about whether individuals and households make good use of the food to which they have access". The author believes that the nutritional value of food in term of essential micronutrient and vitamins and the ability of the body to metabolize and absorb these nutrients is an essential factor of food security.

Townsend et al. (2001) believe that there is a correlation between food security and obesity. According to them, in a logistic regression analysis, mildly insecure women were 30% more likely to be overweight than those who were food secure. Thus, food insecurity had an unexpected and paradoxical association with overweight status .

According to Ivers et al. (2009) human immunodeficiency virus (HIV) infection reduces the efficiency of nutrient absorption and utilization due to compromised immunity. Malabsorption of fats and carbohydrates is common, which invariably affect the absorption and utilization of fat-soluble vitamins. They conclude that infections can lead to metabolic changes, including changes in insulin and glucagon levels, result from both reduced food intake and the immune response to infection.

An additional, key issue according to Hall et al. (2008) is that an effective supply of micronutrients is dependent on their bioavailability, Metabolites present in food may inhibit or enhance absorption, especially of minerals. Metabolomics could provide a tool with which to study aspects related to potential remedies based on, e.g. food processing techniques and bio fortification. Dietary diversity can play a role in identifying the food-insecure.

According to Hoddinott and Yohannes (2002) households with low levels of dietary diversity are likely to have low levels of consumption per person and low caloric availability.

2.3.4. Food Stability

Kannan et al. (2000) consider food security as a situation that ensure the ability of all the people to access food at all times. Josling and Barichello (1984) identify world market stability as a factor to a sustainable food security. According to them, world market stability is

2231

largely dependent upon the actions of major grain trading countries, improvement in the sensitivity of domestic storage and consumption to world conditions could increase their contribution to world food security .Culture is connected to food security through the individual's access to formal education, cultural capital may amplify the benefits of formal education and other forms of human capital for food security (Molnar, 1999).

Food availability, access, utilization, and stability are integral parts of food security. Food security can, therefore, be imagined to a house having three pillars of availability, access and utilization but the ground on which these three pillars are standing for continuous support is the stability factor. We must address each of these factors in ensuring sustainable food security. Each of these factors is dependent on several other sub factors or component which must all be taking into consideration in formulating a framework for sustainable Food security globally (Aborisade & Bach, 2014).

2.4.   Determinants of Food Security

Food insecurity continues to be major challenge facing the world today. New determinants of food insecurity, such as capricious food price changes and climate change , are combining with previously identified namely, poverty, inequality and weak governance to expose ever-growing numbers of hungry people to an all-time high ,Several studies were carried out to identify the determinants of food security in many different contexts using different variables and analytical techniques.

Those studies have considered variables related with household characteristics such as family size, gender, educational attainment and age of household head; economic variables such as size of the land holding, nature of the ownership of the assets, off farm/ non-farm income sources, consumption pattern, food and input prices; and others related to markets and infrastructures such as access to markets, availability of marketing infrastructures and roads, extension services, etc (Joshi et al., 2012).

A study by Bashir et al. (2013) in Pakistan revealed that livestock assets, education, numbers of income earners in a household have a positive impact while family size and household heads' age had a negative impact on food security. Sultana and Kiani (2011), found that in Pakistan place of residence (Urban) and dependency ratio has a significant and negative effect while educational attainment level of household's head beyond intermediate level has significant and positive impact on food security status of household.

2232

Faridi and Wadood (2010) in Bangladesh showed that total land owned by the household, electricity connection, household size, household heads' occupation, and safety net programs had a strong impact on food security situation.

The studies carried out in Ethiopia revealed that the variables affecting household food insecurity were size of the cultivated land, livestock holding and improved seed, sex of household head, soil fertility status and non-farm income (Abdulla, 2015) .

The cultivated land holding size, total livestock holding, total annual income, and use of fertilizer were positive to food security while family size of the household was negative variable (Asmelash, 2014) .

Similarly, a study by Beyene and Muche (2010), showed that the variables such as experiences in farming activities, off-farm and non-farm incomes, land and livestock holdings, use of chemical fertilizer, and soil and water conservation practices significantly affected household food security.

Zakari et al. (2014) in Niger revealed that the gender of the head of household, diseases and pests, labor supply, flooding, poverty, access to market, the distance away from the main road and food aid were significant factors influencing the household having enough daily rations. Similarly, female headed households were more vulnerable to food insecurity compared to male headed households.

Joshi et al. (2012) in demonstrated Nepal that family size, operational landholding and livestock holding were important determinants of food insecurity, whereas, dependency ratio and occupation were important determinants of poverty. Education of household head and landholding were important determinants for both income and consumption poverty.

Concluded that the main factors contributing to food insecurity were limited access to resources, illiteracy, big family size, higher dependency ratio, and dependency on agriculture with small landholding, limited access to irrigation and fertilizer, and dependency on wage labor. With these characteristics, the highest proportion of occupational caste households and households in the mountain and hill were chronically food insecure.The review of past studies indicate that multiple and interrelated factors determine the household food security that might vary from one to other contexts (Joshi & Joshi, 2016).

2.5.   Measurement of food insecurity

2233

Collecting data for a complete analysis of food security can be a virtually impossible task in a situation where household composition is variable and the "household" itself is subject to varying interpretations; where there may be multiple income sources among adult members of a household who have strong incentives not to reveal to each other the full extent of their individual earning power or assets; where responsibility for the production and/or purchase of food may be shared among these adults; and where subsistence production is harvested piecemeal and is neither measured nor recorded.

Semi proletarian households in both urban and rural areas may fulfill each of these criteria for making collection of valid and reliable food security data a difficult undertaking. To get around this difficulty, most analyses rely on measuring food consumption Two major methods have been widely used, and both are subject to measurement problems (Bouis, 1993).

The first, notwithstanding the problems just discussed, is to estimate gross household production and purchases over a period of time, estimate the growth or depletion of food stocks held over that period of time, and presume that the food that has come into the household's possession and "disappeared" has been consumed.

The second method is to undertake 24-hour recalls of food consumption for individual members of a household, and analyze each type of food mentioned for caloric content (and sometimes a more complete nutrient analysis). While this method results in more reliable consumption data and captures intra household distributional differences that the first method overlooks completely, it is also subject to a number of drawbacks: memory lapses, observer bias, respondent fatigue, a short and possibly unrepresentative recall period, and such high data collection costs that resources often constrain analysis to relatively small samples.

The former method is most often utilized by economists; that latter, by nutritionists.Both of these methods result in consumption figures but neither provides a full assessment of food security because neither measures vulnerability or sustainability. "Disappearance" methods take no account of intra household distribution, but 24-hour recalls often are carried out only for certain individuals within a household, and therefore may not adequately reflect food access at the household level (Haddad et al., 1994)

2.5.1. *What are we assessing when we measure food security?*

Jones et al. (2013) prepared review of food security assessment tools in which there are review of measurement tools as food security metrics may focus on food availability, access, utilization, the stability of food security over time, or some combination of these domains.

These metrics may draw from data at national, regional, household, and/or individual levels. Such tools may vary from simple indicators for which data can be quickly collected and easily analyzed to comprehensive measures that required detailed time- and resource-intensive data collection and sophisticated analytic skills to yield results.

Food security measures may rely on data from hypothesized determinants of food security (e.g., the price of commodities) or on data from purported consequences of food security (e.g., child malnutrition) (Jones et al., 2013). In short, the diversity of food security measurement tools currently available provides a rather dizzying array of options, such that it may not always be clear how the measures differ in their conceptualizations of food security and for what purpose a given tool may best be used.

Indeed, the validity of a measurement tool is in separable from the purpose for which it is intended. Identifying the intended use of a tool and understanding the underlying constructs it measures are critically important for determining which metric one should use. The consequences of selecting an in appropriate metric could include: a) measuring an un intended domain or loci of food security; b) measuring multiple domains or loci without the ability to differentiate between them; c) collecting information that is not relevant to those for whom the data will be collected and used; d collecting data at an inappropriate scale; e) collecting data that cannot be measured multiple times at the needed time intervals; or f) selecting a tool that requires resources beyond those available for adequate data collection and analysis.

Food security measures developed for use at the country level often emphasize food availability. Tools for measuring food availability, such as food balance sheets, have traditionally drawn from nationally aggregated data on food supply (i.e., total amount of food produced and imported) and utilization [i.e., the quantity of food exported ,fed to livestock, used for seed, processed for food and non-food uses, and lost during storage and transportation. These data are used to create FAO's core food security measure, the prevalence of undernourishment.

Although food supply and utilization data are useful for estimating food shortages and surpluses, developing projections of future food demand, and setting targets for agricultural production, they operate under the strong assumption that the mean of the distribution of calorie consumption in the population equals the average dietary energy supply. But this is a problematic assumption. Even allowing for the lack of reliable information on food losses and food distribution in food balance sheet data, large disparities have been observed between the

2235

number of food-insecure households estimated by these data and estimates made by the USDA (Jones et al., 2013)

The USDA estimates, e.g., use projected calorie consumption estimates for different income groups based on income distribution data in addition to aggregated estimates of food supplies .National-level food security estimates, then, may be viewed as yardsticks for cross-national comparisons and monitoring changes in macro-level trends (e.g., for monitoring progress toward achieving the Millennium Development (Goals). However, the types and sources of data used, the assumptions made when calculating food security, and the intended purpose of different measures will inform the accuracy and interpretation of results.

For this and other reasons, the FAO now publishes a set of additional food security indicators along with estimates of it "prevalence of undernourishment" measure. These metrics examine variations of the dietary energy supply and undernourishment measures (e.g., share of energy supply derived from cereals, roots, and tubers; average supply of protein of animal origin; prevalence of under nourishment considering energy needs for higher amounts of physical activity, etc.) as well as information on food prices using data on country purchasing power parities and inflation rates and food deficits.

These additional indicators, 26 in total, offer complementary data for interpreting undernourishment estimates and begin to assess food security components beyond just food availability; e.g., food access (e.g., share of food expenditure of the poor) and factors that determine food access (e.g., domestic food price volatility, political stability, and absence of violence (Jones et al., 2013).

2.5.2. Global Hunger Index (GHI):

Other institutions have also developed indices that measure one or more aspects of food security at the country level. For example, the Global Hunger Index(GHI), developed by IFPRI(International Food Policy Research Institute), aims to measure "hunger" using 3 equally weighted indicators: 1) undernourishment (i.e., the proportion of undernourished people as a percentage of the population); 2) child underweight (i.e., the proportion of children younger than five years who have a low weight for their age); and 3) child mortality (i.e., the mortality rate for children younger than age 5years (Unit, 2012).

Countries are ranked on a 100-point scale and categorized as having" low" to "extremely alarming" hunger.Data for the child mortality and undernourishment components of the index come from (United Nations Children's Emergency Fund) (UNCEF) and the Food

and Agriculture Organization(FAO), respectively. The child underweight component of the index comes from 3 sources: The World Health Organization (WHO) Global Database on Child Growth and Malnutrition, Demographic and Health Survey data, and UNCEF's Multiple Indicator Cluster Survey reports.

The stated purpose of the index is to "[highlight] successes and failures in hunger reduction" and "[raise] awareness and understanding of regional and country differences in hunger (von Grebmer et al., 2012). The term "hunger" as used here ostensibly represents a manifestation of severe food insecurity. However, the component measurements of the GHI also reflect child health and under nutrition, the determinants of which are not necessarily associated with food insecurity (e.g., access to health services, household water and sanitation environments, and care for women and children). Interpretation of the GHI as a measure of food security or hunger, then, becomes complicated by this additional information captured by the index (Unit, 2012).

2.5.3. *Global Food Security Index(GFSI)*

The Global Food Security Index (GFSI) is another multi-dimensional tool for assessing country-level trends in food security. It was designed by the Economist Intelligence Unit (one of several companies of the publicly traded multinational, the Economist Group) and sponsored by DuPont. The index uses a total of thirty indicators within three domains of food security, affordability (six indicators), availability, and quality and safety, to provide a standard against which country-level food security can be measured (Unit, 2012) .

Similar to other national-level metrics, the GFSI ranks the performance of countries in achieving food security, but it does so using quantitative and qualitative indicators that reflect not only food availability, but food access (e.g., food consumption as a proportion of total household expenditure, proportion of population living under or close to the global poverty line, food prices) and diet quality (e.g. Dietary availability of micronutrients).

The GFSI is recalculated quarterly based on shifts in food price data. In addition to relying on data from the Economist Intelligence Unit, World Bank, FAO, WFP, and the World Trade Organization,The GFSI relies on expert panels and analysts from the academic, nonprofit, and public sectors. These experts provide subjective scoring to create many of the qualitative indicators that inform the index, assign weights to the indicators, and, in fact, select the indicators that are included in the index.

This reliance on expert opinion and consensus departs from the FAO and IFPRI approaches discussed above; however, subjective interpretation of data are in fact commonly used for developing food security metrics, as will be discussed below. Indeed, the complexity of factors contributing to food security and the importance of context in interpreting these factors has led to some institutions prioritizing consultative methods for developing food security measurement tools (Jones et al., 2013).

2.5.4.　*Famine Early Warning Systems Network (FEWSNET)*

The Famine Early Warning Systems Network (FEWS NET) is a network of international and regional partners funded by USAID that produces monthly food security updates for twenty-five countries included Sudan. The intent is to provide evidence-based analysis to support decision makers in mitigating food insecurity. Regional teams monitor and analyze a lot of information that could include data on long-term and real-time satellite rain fall records, the Normalized Difference Vegetation Index, temperature, agricultural production, prices, trade, economic shocks, political instability, and local livelihoods (Funk & Verdin, 2010).

FEWS NET was initially created to help avert emergency famine situations such as those that occurred in Sudan and Ethiopia in the mid-1980s. However, the network has since evolved to monitor not only droughts and crop failures that cause acute food insecurity but also the under lying causes of chronic food insecurity, such as persistent poverty and livelihood vulnerability. In an attempt to align with a global standard for food security classification, FEWS NET transitioned its classification system to the Integrated Food Security Phase Classification (IPC) system in April 2011 (FEWS, 2011).

2.5.5.　*Integrated food security Phase Classification(IPC)*

The IPC is a set of protocols for broadly assessing the food security situation within a given region. The IPC draws upon data from a wide range of sources to establish common classifications, or phases, for the severity and magnitude of food insecurity in specific contexts. The purpose of the IPC, then, is to identify the severity and magnitude of food insecurity in a given region, compare food security outcomes, and identify strategic action objectives across contexts based on these classifications (Global Partners, 2012) .

The IPC relies on Demographic and Health Survey and Multiple Indicator Cluster Survey data, data from household budget surveys, and consultations with government and nongovernmental organization authorities.

2238

Thus, the IPC approach is not a model-based approach but rather a consultative one that relies on the subjective interpretation by experts of accumulated evidence from multiple domains, including food consumption, livelihood change, nutrition and health, and hazards and vulnerability (FEWS, 2011).

FEWS NET and IPC have historically emphasized classification only of acute food insecurity. However, given the diversity of data considered in phase classification decisions not just on environmental and economic shocks but more broadly on poverty and livelihoods, IPC has recently introduced tools for classifying chronic food insecurity. These tools, designed to classify conditions wherein households are persistently food insecure even in the absence of shocks, are still in prototype form(Global Partners, 2012).This is a welcome development, as explicit recognition of chronic food insecurity may lead to better monitoring and therefore improved programming to address it.

2.5.6. *Measuring HouseHold Food Access.*

Although some of the food security measurement tools described thus far assess more than just available national food supplies, they also do not emphasize household-level behaviors and determinants of food access because of their focus on national- or regional-level estimates and trends. Household-level measures of food security are concerned with food security dynamics between and within households. Because these measures rely on data from household surveys, they are able to more accurately capture the "access" component of food security than measures that rely on nationally aggregated data.Food access refers to physical and economic access to food; however, many of the tools used to measure food access actually measure food acquisition or food consumption.

2.5.7. *Household Consumption and Expenditure Surveys (HCESs)*

Data on household food consumption and expenditures from household-level surveys are increasingly important for assessing household food acquisition. The FAO, which has traditionally focused on food balance sheet data to calculate national level estimates of the prevalence of undernourishment, has in fact recently resolved to make fuller use of increasingly available data sets based on household consumption and expenditure surveys (HCESs) and living standard measurement surveys ,Analyses using these survey data do not make the same assumptions about food consumption (e.g., postharvest losses and non-food uses), the distribution of energy supplies within countries, or the demographic composition of households as compared with analyses using food balance sheet data (Council, 2012).

HCESs measure poverty (i.e. Monetary expenditures as a proxy for income), assess consumer price indices and household socioeconomic status (e.g., education, housing type/quality, assets, health-seeking behavior, income), and examine patterns of food and nonfood consumption among households (Fiedler et al., 2012).

Data on food expenditures usually reflect only the monetary value of foods. Yet more accurate measurement of household food acquisition requires estimation of the quantities of foods acquired (to be able to estimate, e.g., the quantity of foods consumed per capita, diet diversity, or dietary energy availability per capita (Smith & Subandoro, 2007) .

2.5.8. *Household Dietary Diversity Score (HDDS)*

Dietary diversity was also selected as one of the indicators of choice for measuring household food access in the results frameworks of USAID(United States Agency for International Development) . The instrument, developed by the Food and Nutrition Technical Assistance Project, is known as the Household Dietary Diversity Score (HDDS) (Swindale & Bilinsky, 2006).

The score is calculated by summing equally weighted response data on the consumption of twelve food groups (i.e., cereal grain staples, roots and tubers, vegetables, fruits, meat, eggs, fish, pulses and nuts, dairy products, oils and fats, sugar, and condiments). The individual responsible for food preparation in the household is asked if anyone in the household consumed any item from the food group in the previous twenty-four hours. These responses are summed to obtain a score from zero to twelve. The HDDS has no standard cutoffs for defining food insecurity though (only cutoffs based on income data or tertiles of the score. Similar diet diversity scores (DDSs) have been developed to assess the nutritional quality of individual diets (Kennedy et al., 2011).

2.6.   Coping strategies as a food security indicator

What do you do when you don't have enough food and don't have enough money to buy food?

The answers to this simple question comprise the basis of the CSI tool. There are two basic types of coping strategy. One includes the immediate and short-term alternation of consumption patterns. The other includes the longer-term alteration of income earning or food production patterns and one-off responses such as assets sales etc. While it is important to understand longer-term livelihood strategies in an emergency, research has shown that the management of short-term consumption strategies is an accurate indicator of food security.

2240

Typically, food insecure households employ any of four types of consumption coping strategy. First, households may change their diet (switching from preferred foods to cheaper, less preferred substitutes). Second, to the household can attempt to increase their food supplies using short-term strategies that are not sustainable over a long period (borrowing, or purchasing on credit; more extreme examples are begging or consuming wild foods, or even seed stocks).

Third, households can try to reduce the number of people that they have to feed by sending some of them elsewhere (anything from simply sending the kids to the neighbor's house when they are eating, to more complex medium-term migration strategies). Fourth, and most common, households can attempt to manage the shortfall by rationing the food available to the household (cutting portion size or the number of meals, favoring certain household members over other members, skipping whole days without eating, etc.)It will be clear that *all* these types of behavior indicate a problem of household food insecurity, but not necessarily problems of the same *severity*.

A household that does not eat for an entire day is evidently more food insecure than one that has simply switched consumption from rice to cassava. The basic idea is to measure the *frequency* of these coping behavior (how often the coping strategy is used?) and the *severity* of the strategies (what degree of food insecurity do they suggest?). Information on the frequency and severity is then combined in a single score, the Coping Strategies Index, which is an indicator of the household's food security status. It considers only the coping strategies that are important in a particular local context. In brief, monitoring whether the index rises or declines gives a rapid, real time indication of whether household food security in deteriorating or improving (Maxwell, 1996) .

The question that arises is: To what extent does the coping strategies used by food secure households differ from the coping strategies used by food insecure households? A quantitative research method was employed whereby a stratified random sample of 600 households was taken from two low-income areas in South Africa. The Household Food Insecurity Access Scale (HFIAS) was used to determine the food security status of households and the Coping Strategies Index (CSI) was used to determine the coping strategies used by the food secure and food insecure households.

Different statistical techniques were used to compare the food secure and food insecure households with regard to coping strategies used. The studies found that the use of coping strategies increases as households move from food secure to severely food insecure. The study

indicated that there should be policies that deal with the vulnerability of certain groups(Grobler & Dunga, 2017).

According to, Hendriks (2005) South Africa is food secure at the national level but food insecure, in many instances, at the household level.

When households are confronted with adverse events or shocks, like a lack of food availability or affordability, etc., households respond to food shortages with Certain "coping strategies" (Devereux, 2001). Snel and Staring (2001) term this as "Strategically selected acts that individuals and households in a poor socioeconomic position use to restrict their expenses or earn some extra income to enable them to pay for the basic necessities and not fall too far below their society's level of welfare. Maxwell et al. (2003)Argue that coping strategies used may differ from household to household, and within households. In this regard Mjonono et al. (2009) indicates that the coping strategies used will vary between different poverty levels.

In a study by (Gupta et al., 2015), 63.7 % of food insecure households in the urban areas of Delhi, India relied on less preferred and less expensive foods to cope with food insecurity. In the same study, 30.9 % of food insecure households took limited portion sizes at mealtimes. Several other studies, like (Mabuza et al., 2016; Kempson et al., 2003; Dore et al., 2003), show that the most preferred coping strategies of food insecure households are to rely on less expensive foods. (Gupta et al., 2015) in a similar study, found that strategies compromising quality and quantity of food are first observed as a household falls into food insecurity. Gupta et al. (2015) indicated that "coping Strategies used by households can be seen as an expression of negotiated decisions

To minimize the impact of food insecurity in the household". Farzana et al. (2017), Found a significant association between the different types of coping strategies used and the level of household food insecurity. In this study, it was found that severely food insecure households are more inclined to a wider selection of coping strategies to cope with food insecurity, than mildly or moderately food insecure households. Mabuza et al. (2016) indicated that households do not act in an arbitrary way when it comes to food insecurity, they in most cases, develop strategies to minimize the risk to immediate food insecurity.

The CSI is easy and quick indicator for assessing and measuring household's food consumption gap and food insecurity It can be developed by employing a series of questions that depend on what the household does when they do not have access to enough food. The CSI is calculated by combing the means of scoring the relative frequency with the severity of

these coping strategies. The relative frequency of the coping strategies is measured by determining how many days per week a household had to rely on various coping strategies ranking from "never" to "every day."

The mean of the score was given for each frequency category and thus assigned as the value for that category. This provides a numerical estimation for the relative frequency. The sev erity of coping strategies was assessed using the focus group discussion. The level of severity for each coping strategy was collected by asking the individuals to classify the coping strategies they used based on their opinion (1=less severe, 2=moderate, 3=severe, and 4=very severe). The means of scoring reflect the weight of the severity for each coping strategy that the household adopted.

2.7.   State of Sudan Food Security

Periods of drought in the 1970s and early 1980s and more recently have led to reductions in vegetation cover and food production in Sudan. Consequently, they triggered mass migration from farms and villages and thereby upset the economic as well as the social spheres of many areas. Floods and rains in the late 1980s and 1990s were a mixed blessing for both the people and the environment (Mahgoub, 2014).As of Integrated Food Security Phase Classification (IPC), Sudan acute Food insecurity Situation Analysis during year 2017, The most hazard and risks affecting food security situation as follows:

a) Dry spells is affecting production areas in (Darfur, Gedaref, Kassala and North Kordofan).

b) Agricultural pests (Crowd Worm) in parts of the of Gedaref, Blue Nile and Sennar states.

c) Entranced of Animals in some production areas especially in West Darfour.

d) Shortage of water requirement for some crops in some areas.

e) Weak agricultural policies and, no announcement of incentive price for producers.

f) High food prices.

g) Fodder gap estimated at 6 million tons in Kassala State.

h) Entry numbers of refugees from neighboring countries.

i) Shortage and poor quality of drinking water.

The overall performance of the 2017/18 summer cropping season has been above the five-year average, but below the record of 2016/17. The 2017 cumulative main season rainfall between June and August 2017 was average tending to above average over most parts of the Sudan but had an erratic temporal distribution in some areas. Dry spells occurred during June, July and September in some high-producing regions such as Gedaref and Kassala states. Abundant rainfall in August helped to improve moisture conditions, but also caused severe flooding, water logging of crops and damage to infrastructures.

The production of sorghum and millet in 2017/18 is estimated at 3.7 million tonnes and 954 southand and tonnes, respectively, below the levels of last year, but still above the previous five-year average. Wheat production, to be harvested by March 2018, is forecast at about 463 000 tonnes, over 15 percent more than the five-year average. The decrease in cereal production is associated with the decline in the area planted, following farmers' decision to switch to more profitable crops. As a result, production of cash crops (sesame, cotton, sunflowers) is expected to be higher than in the previous year.

Water and pasture availability have been generally good in the areas where seasonal rainfall has been adequate. On the other hand, some regions experienced below-average rainfall and long dry spells that resulted in pasture and water scarcity. Overall, good livestock body conditions have been observed across the country and no major disease outbreaks have been reported.

Using the population projections for mid-2018 by the Central Bureau of Statistics to estimate the food use during the marketing year January-December 2018, the cereal balance sheet provided in this report shows that the country's utilization needs would be covered by the 2017/18 sorghum and millet production, plus high carryover stocks from the previous year. The structural deficit between production and consumption for wheat and rice is expected to be covered by the normal levels of commercial imports.

The prices of locally-produced sorghum and millet in most Sudanese markets have been characterized by a steady upward trend during the last 24 months, essentially due to the high costs of production and transportation, depreciation of the local currency and the decline in cereal production in the current year. The prices of sorghum and millet reached their records in November in most markets despite the ongoing harvest. In November 2017, prices of sorghum and millet were from 30 to 130 percent higher than their levels of the previous year.

2244

The high market prices have affected the most vulnerable groups, including the urban poor, which do not have cereal production or additional income to afford food on higher prices.

Area planted and harvested in 2017/18 , a decrease of 20 percent over last year in the area planted to sorghum, from 11.4 to 9.1 million hectares, has been recorded. The decrease has been mostly in the traditional rainfed sector where a 28 percent reduction has been registered, while in the mechanized rainfed and the irrigated sectors, a 15 and 26 percent decline, respectively, has been observed.

The reasons for this decrease are different. In Blue Nile, Gezira Scheme, Rahad, New Halfa, Sennar and Northern states, the expectation that sorghum prices would decline after the production record of last year encouraged many farmers to opt for other crops with more attractive prices, mainly sesame and cotton, but also millet and vegetables. In River Nile, Khartoum, Gedaref, Gezira and South Darfur states, the reduced area planted has been a consequence of a delayed start of seasonal rainfall.

In White Nile State, farmers opted for shorter cycle crops such as watermelon and hibiscus, while in Kassala and North Kordofan states, they replanted several times with no success. In Gash and Tokar schemes, seasonal river floods were late and low limiting the use of spate irrigation, with a consequent decline in total cultivated area. By contrast, the area planted with sorghum increased in Sennar, West Kordofan and Red Sea states due to favorable rainfall, while in South Kordofan and West Darfur states, a local improvement in civil security was also a key factor.

The total area harvested in 2017 is 6.3 million hectares, 33 percent less than last year (9.4 million), but still 6 percent above the 2011-2016 five-year average. It is about 69 percent of the total area planted, while last year it was 82 percent. This is due mostly to the poor rains in the semi-mechanized rainfed sector, where 34 percent was not harvested.

The area planted with millet in 2017 is 3.8 million hectares, 8 percent less than the 4.1 million hectares of last year. In Tokar, the only irrigation scheme to grow millet, a reduction in area of 23 percent was registered and the whole traditional rainfed sector, where millet is normally grown, scored a 10 percent decline. In the mechanized rainfed sector, the area planted to millet was 17 percent higher (Sennar, Gedaref, Blue Nile) as a consequence of the higher prices expected and the better tolerance of millet to drought.

At the national level, the proportion of harvested area to planted area is 69 percent (4 percent below last year). The area harvested in 2017 is 2.6 million hectares, 13 percent less

than last year but 16 percent higher than the 2011-2016 five-year average. Although planting of the 2017/18 wheat crop had just started at the time of the Mission, the total planted area was anticipated at about 173 000 hectares, compared to 254 000 hectares last year and an average of 230 000 hectares over the last five years. The significant decline is mainly due to the fact that farmers in Gezira Scheme are switching to more profitable winter crops like chickpeas and pigeon peas (FEWS, 2017).

2.7.1. Description of pillars of food security during season 2017\2018 according to Sudan food security outlook report:

2.7.1.1. Food Availability

The mid-season report (Sep 2017) indicate that the agricultural season in most production areas is good, Sorghum cultivated area (until the end of September) is estimated by 86% of the total targeted area, while the cultivated area of Millet is increased by 21% of the target area due to early rain in some areas of Millet production and the incentive price of millet.

Some Parts of North, South, West and Central Darfur, Kassala, Gedaref and North Kordofan have been affected by dry spells.Despite the affecting dry spells, there is a significant positive improvement in the vegetation cover in terms of density and distribution in most production areas, promising good production and rangeland in pastoral and agro pastoral areas, except some parts of Kassala and Gedaref.

2.7.1.2. Food access:

Compared with the previous year (October 2016), the prices of Sorghum, millet and wheat increase by 10%, 33% and 37%, respectively.Livestock prices increased by more than 30%, also there is increase in prices of animal products. Generally, the increase in prices is due to the lean season, fluctuation of rainfall, poor pasture, conflicts, high inflation rates and devaluation. All these factors negatively affect the purchasing power of the most vulnerable groups.Increasing flow of refugees from South Sudan, affect food security situation. This is likely to increase the competition on available domestic food and lead to increase in food price.

2.7.1.3. Food Utilization:

Sudan is characterized by a variety of horticultural, livestock and fishing production, enhancing income and food diversity, good food practices which lead to stabilizing the nutritional status of the population in Phase 1 and 2, on the other side, poor cultural practices affecting food diversity and lead to high levels of malnutrition in Some areas in the eastern and

western parts, in addition to shortage and poor quality of water, poor sanitation, Some diseases, such as watery diarrhea malaria and typhoid, have affected the nutritional status. Increasing flow of refugees from South Sudan, affect food security situation. This is likely to increase the competition on available domestic food and lead to increase in food price (FEWS, 2017).

2.8.   Poverty in Sudan

Poverty has various manifestations including lack of income, hunger, malnutrition, ill health, limited or lack of access to education and other basic services , increased morbidity from illness, homelessness and inadequate housing, un safe environment, social discrimination and exclusion .In addition to lack of income and productive resources that are sufficient to ensure sustainable livelihood, The poor are also characterized by lack of participation in decision making (Muhmode & Mohamed, 2010).

The poverty is prevalent all over the country, but the measure factors were the illconceived development policies followed since independence which have neglected rural development from which the majority of population derive their live hood, the civil war and natural disasters (drought). The development policies were concentrated on irrigated agriculture which was supplied with most of services such as stable irrigation, research,extension, credit and other infra structure. The traditional agriculture was neglected receiving no research services, limited extension, credit, and infrastructure, basic social services in the form of education, primary heath care and safe water supply. Civil wars also have claimed substantial resources which could have been utilized in the development of agriculture and other socialservices (Meade et al., 2003).

Applying income poverty line to income distribution data (Nur, 1995). found that all poverty measures in urban and rural areas in Sudan computed from the expenditure side are smaller than the ones obtained from the income side, except the relative deprivation indices.Using expenditure and income as welfare indicators, Nur (1995) concluded that 83,7|% and 87.1%| of the rural people are below the poverty line using expenditure and income approaches, respectively .Nur results were obtained by employing an income poverty line based on expenditure on food, cost of cooking, housing, clothing, mobility, health and education

The NBHS survey revealed that the most important sources of income for Sudan households are agriculture (40 percent), wage and salaries (31 percent), self-employment (16percent), and other sources (14 percent). The percentage deriving their main livelihood from

2247

farming and livestock activities ranges from 74 percent in Northern Darfur, 69 percent in Northern Kordofan to 3 percent in Khartoum. Over half the households in Western Darfur (62percent), Southern Darfur (68 percent), Southern Kordofan (68 percent), Blue Nile (57 percent)and Sinnar (51 percent) states are engaged in farming and livestock (Ahmed, 2015).

Spread of poverty in Sudan has increased during the 1990 decade, despite the overall growth in per capita GDP because of the relatively low growth rates in per capita expenditure and because of the deterioration in the distribution of expenditure. For the period 1990-99 poverty increased by an annual rate of 0.87 percent. For the first half of the 1990s, poverty increased marginally at an annual rate of 0.24 percent but for the second half, the increase in the headcount ratio was very significant at the rate of 2.4 percent. These estimates are not qualitatively different from the most recent results reported for Sudan, which compare absolute poverty in1990 to that in 1996.

According to these results, the incidence of poverty (as measured by the head-count ratio) has increased by an annual rate of 2.62 percent per annum from 77.5% in 1990 to 90.5% in 1996. Moreover, it is reported that the head-count ratio for 1996 was 81.4 percent for the urban areas (using an urban poverty line of £S.292thousand per person per year) and 94.8 percent for the rural areas (using a poverty line of£S.261 thousand per person per year).In summary, income inequality in the Sudan is relatively high. This relatively high inequality, however, does not seem to be changing over long periods (Ali, 2012).

Gaps in the literature to be filled:

This study is primarily intended to fill part of the gap by providing an in depth study of poverty incidence in the rural areas based on household expenditure.There was no update data about the farmers household food security status and there is alack in studies concerning policy of food security in the state.This research work is an effort tried to fill some of the mentioned gaps.

3. Data and Methodology

3.1. Study Area

Gezira State occupies the tract between the white and Blue Niles south of their convergence at Khartoum. Gezira state is located between latitude 13°-32 " and 15°-30 " North, longitude 22° – 32 " and 20° – 34 " East , with annual rain fall ranging between 200 – 350 mm. The average temperatures between 22° – 29° in Winter and 38 – 42 in Summer (Taha et al., 2012).

The Gezira state consists of eight localities including Medani Elqubra, Elkamlin, East Gezira, South Gezira, Hasahisa, Managil, Elgurashi and Um Algura (Taha et al., 2012).The study was conducted in localities that lies on the two banks of the BlueNile , With special focus between vegetables farmers. The five localities is apart from the largest irrigated schemes, The area of study estimated 6300 Feddans.

3.2. Sample size and sampling design:

The population o fthe study comprised all farming households of vegetables along Blue Nile River. A sample of 150 farm households was selected from a total of 1534-farm households from the above-mentioned divisions to represent the total population at a confidence level of 95% and level of precision of 8%; this was thought to be optimum. The unit of analysis for the study was the household, with the assumption that the household is where one can get most of information with regard to the study objectives.

The main purpose of the present study is to consider household food security with special focus on vegetables farmers in Nile Schemes by measuring poverty intensity and depth of poverty, using poverty line expenditure.

The study is based on primary data collected by the means of questionnaire from a random stratified sample designed to provide statistical information on household. The sample size (N) is determined by using the following formula:

$$N = Z^2 pq / d^2 \qquad\qquad (1)$$

Where N = sample size, Z = statistical certainty desired, p = estimated prevalence rate of food insecurity and q = 1 – p (proportion with out the attribute of interest), and d = degree of precision. The desired precision (d) was set at eight percent (0.08) and statistical certainty was set at 95 percent (z = 1.96). Because the general prevalence rate of the key variable (households food insecurity) was not known, the value of p was set at 50% (0.5) to maximize the impact of this variable on the sample size. Thus, the resulting sample size was: n= $1.96^2*0,5*(1-0,5)/0,08^2$.However, 150 farm households were earmarked (Senefeld & Polsky, 2006).

2249

Table 2: Distribution of farmers according to their localities

	Locality	Numbers of farmers
1	Kamlin	534
2	Hasahisa	175
3	MedaniElqubra	442
4	East Gezira	163
5	South Gezira	220
	Total	1534

Source: Ministry of agriculture, animal wealth and natural resources, Gezira , Sudan (2017).

The questionnaire was then distributed randomly to the hoeholds in each locality according to the share of eac locality in the total sample as given in figure (3.1). Data were then collected on the variables of interest, which include income and expenditure on, food and non food items, (Questionnaire appendix 7.30)

Figure 2: distribution of the sample according to their localities

Source: Auther·s presentation based on research survey, Appendix 7.1)

The other questionnaire for policy makers at the state level distributed among the ministers of the key line ministries ,the questionnaire covers many questions to investigate the availability of policy document in institution and in the state as awhole, to find out the objectives of this policy/strategy if any ,what is the process that has been used to achieve those objectives ,what were the challenges or constraints that faces t he implementation and what were the monitoring and evaluation mchanisms used.

3.3. Data Source and Data collection process:

The data has used in this study were obtained from the selected areas using questionnaires. The purpose of the baseline survey is to gather accurate and reliable recent household information that could predict the current profile of the livelihood and consumption patterns of the population living in the areas of vegetables crops. Data was collected over a period of one year, from January 2017to April2017 by trained agricultural economists in the five localities.

2250

The questionnaire was then distributed randomly to the farmers in each locality acco rding to the share of each unit in the total sample as given in figure (3.1). Data were then collected on the variables of interest Questionnaire appendix 7.28.

The survey provides all the variables which are very important for the measuring and analysis of food insecurity in the study area.   Data collection process is undertaken through a face to face (personal) interview with the comprehensive household questionnaire. A total of 150 farmers have been included in the survey. One of the important problems that faced the researcher in data collection was that some of the respondents underestimated the levels of their incomes and expenditures.

The study also employed secondary data obtained from Gezira state record, and other relevant documentary sources. Another questionnaire was distributed to the policy makers to make clear picture about the existence of food security body in the State and to investigate the challenges and constraints that faces the FSN policies/ strategies development and implementation at the state level targeted policy makers at the state level about 9 respondents from the ministries relevant to food security (Appendix7.31).

3.4.   Data Analysis:

The SPSS software used to analyze primary data collected by means of questionnaire (2questionnaires).Descriptive statistics using percentages and frequencies employed to give some insights about poverty and food security situation in the state. The free software DAD used to measure poverty and inequality.Chi square used to test the association between policy makers opinion at the state level for availability of food security and nutrition policy in the state.

3.4.1. *Measuring poverty and food security at household*

However, due to this relativity and multidimensional nature of poverty, this study adopted the basic Foster-Greer-Thorbecke(FGT) index which is one of the most commonly used as measures of poverty (Foster et al., 1984).

This measure has three components: (a) the incidence of poverty which shows the share of the population that is below the poverty line (absolute poverty), (b) the depth of poverty which shows how far the households are from the poverty line (depth of poverty), and (c) the severity of poverty which relates to the distance separating the poorest households from the poverty line and combines information on both poverty and inequality among the poor . The *P-alpha* measures in analyzing poverty relate to different dimensions of the indices of poverty

P_0 P_1 and P_2 and were used for head count, depth, and severity of poverty. The three measures are all based on a single formula, but each index puts different weights on the degree to which a household or individual falls below the poverty line. This measure is also useful due to its decomposability among subgroups. To see how the measures are defined, the expenditures were arranged in ascending order, from the poorer Y1, next poorest Y2…. with the least poor Yq (Bogale & Shimelis, 2009).

Therefore, this study employs the FGT index in order to estimate the food insecurity gap and its severty among the rural households analyses by DAD software program for distributive analysis using the following equations (Adeyonu, 2015):

$$p_\alpha = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{Yp - Yi}{Yp}\right)^{\alpha} \tag{2}$$

Where,

Yi is the expenditure of the i th poor person.

$$\text{Annual per capita Expenditure} = \frac{\text{Annual expenditure of households}}{\text{Household size}} \tag{3}$$

Yp is the poverty line defined as $\frac{2}{3}$ of Mean annual per capita expenditure

The poverty line defined as the monetary cost to agiven person at agiven place and time of a refrence level of welfare.

N is the population, depending on the value of α, the p_α index takes on different forms. If $\alpha = 0$. The numerator is equal to H, and we get the head count ratio, $\frac{H}{N}$

This head count ratio index reflects the proportion of the poor in the total population measuring the incidence of poverty in the whole population. The advantage of the head count measure is that overall progress in reducing poverty can be assessed right away. Nevertheless, it is insensitive to the depth or severity of poverty and hence not good to assess the impact of a policy measure, when $\alpha = 1$, the FGT becomes a poverty-gap ratio.

This measure estimates the average distance separating the poor from the poverty line. The poverty gap could be understood as the amount of income transfer needed to bridge the gap. In other words, the resources that would be needed to lift all the poor out of poverty through perfectly targeted cash transfers. P1 is sensitive to the depth of poverty but not to its

2252

severity.If α = 2, the FGT measure indicates the squared poverty gap or (severity). This is often described as a measure of the severity of poverty, It depicts the severity of poverty by assigning each individual a weight equal to his/her distance from thepoverty line. P2 there by takes into account not only the distance separating the poor from the poverty line but also the inequality among the poor (Ibrahim & Mirghani, 2015).

3.4.2. Gini Coefficient of Inequality and Lorenz curve

This is the most commonly used measure of the degree of income inequality. The coefficient varies between 0, which reflects complete equality and 1which indicates complete inequality. Graphically, the Gini coefficient can be easily represented by the area between the Lorenz curve and the line of equality. To measure income inequality and compare it among households more accurately, Lorenz curve and Gini index were used (Ahmed et al., 2014).

For calculating the Gini coefficient based on income and expenditure used the following equation denoted G , is given by :Formally, let *xi* be a point on the x-axis, and *yi* a point on the y-axis. Then

$$Gini = 1 - \sum_{i=1}^{N}(X_I - X_{i-1})(Y_i + Y_{i-1}) \tag{4}$$

Lorenz curve shows the relationship between population groups and their respective income or expenditure levels in cumulative percentages on the horizontal axis, the numbers of those who receive income or make expenditure are plotted in cumulative percentages. The vertical axis portrays the share in total income or expenditure received by or associated with each percentage of the population. Both axes are equally long and entire figure represents a square.

A diagonal line is drawn from the lower left hand corner of the square to the upper right hand corner. At every point of that diagonal, the percentage of income or expenditure is exactly equal to percentage of those who receive that income or incur that expenditure.The further (closer) is the Lorenz curve from the diagonal,the greater (smaller) the degree of inequality (Muhmode & Mohamed, 2010).

4. RESULTS AND DISCUSSION

This chapter report results related to the estimated poverty line for the vegetables farmers in Gezira State. The calculation of food security status was based on poverty analysis using Foster Grear and Thorbecke model. Moreover, results pertaining to the head count index, depth of poverty, severity of poverty, coping strategies, Gini Coefficient will be discussed.

2253

4.1.   Socio Economic Characteristics of vegetables farmer Households

4.1.1. *Gender of the household*

However, female-headed households can be disadvantaged both in terms of material assets and social opportunities, which limit access to land tenure, livestock, credit, and extension (Doss et al., 2014; Kassie et al., 2014; Oniang'o & Mukudi, 2002). Climate variability in sub-Saharan Africa has left female-headed households disproportionately food insecure (Tibesigwa et al. 2015), which suggests that the differences between male- and female-headed household food security may grow in years to come.

Gaining a better understanding of the factors that disproportionately affect women-headed household can help address their food insecurity (Babatunde et al. 2008; Kassie et al. 2014). Distribution of the household heads based on gender presented in figure 3 revealed that 100% of the respondents were male also records in Ministry of Agriculture indicate that all membership of River Nile Scheme was male. This result is concur with other studies undertaken in sub- Sahran Africa which supports the fact that family constructions are mainly patrilinear (Mwakubo et al., 2015; Mwenjeri et al., 2016).

Figure 3: Distribution of the household sample according to their Gender
Source: Author's presentation based on research survey, Appendix 7.2)

4.1.2. *Age of household head:*

This figure shows the distribution of the total sample of the household, 86% of the respondents were in their youthful age within the age range of 15–65 years. This indicates that the respondents are in their active work life and can engage in diverse income generating opportunities.

2254

Figure 4: distribution of the total house hold sample according to their age.
Source: Authors presentation based on research survey (Appendix 7.3).

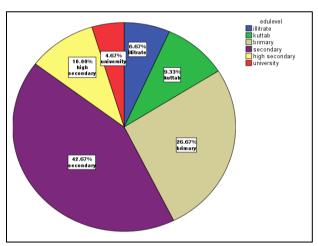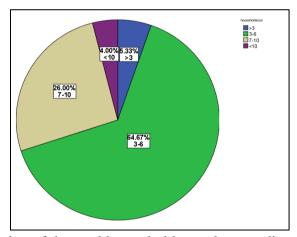### 4.1.3. Education level of household head:
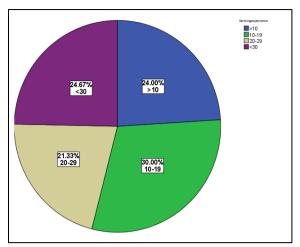

Figure 5: distribution of the total house hold sample according to their educational level
Source: Authors presentation based on research survey (Appendix 7.4)

It is a dummy variable defined whether the household head is literate or illiterate. Education is an important variable related to household food security where educated households have a better chance of managing their farm by adopting improved practices, which in turn increases total yield. It is assumed that a literate household head often tends to adopt new skills and ideas which in turn have positive effects on food security (Garrett & Ruel, 1999) hence, it is positively related with household food security.

As it clear from figure 5 The level of education of respondents as revealed that 26.67% of the respondents of the sampled population had no formal education. Only about 16% had tertiary education and 42.67% had secondary education. Educational level of respondents is an additional factor which is thought to influence the food security status of households. The awareness of food groups necessary for human growth and wellbeing may be dependent upon

2255

the level of education of the household head. The knowledge of these food groups ultimately influenced nutritional decisions that enhanced quality of food intake.

4.1.4. Household size

Household size refers to the total number of household members who live and consume from the same household and is expressed in adult equivalent. It is an important variable which determines the state of household food security and expected to have negative impacts on household food security. An increase in household size implies more people to be fed from the limited resources. The result presented in figure 6 shows the number of children range between 0 to 2 children about 5.3 % of total sample household about 64.7% of the sample have three to six children and 26% have between 7-10 child beside 4% have 10 children or more.
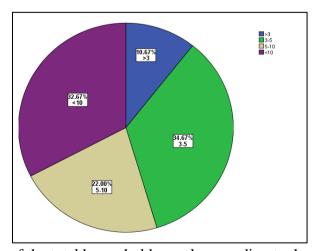

Figure 6: distribution of the total house hold sample according to household size
Source: Authors presentation based on research survey (Appendix 7.5).

4.1.5. Farming experience

This implies that increase in farming experience predisposes farmers to acquisition of skills and better farming practices which will increase food production and decrease food insecurity incidence

Figure 7: distribution of the total house hold sample according to the years of experience in farming

Source: Authors presentation based on research survey (Appendix 7.15)

This figures showed that majority (about 52%) of the sampled population has farming experience of between 10-29 years beside 21.3% has experienced in farming more than 30 years.

4.1.6. Size of cultivated land:

Size of cultivated land is a continuous variable measured in hectare or feddan. Cultivated land is a salient resource expected to be associated with a household's food security status. Some have assessed that size of cultivated land is associated with food security (Grootaert et al., 2004). In the study area size of owned or rented area less than three feddan are 10.7% while 57% the area size between 3 and less than 10, 32.67% from the sample the area size is more than ten but the whole area is owned or rented is not cultivated during the year of study.

Figure 8: distribution of the total house hold sample according to the size of cultivation area
Source: Authors presentation based on research survey (Appendix 7.16)

2257

4.1.7. *Societies member ship*

The analysis of result on productive societies membership revealed that about 88% of the respondents were not members of any productive society and only about 12% of the respondents were members. It is believed that productive societies membership did not offers members access to agricultural inputs, modern technologies and food items at affordable price rates.
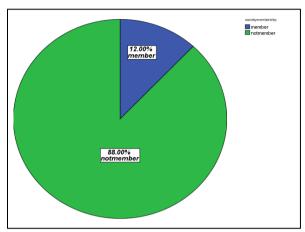

Figure 9: distribution of the total house hold sample according to the society's membership
Source: Authors presentation based on research survey (Appendix 7.19.)

4.1.8. *Access to extension service*

Extension services from the various agricultural agencies enhance information dissemination on good agricultural practices and could lead to improved productivity and yield of farmers. It can, therefore, be said that a farmer's frequent access to extension services would enhance his/her food security status.

Results on extension agent contact showed that about 90% of the respondents did not have any contact with extension staff during the 2017 cropping season, while only about 10% had extension contact during the same cropping season. This implies that traditional farming methods were still widely practiced in the study area. This could affect productivity in quality and quantity of output, incomes of farmers and ultimately the food security status of households.

Ibrahim and Onuk (2009)opined that access to extension services by farming households' accords households the knowledge of improved inputs as well as adoption of new techniques of farming and marketing. Adebo and Ajiboye (2014) Reported that 92% of the farmers did not have access to extension.
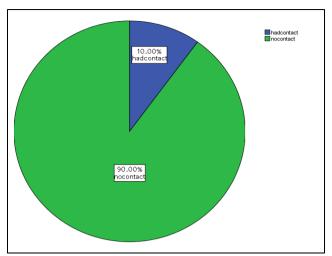
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Figure 10: distribution of the total house hold sample according to the extension services
Source: Authors presentation based on research survey (Appendix 7.18)

4.1.9. Access to credit

One of the major constraints farm households face in the expansion of their agricultural investments is the difficulty in accessing credit. The data presented in figure 12 did not depart from this fact. The result showed a high percentage (76%) of households did not have access to credit compared to a handful of the respondents representing 25% who received credit. Among other factors, this may be due to low level of education and lack of collateral, especially among farming households. It is expected that low access to agricultural loans will adversely affect in domestic food production and other agro-processing enterprises resulting in food insufficiency, decreased incomes, and lack of sustainable rural household food security as well as reduced quality of life.
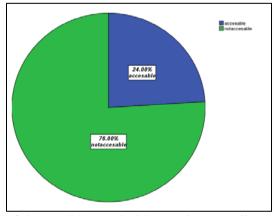

Figure 11: distribution of the total house hold sample according to accessibility of credit
Source: Authors presentation based on research survey (Appendix 7.20)

4.1.10. Humanitarian assistance

All the sample does not get any humanitarian assistance this due to the absence of Zakat champers institution and non-governmental organization role in the study area (Appendix7.21).

2259

4.1.11. Status of floor , toilet, main source of drinking water, main energy source for cooking and lighting

One of alternative indicators for incomes: size of a family dwelling or its number of rooms, the type of materials used in the construction of the roof, floor, and walls of a dwelling the method of water collection and sanitation available (Riely et al., 1999).

Housing conditions are considered an essential part of people's living standards.86% living in own dwelling, 95,3% has got healthy water and 96% has got electricity services and 98% from the sample has toilet facility, ,37.3 % has got ordinary earth and 18,7% has got ceramic floor, 97% from house hold used gas for cooking so their utility and standard of living are acceptable
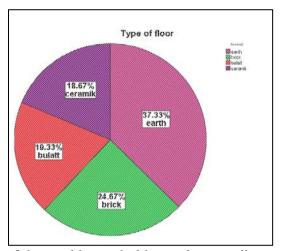

Figure 12: distribution of the total house hold sample according to the main type of floor
Source: Authors presentation based on research survey (Appendix 7.9).
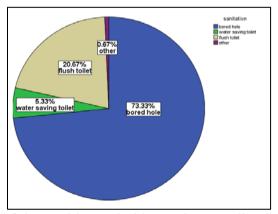

Figure 13: distribution of the total house hold sample according to the main type of toilet facility
Source: Authors presentation based on research survey (Appendix 7.10)
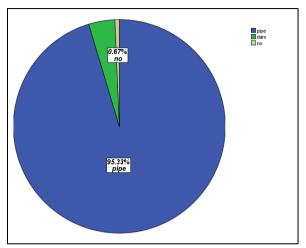
2260

Figure 14: distribution of the total house hold sample according to the main source of water
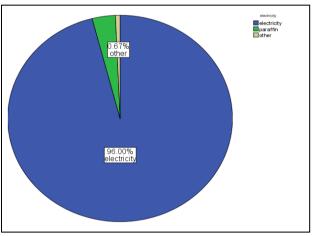Source: Authors presentation based on research survey (Appendix 7.9)

Figure 15: distribution of the total house hold sample according to the main source of energy for lighting
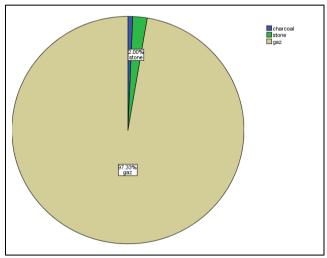Source: Authors presentation based on research survey (Appendix 7.13.)

Figure 16: distribution of the total house hold sample according to the main of energy for cooking
Source: Authors presentation based on research survey (Appendix 7.14)

2261

4.1.12. Households Income Generating Sources

Income from the agricultural production may not be the only source of income for the rural household. The success of households and their members in managing food insecurity is largely dependent on their ability to get access to off-farm/non-farm job opportunities, which could serve as livelihood diversification strategies(Barrett et al., 2001; Reardon, 1997). Hence, it is expected that the availability of off-farm/non-farm income is positively associated with household food security.

As the yearly incomes of households increase when households invest in more income generating activities, purchasing power of households is expected to improve and probability of household food security also increases. Consequently, increased household income could positively influence food production and access to food in quantity and quality. In the study area sampled households engaged in multiple income generating activities as presented in figure 17.

The result showed that all the respondents were famers (100%). Other major income generating activities were traders (21%), (9%) vegetables sailors(1.3%), animal husbandry and free jobs (6%) This implies that 44.3% respondents had other income sources besides farming for general livelihood sustenance (Babatunde et al., 2007; Kwaghe, 2006) in their studies observed that households that engage in different enterprises earned additional money apart from the farm income. It is expected, therefore, that level of food insecurity may be less among such households also other studies show there is a strong correlation between household income and food security (Deaton, 1997).
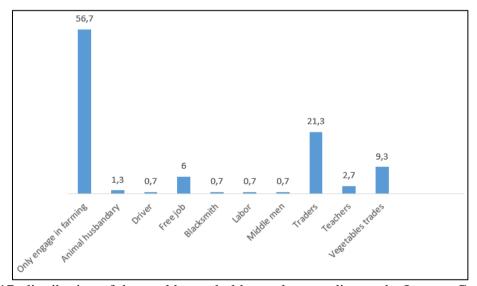

Figure 17: distribution of the total house hold sample according to the Income Generating
Source: Authors presentation based on research survey (Appendix 7.22)

4.1.13. Coping Strategies adopted by vegetables farmers:

Coping strategies used by the households can be seen as an expression of negotiated decisions to minimize the impact of food insecurity in the households. Hence, understanding these food insecurities coping strategies could be a good starting point to develop and formulate community based contextually sensitive interventions to improve household food insecurity. The coping strategies adopted by households in the vegetables farmers were consistent with previous studies done in other countries also Households in Northern Sudan apply a variety of coping strategies, the most common being to rely on less preferred or less expensive food or eat borrowed food or borrow money to buy food, and more severely to reduce the number of meals eaten in one day]. So, the farmers of vegetables of Gezira State were apart from those strategies, (50,7%) borrowing money,15,3% sell some of unproductive animals (14,7%) lessens the consumption amount of food to meet the daily food needs of the households.
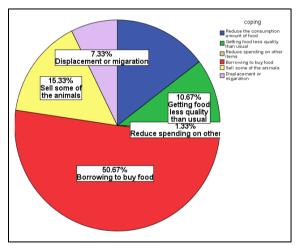

Figure 18: Description of coping strategies adopted by farmers of vegetables
Source: Authors presentation based on research survey (Appendix 7.23)

The coping strategies adopted by households in the area of study were consistent with previous studies done in other countries. They have reported similar strategies of relying on less preferred and less expensive foods and consuming seasonal vegetables being adopted by the food insecure households to meet the daily food needs of the households. Earlier studies have also shown that households follow rationing strategies in the situation of food insecurity.

Corbett (1988) reported households reducing number of meals per day as a coping mechanism Studies found significant association of food insecure households with borrowing money/ food and selling valuable materials (Shariff & Khor, 2008; Studdert et al., 2001). Mardiharini (2016) and Agbola (2008) identified that households during food insecurity, tended to borrow money from friends and relatives, sell or pawn own assets to get cash and

2263

purchase food on credit. Eating at religious places, sending children to eat else-where or with neighbors/ relatives can be referred to as food seeking strategies. Norhasmah et al. (2010) also enlisted these strategies as part of coping strategies of food insecure families .Study in Elgadarif state showed that (60.2%) borrowed to meet their food needs (Bushara & Ibrahim, 2017).

4.1.14. Yearly income position

One important factor to assess the food insecurity of the household is income or consumption level of household .Households having higher income are obviously less likely to be food insecure, as compared to households with low income. Households with high income can spare more money on food after meeting other needs. Household yearly income in the study area is presented in Table 3 about 20% of the respondents have monthly income range between138000 – 40000 SDG and about 20 % of the households have monthly income between 158,000- 915000SDG.As the monthly incomes of households increase and households invest in more income generating activities, purchasing power of households is expected to improve and probability of household food security also increases. Consequently, increased household income could positively influence food production and access to food in quantity and quality (Ahmed et al., 2015).

Table 3: yearly income position for household

Variables	Frequency	Percent %
13800-40000	30	20%
41000-62000	30	20%
63000-95000	30	20%
97000-156000	30	20%
158000-915000	30	20%

Source: Authors presentation based on research survey (Appendix 7.24)

4.1.15. Yearly expenditure position

Table 4: yearly expenditure position for household

Variables	Frequency	Percent %
2550-6748	30	20%
6768-8044,8	30	20%
8048,5-10848	30	20%
11297-15716	30	20%
16128-44950	30	20%

Source: Authors presentation based on research survey (Appendix 7.25)

Household yearly consumption in the study area is presented in Table (4.1) About 20% of the respondents have monthly expenditure range between2550-6748SDG and about 20 % of the households have yearly expenditure between 16128-44950 SDG this indicate the inequality in the distribution of income and consumption between household. From previous result, the

2264

breakdown by total consumption groups shows that the level of daily per capita calorie intake increases as household per capita expenditure increases. (Shiferaw et al., 2003; MoFED, 2013).

4.2.   Results of the FGT Measures

The standards of living of households in the study area was measured based on the expenditure of the household. The household expenditure was converted into per capita expenditure by dividing it by the number of the members of the household.

4.2.1. *Estimation of the Poverty Line and Poverty Status*

The first step in the analysis of poverty is the determination of the poverty line. The poverty line in Sudan study was calculated from the National Household Budget and Poverty Survey (NHBPS) in 2014. The survey was the fourth (68_78_2009-2014) in the series of similar surveys undertaken by the Central Bureau of Statistics (CBS). The results of the study show that the annual per capita consumption in Sudan was 6,082 Sudanese Pounds. Urban areas displayed average consumption levels higher than rural areas, at 7,149 SDG and SDG 5,509 respectively. The literature review indicated that the poverty line poverty line defined as $\frac{2}{3}$ of Mean annual per capita expenditure (Adeyonu, 2015) so the poverty line in this study computed for respondents using the two-thirds of mean per capita household expenditure and its estimation is 7196SDG .

Table 5: Head count index, Depth of poverty, Severity of poverty

The poverty measures	Poverty index % (All localities level)
head count index(p_0)	25
Poverty gap index (p_1)	5
poverty severity index (p_2)	2

Source: Authors presentation based on research survey (Appendix 7. 26)

From table 5 It is clear that the result, 25% head count index (p_0)means that 25% from the sample were under poverty line, unfortunately, this measure is the same whether those in poverty earn 90 SDGper day or 50 SDG per day, so it cannot reveal the depth of poverty. Indeed, the easiest way to reduce the headcount index is to target benefits to people just below the poverty line, because they are the ones who are cheapest to move across the line. But by most normative standards, people just below the poverty line are the least deserving of the poor.

In the study the poverty gap index is estimated to be 5% this means that the cash transfer needed to lift the poor out of poverty each poor person represents 5 percent of the poverty line, In other words, this indicates government policy intervention should target this 5% of the poorest among the poor.These are the group of people or as it were the percentage of the

2265

population in study area that needs policy intervention by the government and other stakeholders

Severity of poverty in this study is equal to 2% indicated that there is low severity of poverty compared with high poverty gap. This indicates government policy intervention should target this 2% of the poorest among the poor.

Table 6: FGT measure of poverty in Gezira State, vegetables farmers by localities

Poverty type	Head count ratio(P_0)	Poverty gap(P_1)	Poverty severity(P_2)	Gini coefficient
Kamlin locality	0.37	0.06	0.02	0.32
Medani	0.27	0.06	0.03	0.34
East Gezira	0.19	0.06	0.03	0.30
Hasahisa	0	0	0	0.13
South Gezira	0.14	0.04	0.01	0.27

Source: Author's presentation based on research survey(Appendix 7. 27)

The FGT results showed that there were significant differences in the geographic distribution of poverty among the five localities under study. Furthermore Kamlin locality record the highest poverty incidence among other localities. However, with respect to the poverty gap, Kamlin.Medani, East Gezira reported the higher income distance from the poverty line, likewisethe severity of poverty in Medani and East Gezira are found to have ahigher percentage distance from the poverty line.

4.3. Measure of income inequality

4.3.1. Gini Coefficient of Inequality

Attributed to Gini (1912), is by far the most widely used measure of inequality; the reason for this may be the fact that it is a straight forward, easy to understand and not at all complicated to calculate. Another reason for its popularity can be attributed to the availability of inequality datasets, particularly the one of Deininger and Squire (1996). Its value ranges from 0 to 1, (Although it is commonly multiplied by 100 in empirical studies) being 0 the value of perfect equality and 1 of maximum inequality (i.e. one individual holds all the income or wealth and the rest hold no income or wealth). Another advantage of the Gini- coefficient is that it can be easily represented in the Lorenz (1905) graph for a graphical, more intuitive, description, as it represents the ratio of the difference between the line of absolute equality and the Lorenz curve which represents the income (wealth) distribution among population quintiles.

Table 6: Gini Coefficient of inequality of household expenditure in the study area

2266

Gini inequality (value)when income was used as a welfare indicator	O.47
Gini inequality (value)when expenditure was used as a welfare indicator	0.31

Source: Author's presentation based on research survey (Appendix 7. 30)

Gini coefficients are aggregate inequality measures and can vary anywhere from 0 (perfect equality) to 1 (perfect inequality). In fact, as you will soon discover, the Gini coefficient for countries with highly unequal income distributions typically lies between 0.50 and 0.70, while for countries with relatively equal distributions, it is on the order of 0.20 to 0.35 (Todaro & Smith, 2012).The Gini coefficient of expenditure and distribution among vegetable farmers was equal to 0.31 and 0,47 ,respectively this result indicated that there was relative equal distribution in expenditure and income distribution compared with Sens measures of poverty expenditure and income was equal to 0,28 and 0.45 and (Sen, 1999) A study by Rabab in Greater Wad Medani indicated that Gini coefficient of expenditure and income distribution was equal to 0.33 and 0.23 (Taha et al., 2012) .
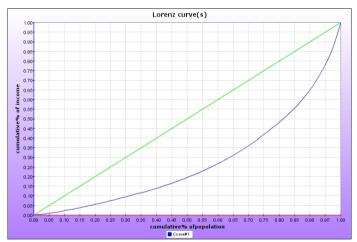
4.3.2. Lorenz curve

Figure 19: Lorenz curve illustrates expenditure inequality in Gezira State among vegetables farmers
Source: Author's presentation based on research survey.

Lorenz curve plots the cumulative percentages of total income received against the cumulative percentages of population starting with the poorest individual or household (Figure 3). First, all the individuals or households were ranked according to their income level, from the poorest to the richest. Then all of these individuals or households were divided into 20 groups (five percent each). The results showed that the poorest 20% of the population earned 0.06% of the total income while the richest 20% earned 45% of the total income. The second 20% poorest earned 6 %, while the following 20% earned 9% of the total income.

2267

5. POLICY CHALLENGE

To conduct this research, firstly we have to identify the institutions that have a food security and nutrition concerns and related to the food security and nutrition policies.

Then the availability of the documents of food security and nutrition policies have been examined. The key line ministries and other institutions in relation to food security policy in the state are listed below:

a) Ministry of agriculture, animal wealth and natural resources.

b) Ministry of health

c) Ministry of finance and man power

d) Ministry of social fare

e) ZakatChampers

f) National and International non government organizations

5.1. Availability of policy document

Acomreensive document of food security and nutrition policies was prepared by the Food Security Technical Secretariat in collaboration with Food Security Policy and Strategy Capacity Building Programme, of the Food and Agriculture Organization of the United Nations (FAO) IN August2015. The main objective of this document is to prepare adequate policies to help in achieving the food security and nutrition. This document tries to to draw national policies targeting all the four pillars of the FSN conept, The aforementioned document is intended to make framework to help in coordination among the key line ministries and partners (Bushara & Ibrahim, 2017).
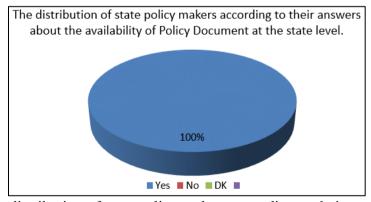

Figure 20: The distribution of state policy makers according to their answers about the availability of Policy Document at the state level
Source: Author's presentation based on research survey, (Appendix 7.29).

2268

Figure 20 shows that all the respondents, 100 % of 9 respondents from all policy makers in the state, said there is a policy document or strategy in the state concerning the FSN issues
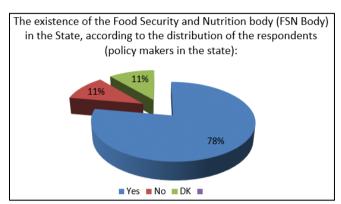
5.2. Food security and nutrition body

Figure 21: The existence of the Food Security and Nutrition body (FSN Body) in the State, according to the distribution of the respondents (policy makers in the state)
Source: Author's presentation based on research survey, (Appendix 7.29).

Figure 21 shows that 78 % of the policy makers in the State said that there was a food security body in the state (FNSC), this good percentage may come from the fact that almost all the policy makers in the state are members of the (FNSC), 22 % of the respondents did not know this body.
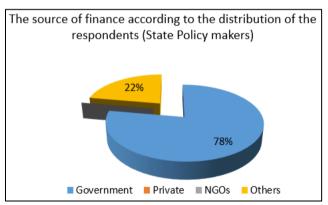
5.3. Finance

Figure 22: The source of finance according to the distribution of the respondents (State Policy makers)
Source: Author's presentation based on research survey, (Appendix 7.29).

Figure 22 shows that the majority of the FSN policy makers in the State, 78% of them, believe that the main source of finance is the Government either from national Government or State Government, and none of them, believe that the private sector and the NGOs contribute in the process of policy development and implementation.
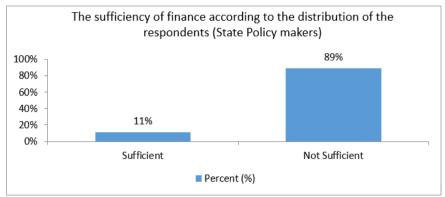
2269

Figure 23: The sufficiency of finance according to the distribution of the respondents (State Policy makers)
Source: Author's presentation based on research survey, (Appendix 7.29).

Figure 23 shows that 89% of FSN policy makers in the State said that the finance is not sufficient, only 11 % of the respondents believe it is enough. In the coming figures will see the reason of the in sufficiency of finance according to the respondent's answers.
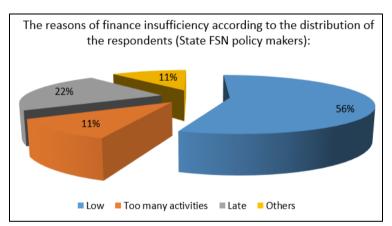

Figure 24: The reasons of finance insufficiency according to the distribution of the respondents (State FSN policy makers)

Figure 24 shows that 56 % of FSN policy makers in the state, said that the finance came in a low amount of money, so they could not implement the policies as they hope, about 22 % of the respondents believe that it came late and the rest of them split between two reasons, first they have too many activities to be done and some others reasons.

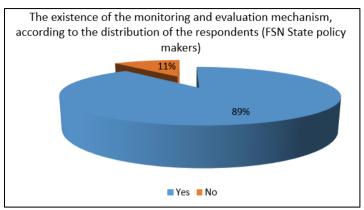## 5.4. Monitoring and evaluation System

2270

Figure 25: The existence of the monitoring and evaluation mechanism, according to the distribution of the respondents (FSN State policy makers)
Source: Author's presentation based on research survey, (Appendix 7.29).

Figure 25 shows that 89 % of the policy makers in the State said that there are monitoring and evaluation mechanisms concerning FSN, only 11% of the respondents said there is no mechanism at all.

6.   SUMMARY, CONCIUSION AND RECOMMENDATION

This chapter highlights the summary, conclusions, and recommendations of the study as well as suggestions for future research.

6.1.   Summary

Now a day food security issues become one of the critical concerns and top priority area for developing countries. Having clear picture on food security status and its major determinants helps policy makers and planners to devise new policies that enhance food security. Hence, this study was carried out in Gezira State among vegetables farmers along Blue Nile river bank, this study is to determine the status of food security and poverty of the household in the state and to assess and evaluate the situation of food security and nutrition policy in the state.

The study used primary and secondary data, Primary data were collected using structured questionnaires (two questionnaires) household of vegetables farmers and targeting state policy makers. SPSS software was used to analyze the data and DAD software for poverty analysis were used to analyze severity and depth of poverty and inequality. In order to achieve these objectives; demographic and socio-economic data a stratified sampling technique was used to select the respondents that were interviewed, the households were selected from five localities lays across Blue Nile river. In all 150 farming households were interviewed. Policy documents were collected by the mean of questionnaire targeting state policy makers.

2271

Poverty indices were calculated using expenditure and income as welfare indicator. Gini coefficient was used to gain insight into the degree of inequality in the distribution of expenditure and income, the results showed that the majority (75%) of the respondents were above poverty line.

The result shows that there were 25% under poverty line ,5% the depth of poverty and 2% the severity o poverty and 0.47 the value of Gini inequality, about 50.7% use borrowing from others as one of their coping strategies. The result shows that there was a food security body in the state and acceptable access and utility concern the pillars of food security in the study area.

6.2. Conclusion

From all the previous information the following have been concluded:

a) In total sample households, the depth and severity of poverty, were 5% and 2%, respectively when the poverty line (7196) SDG was applied while the head count index were25%.

b) According to Gini coefficient the income distribution estimated at 0.46 while that for expenditure distribution is estimated at 0.31, These results suggest a higher degree of inequality in the distribution of income compared to expenditure distribution among the study sample.

c) The main findings related to the application of coping strategies were that households applied short-term food consumption coping strategies to cope with food shortages,

d) There was a food security body in the state (FNSC.

e) There are monitoring and evaluation mechanisms concerning FSNand the financial aid is not sufficient.

f) No existence of zakat champer and NGO in the area of study.

g) Absnce of extension services.

6.3. RECOMMENDATIONS

The study recommended the following:

- The cash transfer needed to lift the poor out of poverty each poor person represents 5 percent of the poverty line, so government policy intervention should target this 5% of the poorest among the poor.

2272

- Strengthening capacity building for extension workers and provide transportation means to reach farmers in their farms

- More social services through Zakat champer will increase likelihood of being in a low povertystatus especially inMedani and East Geziralocalities

- Understanding the coping strategies could be a good starting point to develop and formulate community based contextually sensitive interventions to improve the situation of household food insecurity.

- Improvement in the level of educational attainment; since low level of educational attainment predisposes farmers to poverty in the study area.

- Access to loan facilities: loan facilities should be made available and accessible to farming households at moderate facilities. and diversification of household economic activities to include off-farm income.

- Provision of alternative source of income (off-farm income) for poor households farmers;

- Build a food security and nutrition policy putting the natural resources conservation in consideration.

- Give the State Food Security Technical Secretariat (SFSTS) a power to conduct their recommendation and follow the implementation.

- Policies interventions are useful for eliminating the existing inequalities and boost farm output. Moreover, supporting low incomegroups, provide loan for products, facilitate access to market, and ongoing monitoring of food

- Conduct further studies on food security conditions among vegetable farmers in non-Nile areas.

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2280