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## AGRICULTURAL INFRASTRUCTURE ON SUSTAINABLE RURAL LIVELIHOODS AMONG MAKUENI COUNTY RESIDENTS, KENYA

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**Abstract:** *The purpose of this study was to investigate Agricultural infrastructure on sustainable livelihoods among the rural residents of Makueni County, Kenya. This study applied descriptive survey research design and used mixed method for data collection and analysis. The study targeted 362,105 people from two sub counties from which a sample size of 110 was drawn made up of both farmers and agricultural extension officers. The study used Disproportionate stratified random sampling techniques to select the sample size (farmers) and purposive to select the extension service providers. From the findings the mostly used approaches in reaching farmers were training in Barraza and farmer to farmer and were also reached via local radio stations. On the role of agricultural infrastructure the study found that, road transport was very unreliable and the most available means of transport was Farm animals. It was also found out that the County government provided some transport means to the local traders at minimal fee and especially during market days. Management was the main challenge facing farmer organizations leading to many withdrawing from the Sacco's hence missing the benefits. It was recommended that the county government to expand the market via value chain. It should also collaborate with NGOs for the purpose of supporting sustainable rural agriculture. The County and National governments should collaborate to extend proper road and cost effective transport means of transport for the rural farmers.*

**Key words:** *Infrastructure, Sustainable livelihoods, Resilience, Agricultural extension services*

## 1.1 Study background

Universally farmers are criticized for causing damage to the environment but they retort that they are the “stewards of the countryside”, providing landscapes and green spaces that benefit urban dwellers and tourists, and controlling the flow of water to avoid floods and droughts. It is clearly not in farmers’ interest to destroy the resources on which their livelihoods depend, but this puts them in a dilemma. All this has led to serious rethinking about the role of agriculture in our societies. What do we want from farming? How can we best feed the world while conserving natural resources? Should we be paying farmers to protect the environment? Are current farming practices sustainable? Will agricultural trade liberalization help or hinder the pursuit of a more sustainable agriculture? Therefore Sustainable agriculture seeks to achieve three main goals: economic efficiency, environmental quality and social responsibility (OECD, 2018). The production and social structures of individual farms are highly diverse, suggesting that the ability of smallholder farmers to respond to climate change and variability will be similarly varied, resulting in different farm-scale climate impacts. Strengthening the resilience of individual farms therefore forms part of a broader goal to increase the resilience of both current and future climate change and variability (Vijayan et al, 2018).

In Europe farming faces a vast range of environmental, economic, social and institutional challenges. Examples include more unpredictable producer and input prices, higher probability of extreme weather occasions, increasing dependence on land owners and financial institutions, organizational change within value chains, competing policy objectives and increasing administrative demands ,and new societal concerns and changing consumer preferences (Rosin et al., 2013; Maggio et al., 2014; Gertel and Sippel, 2016). Asia contains 10 out of 16 most vulnerable countries to climate change. Climate change is leading to sea level rise, saline intrusion into fresh water sources change of seasonality and rainfall patterns. All these changes undermine people’s livelihoods and put their live at a risk (Verisk, 2011)

African agriculture relies on rain-fed farming systems and the observed and projected climatic changes, within and across different seasons, make food production systems of Africa highly vulnerable (Lobell et al., 2011; Berg et al., 2013; IPCC, 2014). Climate change already has, and will further, result in environmental perturbations that increase the vulnerability of agricultural systems of Africa. Further changes are predicted to occur earlier than in other areas of the world and hence adaptation is urgent (UNEP, 2015. Centre for Population and Environmental Development (CPED), 2017) contents that in the Nigerian Niger Delta, more than 80% of the farmers are involved in biodiversity. When the natural biodiversity is lost through poor agricultural practices, livelihoods of the rural people who depend on agriculture are negatively affected Adjusting to shocks of live becomes a great challenge too. The government of Tanzania has put in place strategies to accomplish resilience agriculture especially in this time of climate change and variability, which includes : implement a participatory, risk-based approach to climate actions, Develop time-bound, prioritized and coasted actions, Identify entry-points to mainstream climate change adaptation and mitigation, Strengthen the institutional framework for addressing climate change issues and Leverage additional financial resources- GoT/bilateral /International sources (Government of Tanzania (GoT) , 2014).

Kenya is a drought-prone country located in East Africa, with 80 percent of the territory covered

by arid and semi-arid land where annual rainfall varies between 200-700 mm. Only about one-third of the total land area of Kenya is agriculturally productive (Wokabi, 1996). The following are some of the key approaches that the government of Kenya has adopted: Agriculture-based livelihoods that promotes equality and inclusivity, Increasing the productivity of medium-and small-scale agricultural producers through diversified practices and alignment to markets, Improving the management of land, water and other natural resources for enhanced food security and socio-economic development at national, county and community levels, Refining Livelihood resilience of targeted, vulnerable populations and enhancing access to and use of information, innovation and a global pool of knowledge and expertise drives holistic growth in the agricultural sector (FAO, 2017). The livelihoods of Makueni county residents depend on rain-fed small-scale farming, a practice that is highly vulnerable to the effects of climate change and environmental degradation. Given the strong links between population dynamics, environment, and climate change, integrated policy and program responses to addressing them would make sense and offer combined benefits for sustainable development in Makueni County (Makueni CIPD, 2013).

### **1.2 Statement of the problem**

Historical rainfall records from the Kenya meteorological department, for the last three decades show that ‘severe’ and extreme drought conditions have occurred in Makueni County. Previous studies shows that, Makueni County of Kenya has suffered many severe and extreme drought conditions the nature and impacts of which have however remained unknown and undocumented. Traditional drought resistant crops have been abandoned and livestock has remained the only viable economic activity (CIDP, 2013). Makueni County is one of those counties in Kenya with poor infrastructure network. Many rural and hardworking farmers count losses after their harvest due to poor and high cost of transport to the market, poor storage facilities that won’t allow their produce time to the market, poor electricity network and high cost which deters efficiency as well as poor irrigation systems which could not be relied upon due to poor rain patterns. If these conditions persist in the County, more and more young people will continue to engage in unsustainable livelihood activities like sand harvesting, logging, unreliable businesses like *Khat* trade, prostitution, among other unreliable livelihood activities. At this rate, the County might “lose” a generation and water down all the development achievements so far the county has achieved since the inception of devolution in the country. Studies carried in the past to investigate on the role of agricultural infrastructure on sustainable livelihoods are scanty. It is against this background that the researcher carried out empirical study in this county to confirm the phenomenon.

### **1.3 Study objectives**

The broad objective of this study was to explore the role of agricultural infrastructure on sustainable livelihoods among rural residents of Makueni County.

## 1.4 The Conceptual framework

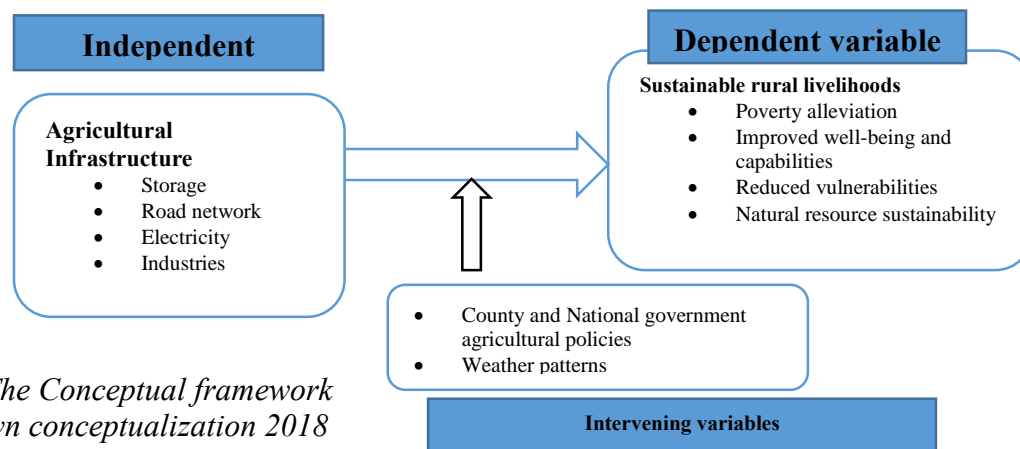


Figure 1: The Conceptual framework  
Source: Own conceptualization 2018

The above diagram demonstrates the researchers' perception on how variables for the study interact. The independent variables affect the dependent variables under the influence of the intervening variables.

## 1.5 Study Justification

Although Kenya has well-developed agricultural research systems, optimum use of modern science and technology in agricultural production is often constrained by changing climate and weather variability. The effects of climate change are felt mostly by the farmers practicing rain-fed agriculture. Makueni County's Integrated Development Plan (CIDP) identifies population dynamics, environmental degradation, poor infrastructure and climate change as key development challenges. These issues need to be linked in county policies and programs to ensure that projects that address them are implemented jointly. Addressing poor infrastructure should be a top priority if the County is to achieve sustainable development (CIDP, 2013). Therefore this study is relevant and will be able to help the residents of Makueni to adopt the resilient agricultural strategies and how to adapt to the climatic changes and have a sustainable livelihoods.

## 1.6 Theoretical and empirical review

### 1.6.1 Theoretical review

Sustainable livelihood approach (SL): This theory was first introduced by the Brundtland Commission report on Environment and Development, and the 1992 United Nations Conference on Environment and Development expanded the concept, advocating for the achievement of sustainable livelihoods as a broad goal for poverty eradication (Krantz, 2001). Chambers and Conway 1992 proposed the following definition of a sustainable rural livelihood, which is applied most commonly at the household level: A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term. SL approaches provides a way of conceptualizing key influences on the livelihoods of poor people, including their vulnerability, their access to assets, and the various

factors that influence what they can achieve with these assets. It facilitates an understanding of the underlying causes of poverty by focusing on the variety of factors, at different levels, that directly or indirectly determine or constrain poor people's access to resources/assets of different kinds, and thus their livelihoods. It employ a holistic perspective in the analysis of livelihoods to identify those issues of subject areas where an intervention could be strategically important for effective poverty reduction, either at the local level or at the policy level. With this theory however, none of the SL Approaches deal with the issue of how to identify the poor that you are trying to assist. Also, the way resources and other livelihood opportunities are distributed locally is often influenced by informal structures of social dominance and power within the communities themselves. Gender is an aspect of social relations and to the extent that relations between men and women are characterized by marked inequality and social domination, they obviously form part of the problem. All three agencies give at least some consideration to gender, but the difficulties of genuinely giving the appropriate time and space to women is not really addressed.

## **1.6.2 Literature Review**

### ***Role of infrastructure***

According to Warner and Kahan (2008) agricultural infrastructure is a major source of competitiveness in agricultural value chains and sustainable food production. This includes infrastructure that: supports on-farm production like irrigation, energy, transportation, pre- and post-harvest storage; ensures efficient trading and exchange including telecommunications and covered markets; adds value to the domestic economy like agro-processing and packaging facilities, and this enables produce to move rapidly and efficiently from farm-gate to processing facilities and then to wholesalers bulk storage. Agricultural infrastructure thus includes all of the basic services, facilities, equipment and institutions needed for efficient functioning of the food and fiber markets. FAO (1996) in one of the technical background documents for the World Food Summit, resolved that "Roads, electricity supplies, telecommunications, and other infrastructure services are limited in all rural areas, although they are of key importance to stimulate agricultural investment and growth. These deductions are supported by several empirical studies on infrastructure in developing countries ( Antle 1984; Binswanger, Khandker, and Rosenzweig 1993; Fan, Hazell, and Thorat 2000; Mundlak, Larson, and Butzer 2002; Fan, Zhang, and Zhang 2002; Fan and Zhang 2004) , which discloses that investment in infrastructure is essential to increase farmers' access to input and output markets, to stimulate the rural non-farm economy and vitalize rural towns, to increase consumer demand in rural areas, and to facilitate the integration of less-favored rural areas into national and international economies. (Andersen and Shimowaka, 2006)

Even when farmers manage to achieve higher crop yields through input subsidies, favorable rainfall patterns, or irrigation infrastructure, their harvests are still at risk because of inadequate storage facilities. Agriculture in Nigeria suffers greatly because of the lack of developed infrastructure. This is for the reason that most of the farmers operate without good infrastructure in the rural areas leading to poor investment, trade, and agricultural production. This problem is mostly caused by the government, as the government favors urban development over rural development by a great margin. The lack of infrastructure continues because of bad political leadership, poor governance, government neglect, poor maintenance culture and poor funding (Ufiobor, 2017)

Bitumen roads in Makueni County are in fairly good condition but most of the gravel and surface

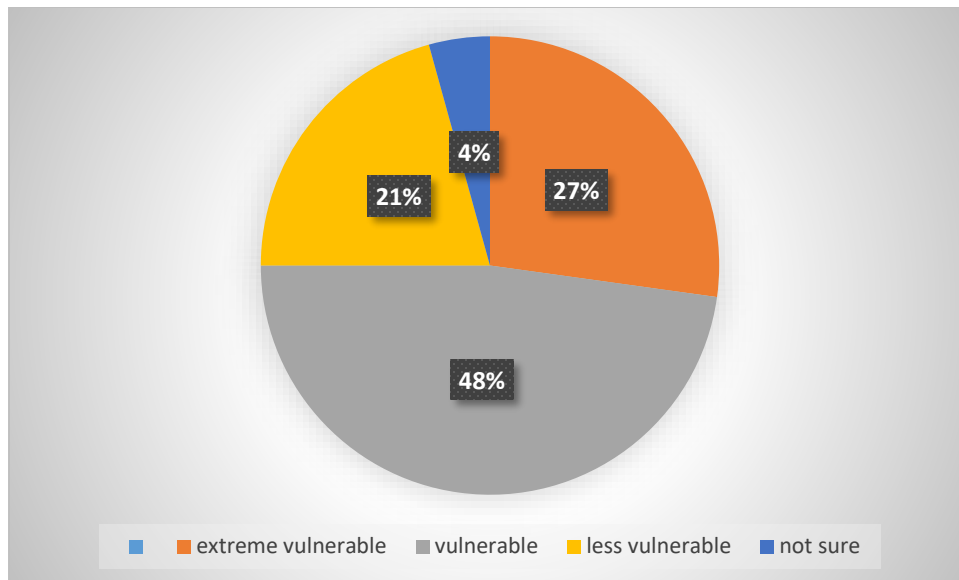
roads are in poor state which makes them impassable during rain seasons. The county is traversed by 140km railway line and one operational airstrip. The County is well served by communication and regional radio services but Television signal reception is poor and is mainly available through pay stations. Electricity coverage within the County has been expanded through the rural electrification Programme and is mostly used in the households for lighting purposes. The County experiences long hours of sunshine that has not been exploited to provide solar energy, basically due to lack of financial capabilities and low awareness of technologies for installation and utilization of this environmentally friendly renewable source of energy therefore opting to use firewood as the major source of cooking fuel whose effects poses a great danger to the environment. (CIDP, 2013). Granaries are the main storage facilities in the county for rural farmer especially cereals. Despite this there has been reported case of *aflatoxin* wherever there is plentiful harvest. The county is served by only one cereals and produce board store in Wote which help farmer in getting seeds cereals and fertilizers at reduced prices.

### **1.7 Research Methods**

The study used descriptive survey design. The relationship between the independent and dependent variable in this study were examined in both the current and past periods. The study applied qualitative method for data collection. Questionnaire and interview guide as tools for data collection were used to collect data to realize the goal of the study. The target respondents included farmers from the selected study area and the agricultural extension service providers. The projected population for Makueni and Kibwezi west constituencies in 2017 according to KNBS (2013) was 216,657 and 185,484 respectively with 40,046 of urban population. The sample size was statistically determined using the Slovine formula of 1960 to get a sample size of 100 respondents. Structure questionnaires and interview guides to collect primary data were used. Analysis of quantitative data included running of descriptive statistics such as frequencies and percentages and presented using tables, pie charts and bar graphs.

### **1.8 Research findings and discussion**

The researcher sought to understand the farmers' level of vulnerability when there is inadequate rainfalls for their crops and animals and gathered data was summarized and presented in the figure below:

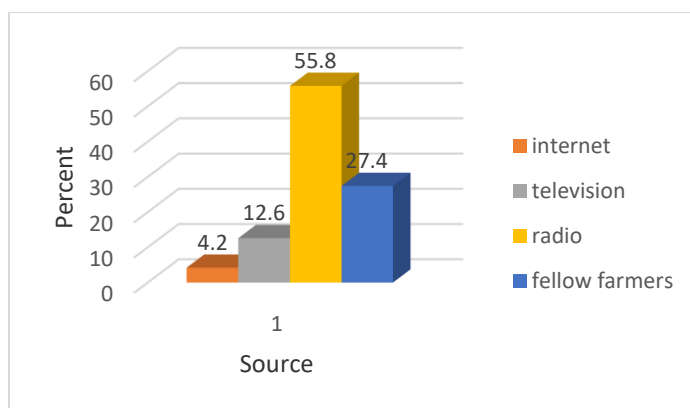


*Figure 2: Coping level when rainfalls are inadequate*  
 Source: Field data, 2018

The figure above shows that 46(48%) of the respondents were vulnerable when rainfalls are not adequate for their food crops and animals, 26(27%) are extremely vulnerable, 20(21%) are less vulnerable while the remaining 4(4%) were not sure. These findings implies that the respondents could hardly cope with inadequate rainfalls. This is because large population of the farmers depends only on the rain for their agriculture and they practice subsistence farming is where the farmer produces food for himself and his family. Farming in this case is usually done on relatively small land holding with simple farm tools. It is perceived, that the farmers in this system are poor and do not use fertilizers and improved seeds as much as they should. Productivity is usually low

***The role of agricultural infrastructure technology on sustainable livelihoods***

The researcher also sought to determine the source of information from which they got the information about the new farming methods and responses were summarized in figure 3 below:-



*Figure 3: Source of information*

Source: Field data, 2018

The above findings shows that majority 53(56%) of the farmers got the information from radio and 26(27%) from fellow farmers. This shows that the leading source of information in informing farmers about the farming methods was radio. Further implies that rural farmers are also able to use technology in farming something which reduces farming expense in different ways. This concurs with Timmer, (1988) that the technological advances has provided a route out of poverty through: directly increasing producer incomes and wages; lowering the price of food; and generating new livelihood opportunities as success in agriculture provided the basis for economic diversification

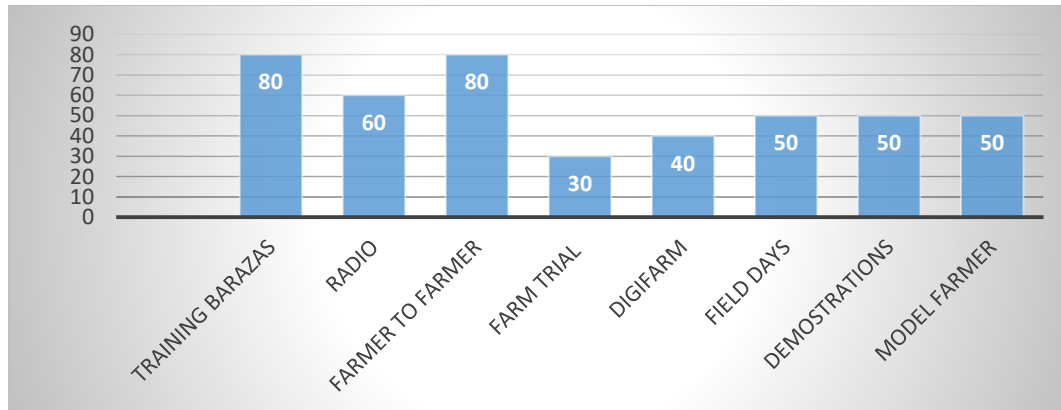


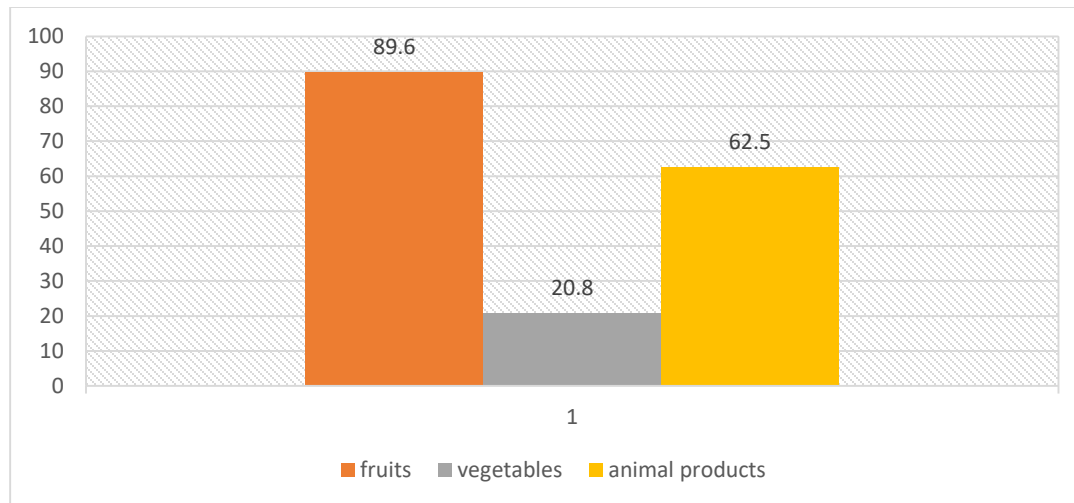
Figure 4: Approaches used to reach farmers

Source: Field data, 2018

The above figure shows that the most used approaches in reaching farmers are training Barraza in and farmer to farmer .This implied that the most convenient approaches in reaching farmers was Training Barraza’s, organized by local administrators and farmer to farmer approach. . An interview with extension officer R1 from one of the research station agreed with this findings about the approaches used to reach farmers.

*“We use Radios, mobile phones, books, pamphlets, field days, agricultural shows, and farmer field schools, administration meetings, demonstrations, model farmers, farm trials, Barazas and the digiFarms to reach our farmers.” (Respondent R1, 21<sup>st</sup> August 2018)*





*Figure 5: Type of processing done in the county*

*Source: Field data, 2018*

Figure 5. Reveals that 90% of the respondents indicated that fruit as the type of processing done in the county while 63% indicated animal's product as the type of processing done in the county. This implies both fruits and animal products are the kind of farming products which are highly processed in Makueni County. Therefore the study report shows value chain addition is done within the county, for products like Mangoes and Milk. This concurs with Andersen and Shimowaka, (2006) who stated that investment in infrastructure is essential to increase farmers' access to input and output markets, to stimulate the rural non-farm economy and vitalize rural towns, to increase consumer demand in rural areas, and to facilitate the integration of less-favored rural areas into national and international economies.

### **1.9 Conclusion**

Agricultural production has been unstable as a result of its complex dynamic and interrelated factors such as climate, markets and public policy that are beyond farmers' control. Farmers must therefore develop new farming strategy incorporating innovations in objectives, organization and practices adapted to changing production contexts. The researcher therefore concluded that for Makueni rural residents to achieve sustainable livelihoods, modern farming technology must be adopted to maximize production, control pests and use of improved breeds, improvement in infrastructure and training and forming of small groups of farmers who can be easily reached by field extension officers.

### **1.10 Recommendations**

The following recommendations were drawn for all the stakeholder involved in implementing the agricultural resilience strategies; the study recommends that the county government to expand the market via value chain and should allocate funds to improve the infrastructure. The county government should also collaborate with NGOs for the purpose of supporting sustainable rural agriculture and provide farm resources at subsidized prices [seeds, fertilizers and pesticides]. Farmers need to invest in educated on the value of resilient agricultural practices as an alternative to unsustainable livelihoods. Extension service providers needs financial support and capacity building via training to ensure they deliver effectively to the farmers.

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