

INFLUENCE OF IRRIGATION WATER SUPPLY ON FOOD SECURITY AMONG HOUSEHOLDS IN LARE WARD IN NJORO SUB-COUNTY, NAKURU COUNTY, KENYA

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Abstract

Food security over the last few decades has largely focused on production and the challenges facing the agricultural systems. The concept of food security has also been directly associated with hunger, poverty and humanitarian aspects. In Kenya, food insecurity affects people living in the rural, urban, high potential, arid and semi-arid areas and the current food policies have had limited success. This study employed a descriptive survey research design to assess the influence of irrigation water supply on food security among households in Lare Ward in Njoro Sub-County, Nakuru County, Kenya. A random sample of 97 households in Lare Ward of Njoro Sub-County was conducted. Data was collected using structured questionnaires. Descriptive statistics such as frequencies and percentages were used to summarise data while inferential statistics in form of chi-square was used to test the formulated research hypothesis. The study found that irrigation water supply had significant influence on food security. It thus recommended that water harvesting should be promoted by both the County and National Governments so as to have enough water throughout the year for irrigation purposes which will in turn boost food Security in the area of concern for this study in particular and the whole Country in general.

Keywords: Food Security, Households, Irrigation, Water Supply

I.INTRODUCTION

Food security, as defined by the United Nations' Committee on World Food Security, is the condition in which all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The 2018 Global Report on Food security indicates an estimated 124 million people in 51 countries are currently facing Crisis food insecurity. Climate change, conflict and insecurity continued to be the primary drivers of food insecurity (FAO, 2018). The global food security challenge is straightforward in that by 2050, the world must feed 9 billion people. The demand for food will be 60 percent greater than it is today (FAO, 2018)

Population growth in Africa is expected to double from 1 to 2 billion by 2050. Populations in the developing world are also becoming increasingly urbanized, with 2.5 billion additional urban residents projected in Africa and Asia (World Resources Institute, 2018) Not only is the population growing, but its diet is changing too. Climate change poses another problem. Currently, 40 percent of the world's landmass is arid and rising temperatures will turn yet more of it into desert. At current rates, the amount of food we're producing today will feed only half of the population by 2050 (World Resources Institute, 2018). Water scarcity is another impending crisis: 28 percent of agriculture lies in water-stressed regions. It takes roughly 1,500 litres of water to produce a kilogram of wheat, and about 16,000 litres to produce a kilogram of beef. In 2050, we'll need twice as much water.

There are troubled farmers in developed countries where less than 2 percent of people grow crops or breed animals for food. Fewer and fewer people are choosing farming as an occupation. Meanwhile, food prices are rising, arable land continues to be lost to sprawl and

soil is being degraded by over-farming (World Resources Institute, 2018). In 2007 and into the first half of 2008, global food prices increased sharply stirring social unrest and riots in both developing and developed economies, from Bangladesh to Brazil, from Mexico to Mozambique. This prompted the World Economic Forum to define in 2009 a New Vision for Agriculture (NVA) to achieve through market-based public-private approaches 20 percent improvement in food security, environmental sustainability and economic opportunities every decade till 2050 (World Economic Forum , 2017)

The agricultural sector contributes approximately 30 percent of Gross Domestic Product (GDP) annually. However, Kenya is classified as a food deficit country. Currently, close to 1 in every 3 Kenyans (14.5 million) suffer from chronic food insecurity and poor nutrition annually (Kenya National Bureau of Standards, 2013) Agricultural production has not increased in tandem with the rapid growth in population, and with increased competition for land, the area under agriculture has been declining with time. The Ministry of Agriculture and Irrigation estimates the annual food available per person at 81kg for maize, 7kg for rice and 21kg for potatoes. The low levels of food crop supply has been as a result of several factors, namely: high cost of farm inputs, low adopting of technology, rising prevalence of pests and diseases, climate change and variability, collapsed marketing system, and the conversion of agricultural land into other uses (KIPPRA, 2011).

In addition, migration from rural to urban areas especially among young people has meant that only old people are left in rural areas to carry on agricultural production activities. Unlike crops, livestock production has shown tremendous growth since 1969. In Kenya, the bulk of the beef is produced in ASAL counties where pastoralism is the dominant livelihood activity and is highly vulnerable to drought thus calling for water harvesting (KIPPRA, 2011). The Kenyan government in response to recurrent food crises since independence has in the past attempted to tackle the crises through formulation of various policies. These policies have largely been targeted on three types of interventions such as increasing supply, stabilizing prices and enhancing income related policy interventions. The Government has prioritized food and nutrition security under the “Big Four” agenda. It has pledged to ensure that all Kenyans are food secure by the year 2022 through expansion of food production and supply, reduction of food prices to ensure affordability, and through support to value addition in the food processing value chain (ibid).

Water management in agriculture is a big challenge in Kenya. (Big Four Agenda, 2018). Water harvesting (WH) is the collection of rainfall runoff for subsequent beneficial use. Farmers worldwide have been using it for centuries to both reduce erosion and increase crop yields and production reliability. Many water harvesting technologies originate locally, and others have been introduced from other regions or countries. Various classifications of WH technologies exist but, at the broadest level, the term “rainwater harvesting” is applied to those technologies that harvest runoff from roofs or ground surfaces and “floodwater harvesting” is applied to those that collect discharges from watercourses (Pacey, 1991).

II. RESEARCH OBJECTIVE

- (i) Influence of irrigation water supply on food security among households in Lare Ward in Njoro Sub-County, Nakuru County, Kenya.

III. RESEARCH HYPOTHESIS

- (i) **H₀₁:** Irrigation water supply has no significant influence on food security among households in Lare Ward in Njoro Sub-County, Nakuru County, Kenya.

IV. LITERATURE REVIEW

Food Security Status Globally

Global food demand is expected to be more than double by 2050 because of population growth and increased per capita consumption. While the challenge cannot be met through increased agricultural production alone, increased production is essential as part of the solution (Rao *et al*, 2007). Concepts of food security globally, have evolved in the last thirty years to reflect changes in official policy thinking (Clay, 2002). The term first originated in the mid-1970s, when the World Food Conference (1974) defined food security in terms of food supply, assuring the availability and price stability of basic foodstuffs at the international and national level. Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices (FAO, 2018).

In 1983, FAO analysis focused on food access, leading to a definition based on the balance between the demand and supply side of the food security equation. Food security was thus defined as ensuring that all people at all times have both physical and economic access to the basic food that they need (FAO, 1983). The definition was revised to include the individual and household level, in addition to the regional and national level of aggregation, in food security analysis. In 1986, the highly influential World Bank Report on Poverty and Hunger (World Bank, 2009) focused on temporal dynamics of food insecurity (Clay, 2002). The report introduced the distinction between chronic food insecurity, associated with problems of continuing or structural poverty and low incomes, and transitory food insecurity, which involved periods of intensified pressure caused by natural disasters, economic collapse or conflict. This was complemented by Sen's theory of famine (1981) which highlighted the effect of personal entitlements on food access. The link between food security, starvation and crop failure has been known in the past, but analysis of food insecurity as a social and political construct has emerged (Duveskong, 2001)

More recently, the ethical and human rights dimension of food security has come into focus. The Right to Food is not a new concept, and was first recognized in the UN Declaration of Human Rights in 1948. In 1996, the formal adoption of the Right to Adequate Food marked a milestone achievement by World Food Summit delegates. It pointed the way towards the possibility of a rights based approach to food security. Currently over 40 countries have the right to food enshrined in their constitution and FAO estimates that the right to food could be judicial in some 54 countries (McCall, 1994). In 2004, a set of voluntary guidelines supporting the progressive realization of the right to adequate food in the context of national food security were elaborated by an Intergovernmental Working Group under the auspices of the FAO Council.

Efforts to combat hunger and malnutrition have advanced significantly since 2000. Ending hunger, food insecurity and malnutrition for all, however, will require continued and focused efforts, especially in Asia and Africa. More investments in agriculture, including government spending and aid, are needed to increase capacity for agricultural productivity. Ending hunger demands sustainable food production systems and resilient agricultural practices (FAO, 2018). The share of sector-allocable aid allocated to agriculture from member countries of the

Development Assistance Committee of the Organization for Economic Cooperation and Development (OECD) fell from nearly 20 percent in the mid 1980s to 7 per cent in the late 1990s, where it remained through 2015. The decline reflects a shift away from aid for financing infrastructure and production towards a greater focus on social sectors (FAO, 2018).

In 2016, the number of undernourished people in the world increased to an estimated 815 million, up from 777 million in 2015 but still down from about 900 million in the year 2000. The food security situation has visibly worsened in parts of sub-Saharan Africa and South-Eastern and Western Asia (FAO, 2018). Deteriorations have been observed most notably in situations of conflict, often compounded by droughts or floods. The situation has also deteriorated in some peaceful settings, particularly those affected by economic slowdowns. A number of countries heavily dependent on commodity exports have suffered dramatically reduced export and fiscal revenues in recent years, which has affected both food availability through reduced import capacity and food access through reduced fiscal potential to protect poor households against rising domestic food prices (World Economic Forum., 2017). The transformational vision of the 2030 Agenda for Sustainable Development calls on all countries and stakeholders to work together to end hunger and prevent all forms of malnutrition by 2030. This ambition can only be fulfilled if agriculture and food systems become sustainable, so that food supplies are stable and all people have access to adequate nutrition and health (GoK, 2007).

Food Security Status in Africa

Since the end of 2016, the African continent is facing an unprecedented rise in food insecurity. Millions of people are in urgent need of humanitarian assistance, particularly where consecutively poor rainfall, rising food prices and insecurity continues to worsen the situation. Many countries are facing emergency levels of food insecurity, which has had devastating impacts to millions whose livelihoods depend on their crops and livestock. Famine could be imminent in South Sudan, Somalia and Nigeria where conditions were quickly deteriorating in early 2018 (FAO, 2018). Ethiopia faced a serious food crisis after consecutive rain failures in 2015, combined with erratic El Nino weather conditions. Lack of rain had impacted access to water and adequate grazing land, resulting in death of livestock; abnormal migration; severe food and milk shortages and rising malnutrition. Drought has further exacerbated vulnerabilities to disease outbreaks, including acute watery diarrhoea and cholera (FAO, 2018).

Nigeria has faced one of the most severe humanitarian crises in the world. The armed conflict left an estimated 8.5 million people in need of humanitarian assistance in the worst affected states of Borno, Adamawa and Yobe. Populations suffered the cumulative impact of years of conflict and violence and food and water shortages, following consecutive seasons of poor rain fall. Food insecurity has reached crisis and emergency levels across Somalia. Years of consecutively poor rainfall has left 6.2 million people in need of emergency food and livelihood support. This is well over half of the population. Levels of acute food insecurity and malnutrition will remain high in Somalia for some time (FAO, 2018).

Food Security Status in Kenya

According to Gitu (2006) food insecurity in Kenya is either chronic or transitory. Kenya continues to grapple with the challenge of food insufficiency with the problem getting worse as the population increases against diminishing natural resources with the goal of food

sufficiency for domestic consumption and export remaining elusive (Ayieko & Tschirley, 2009). The food insecurity affects the people living in both the urban and rural areas as well as those in high potential areas just as those in the ASAL areas (Gitu, 2006). Over half of the population lack access to adequate food, the majority living in high poverty levels (Kenya National Bureau of Standards, 2013). About 40 percent of the population live below the poverty line and are permanently food insecure, another 40 percent are normally self food sufficient but are vulnerable to shocks and the rest are food secure (KIPPRA, 2011). About 51 percent and 38 percent of the rural and urban population respectively are food insecure (Gitu, 2006). About 2 million people rely on relief interventions from either the government and or other well wishers at any one time (KFSSG, 2010).

There is general consensus that while Kenya is food insecure, it has the potential to produce more than its food needs though the vibrant economic policies have had limited success in addressing food security (GoK, 2008). The agricultural sector contributes approximately 30 percent of Gross Domestic Product (GDP) annually. However, Kenya is classified as a food deficit country. The 2009 Kenya Population and Housing Census enumerated a total of 38.6 million people, representing an increase of about 35 percent from the 1999 census of 28.7 million persons (Kenya National Bureau of Standards, 2013). Agricultural production has not increased in tandem with the rapid growth in population, and with increased competition for land, the area under agriculture has been declining with time. As a result, demand for food has outstripped production. The low levels of food crop supply has been as a result of several factors, namely: high cost of farm inputs, low adopting of technology, rising prevalence of pests and diseases, climate change and variability, collapsed marketing system, and the conversion of agricultural land into other uses (Ministry of Agriculture and Rural Development, 2017).

These policy interventions are yet to attain food and nutritional security in Kenya. With this realization, the Government has prioritized food and nutrition security under the “Big Four” agenda. It has pledged to ensure that all Kenyans are food secure by the year 2022 through expansion of food production and supply, reduction of food prices to ensure affordability, and through support to value addition in the food processing value chain (KIPPRA, 2011). There is need to put in place mechanisms that provide accurate information on global, regional and local markets. Currently, there is inadequate capacity to produce consistent, accurate and timely agricultural market data and analysis especially in response to weather shocks such as floods or droughts. Likewise, information is required on production forecasts, food stocks, and food prices, on both cash and future markets. There is need to expand public spending on rural infrastructure including feeder roads, extension services, and promoting agricultural research, science and technology including biotechnology. Resource allocation to the agriculture and rural development sector has averaged about 3 percent per annum of national expenditure, which falls short of the Malabo Declaration. Financial allocations in the sector following devolution are even lower (World Economic Forum, 2017).

Water Harvesting

With a global withdrawal rate of 600 to 700 km³ per year, groundwater is the world most extracted raw material. Irrigation systems in many parts of the world strongly depend on water harvesting. However, managerial control over water resources development and protection is often lacking and that has led to uncontrolled aquifer exploitation and pollution. It has been estimated that about 80 countries, constituting 40 percent of the world population,

are suffering from serious water shortages and that within 25 years two thirds of the world population will be living in water-stressed countries (Ashton, 2002)

Although has been seen as the only option to improve crop productivity and thus the quality of life of millions of people, development of irrigation is not always possible because of the inherent climatic constraints in the arid and semi-arid regions of the world. Development of rain-fed agriculture is not only necessary to improve the food security but also is a necessary prerequisite for the sustainable development of the world (Ramaswamy, 2008). Almost 6.1 billion ha (40 percent) of the earth's total land surface is dry. It is estimated that 70 percent of partially productive dry lands are threatened by various forms of degradation, impacting the well being and future of one-sixth of the world population (Harahsheh, 2002). In many areas of the world, production capacities of dry land countries are deteriorating in the face of rapid population growth, misdirected agricultural practices, and widespread of land degradation (Rao, *et al*, 2007).

Different types of water harvesting management systems have been implemented throughout Kenya as a strategy to secure water resources in rural areas. The beauty of water harvesting is that the methods are simple enough to execute and maintain at individual or community level with little training from specialists or technicians (Mugerwa, 2007). Water harvesting technologies can be classified by the runoff generating process, the size of a catchment and the type of storage. Runoff generating processes are rivers, lakes and rainfall (Greater Horn of Africa Rain water Partnership, 2010).

V. RESEARCH METHODOLOGY

The study employed a descriptive survey research design to assess the influence of irrigation water supply on food security among households in Lare Ward in Njoro Sub-County, Nakuru County, Kenya. A random sample of 97 households in Lare Ward of Njoro Sub-County was conducted. Data was collected using pre-tested structured questionnaires. Descriptive statistics such as frequencies and percentages were used to summarise the data while inferential statistics in form of chi-square was used to test the formulated research hypothesis.

VI. RESEARCH FINDINGS AND DISCUSSIONS

Food Status in Households before Adoption of Water Harvesting

The study sought to determine how food status of the household was before they adopted water harvesting. The results were as indicated on Table 1:

Table 1: Food Status before Adoption of Water Harvesting

	Frequency	Percent
Food secure	5	5.6
Food insecure	84	94.4
Total	89	100

On food status of the households, the results on Table 1 indicate that majority 84(94.4%) of the respondents held the view that food status in their household before they adopted water harvesting was insecure while only 5(5.6%) of the respondents indicated that before adopting water harvesting food status in their household was secure.

The study secondly sought to identify whether after adopting water harvesting, food security situation changed among the households. The results to this query are as shown on Table 2:

Table 2: Changes on Food Security in Households after Adopting Water Harvesting

	Frequency	Percent
Yes	79	88.8
No	10	11.2
Total	89	100

The results on Table 2 indicate that majority 79(88.8%) of the respondents that after adopting water harvesting, food security situation had changed in their household, while 10(11.2%) of the respondents held the opinion that food security situation had not changed in their household even after adopting water harvesting. This is so because some households have water harvesting structures but are not put into proper use in terms of crop or livestock production.

The study thirdly sought to identify whether households' were food secure all the year round. The results are indicated on Table 3:

Table 3: Household Food Security in a Whole Year

	Frequency	Percent
Yes	21	23.6
No	68	76.4
Total	89	100

The results on Table 3 indicate that majority of the respondents 68(76.4%) held the opinion that their households were food insecure all year round, while (23.6%) indicated that their households were food secure. This is mitigated by buying food staffs using money from livestock products and vegetable sales.

The study fourthly sought to identify whether there was any relationship between water harvesting and food security among the households. The results are shown on Table 4:

Table 4: Relationship between Water Harvesting and Food Security in Households

	Frequency	Percent
Yes	77	86.5
No	12	13.5
Total	89	100

Based on the results on Table 4, there was a relationship between water harvesting and food security according to a larger majority 77(86.5%) of the respondents. Respondents indicated that the relationship includes; enhanced food security and improved income, while 12(13.5%) held the opinion that there was no close relationship between water harvesting and food security in their household. Further, according to key informant E₁, E₂, E₄ and E₇; level of food intensity in Lare Ward in the last five years has been severe. This has been attributed to climate change since the area is semi-arid. There has been low and erratic rainfall in the area as well as inappropriate irrigation systems used by households who practice irrigation.

Irrigation Water Supply

Respondents were asked to indicate their responses on items relating to irrigation water supply. The study firstly sought to establish what the sources of water in the households' area of residence were. The results are as indicated on Table 5:

Table 5: Sources of Water in the Area of Residence

	Frequency	Percent
Rivers	24	27
Dams	21	23.6
Water-pans	16	18
Wells	2	2.2
Bore holes	9	10.1
Roof catchment	17	19.1
Total	89	100

On sources of water, the results on Table 5 indicate that 24(27%) of the respondents drew water from rivers, 21(23.6%) draw water from dams, 17(19.1%) of the respondents get water from roof catchment, 16(18%) source of water was water pans, 9(10.1%) of the respondents indicated that their source of water was boreholes while 2(2.2%) held the opinion that wells were their source of water. Further, most respondents indicated that among the water harvesting structures that they had in their farms for harvesting irrigation water included water pans, earth dams and tanks.

The study secondly sought to establish whether from the time the respondents started practicing water harvesting, it had affected irrigation water supply in their households. The results are as indicated on Table 6:

Table 6: Relationship between Water Harvesting and Irrigation Water Supply

	Frequency	Percent
Yes	57	64.0
No	32	36.0
Total	89	100

The results on Table 6 indicate that majority of the respondents 57(64%) held the opinion that by practicing water harvesting, it has affected irrigation water supply in their households leading to increased irrigation water supply. Further, there was disagreement among households comprising 32(36%) of the respondents which were of the contrary opinion.

Influence of Irrigation Water Supply on Food Security

The main objective of the study was to assess the influence of irrigation water supply on food security among households in Lare Ward in Njoro Sub-County, Nakuru County. The influence of irrigation water supply on food security was examined using Chi-square test ($\chi^2=89.000$, $p<0.05$) as shown on Table 7, since the p value was less than the conventional probability value of 0.05, it was established that there is a significant association between irrigation water supply and food security among households in Lare Ward in Njoro Sub-County, Nakuru County. This implies that the null hypothesis (**H₀₁**) "Irrigation water supply has no significant influence on food security among households in Lare Ward in Njoro Sub-County, Nakuru County" was rejected by concluding that irrigation water supply has a significant influence on food security among households in Lare Ward in Njoro Sub-County, Nakuru County.

The results of this study are in line with Barghouti (1990) who states that water is the most important requirement of agricultural production. The results are also in agreement with those of Kelly (1998) who argues that irrigation water cools the soil and the surrounding thus

making the environment more favourable for plant growth. It also washes out and dilutes salts in the soil. Irrigation water also softens clods and hence makes tillage easy. It as well enables fertilizer applications. Farther, irrigation water reduces the adverse effects of frost on crops. Irrigation ensures crop success during durations of drought and enhances food security (Kelley, 1998). For optimum plant growth, it becomes necessary to make up for the deficiency by adding water or irrigating the root-zone soil (Farah, Nyariki, Noor, Ngugi, & Musimba, 2001). These results are as summarised on Table 7:

Table 7: Chi-square Test of Association between Irrigation Water and Food Security

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	89.000 ^a	0.012
Likelihood Ratio	64.093	1.000
Linear-by-Linear Association	4.471	0.023

VII. CONCLUSION

The study concluded that irrigation water supply has a significant influence on food security among households in Lare Ward in Njoro Sub-County, Nakuru County, Kenya. It was further concluded that after adopting irrigation for crop production, households have experienced positive changes in domestic incomes in that they are now able to produce more food than they used when they depended on rainfall for crop production. This enables them to save money for buying food as well as sell the surplus.

VIII. RECOMMENDATIONS

The study recommended that the local leadership from the County government should work a plan to ensure that the residents have a reliable source of water for irrigation purposes. The leadership should ensure that all the boreholes are cleaned regularly to remove silt or sand so that the water is made sufficient and that the residents are guaranteed water throughout the year when other water sources are not dependable or dry up.

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