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security

Gender and Generational Aspects of Sustainable Intensification

– Social-Economic Dimensions of Kenyan
Smallholder Based Agriculture and Food
Security

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AgriFoSe2030

Agriculture for Food Security 2030

- Translating science into policy and development

Today more than 800 million people around the world suffer from chronic hunger and about 2 billion from under-nutrition.

This failure by humanity is challenged in UN Sustainable Development Goal (SDG) 2: "End hunger, achieve food security and improve nutrition and promote sustainable agriculture".

The AgriFoSe2030 program directly targets SDG 2 in low-income countries by translating state-of-the-art science into clear, relevant insights that can be used to inform better practices and policies for smallholders.

The AgriFoSe 2030 program is implemented by a consortium of scientists from the Swedish University of Agricultural Sciences (SLU), Lund University, Gothenburg University and Stockholm Environment Institute and is hosted by the platform SLU Global.

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Summary

Food insecurity remains a problem in developing countries yet more than 40 million Kenyans live in dry lands, particularly and undertake agriculture as the prime livelihood activity. However, little is known about gender and generational sustainable intensification. This paper synthesised the available empirical evidence and nuanced the socio-economic dimensions of smallholder farmers, in Kenya, and reproduced the information to support policies and improve practices for sustainable agriculture. The government of Kenya has designed various policies for youth and women empowerment and entrepreneurship. However, there was found to be systematic under-representation of women and youth in policy making process that leads to perpetuation of food insecurity. Furthermore, the policies face challenges of political management, policy pluralism and sometimes lack of policy enforcement plan. Review of literature revealed that the participation of youth in the agriculture sector was low due to high production and marketing risks, land tenure insecurity, inadequacies in extension and financial services. Women are faced with inequality, asymmetry in the production and marketing information, land tenure insecurities and multiple task at household and farm level. Yet, the women and youth are a crucial group in achieving the sustainable development goals 2030 and Kenyan Vision 2030. The process of policy design and development should involve women and youth. Indigenous knowledge and creativity held by women and youth should be integrated with science through mutual learning in design and development of policies. Also, policy makers should take into account the differential vulnerabilities of men, youth and women farmers to environmental and social concerns.

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1. Introduction

Worldwide, about 870 million people suffer from hunger and malnutrition. The majority living in developing countries depend on agriculture as their main source of livelihood (FAO, 2012; Ahmed et al., 2007). The agriculture sector is the mainstay of the Kenyan economy, contributing to 24 % of national GDP directly and 27% indirectly. The agriculture sector is not only the driver of Kenya's economy, but also the means of livelihood for the majority of Kenyan people (FAO, 2010). The sector provides income to more than 80% of the population, employing over 40% of the total population and over 70% of the rural population (GoK, 2017). However, the sector is underperforming and threatened by poor governance, environmental degradation, natural resource based- conflicts and changing climate. Moreover, women and youth make essential contributions to the agricultural and rural economies in all developing countries, yet they face constraints that reduce their productivity.

More than 70% of Kenya's agricultural labour force is women and youth but they face challenges of gender inequalities and limited access to essential resources e.g. land, markets, extension services and agricultural technologies that undermine their productivity contributing to food insecurity (Institute for Development Studies, 2006). In particular the systematic under-representation of youth and women in policy making process leads to perpetuation of food insecurity. Yet for development to be sustainable and resilient, it must be inclusive particularly for vulnerable groups like women and youth. Inclusivity of women and youth is important particularly in a country where agriculture is the key sector. For instance, Kenyan Vision 2030 (GoK, 2007) identified agriculture as one of the key sectors to deliver a 10% annual economic growth rate.

Furthermore, the government of Kenya in its development strategies recognizes in order to achieve food security and industrialization smallholder subsistence agriculture, dominated by women and youth, needs to be transformed into an innovative, sustainable and commercially-oriented modern agricultural sector. In this paper we draw on the available empirical evidence to document the pathways for sustainable intensification of agriculture by critically analysing the social and economic dimensions of Kenyan smallholder based agriculture and food Security among women and youth

in Kenya. The study involved syntheses and reproduction of science in a format that can be used to support policy and improve practices within the agricultural sector. The research questions included:

1. What are the socio-economic factors that characterize agricultural performance among the youth and women?
2. What are the risks associated with smallholder farming among the youth and women?
3. What factors enhance adoption of technologies by the gender groups?
4. What factors impede adoption of technologies by the gender groups?
5. How do the youth/women cope with the ever changing factors in the economic policies, physical and political environment (e.g. climate change)?
6. How is collective action being promoted as a strategy to improve productivity?
7. Identification of gaps in policy and recommend priority policy research agenda

1.1 Empirical evidence of Food insecurity in Kenya

The achievement of national food security is a key objective of the agricultural sector. Food security in this case is defined as “a situation in which all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life” (Kenya Food Security Steering Group,-KFSSG- 2008). In the recent years, the country has been facing severe food insecurity problems. These are depicted by a high proportion of the population having no access to food in the right amounts and quality (KFSSG, 2008). Official estimates indicate over 20 million people in Kenya are food insecure with majority of them living on food relief. Households are also incurring huge food bills due to the high food prices. Maize being staple food due to the food preferences is in short supply and most households have limited choices of other food stuffs (KFSSG, 2008).

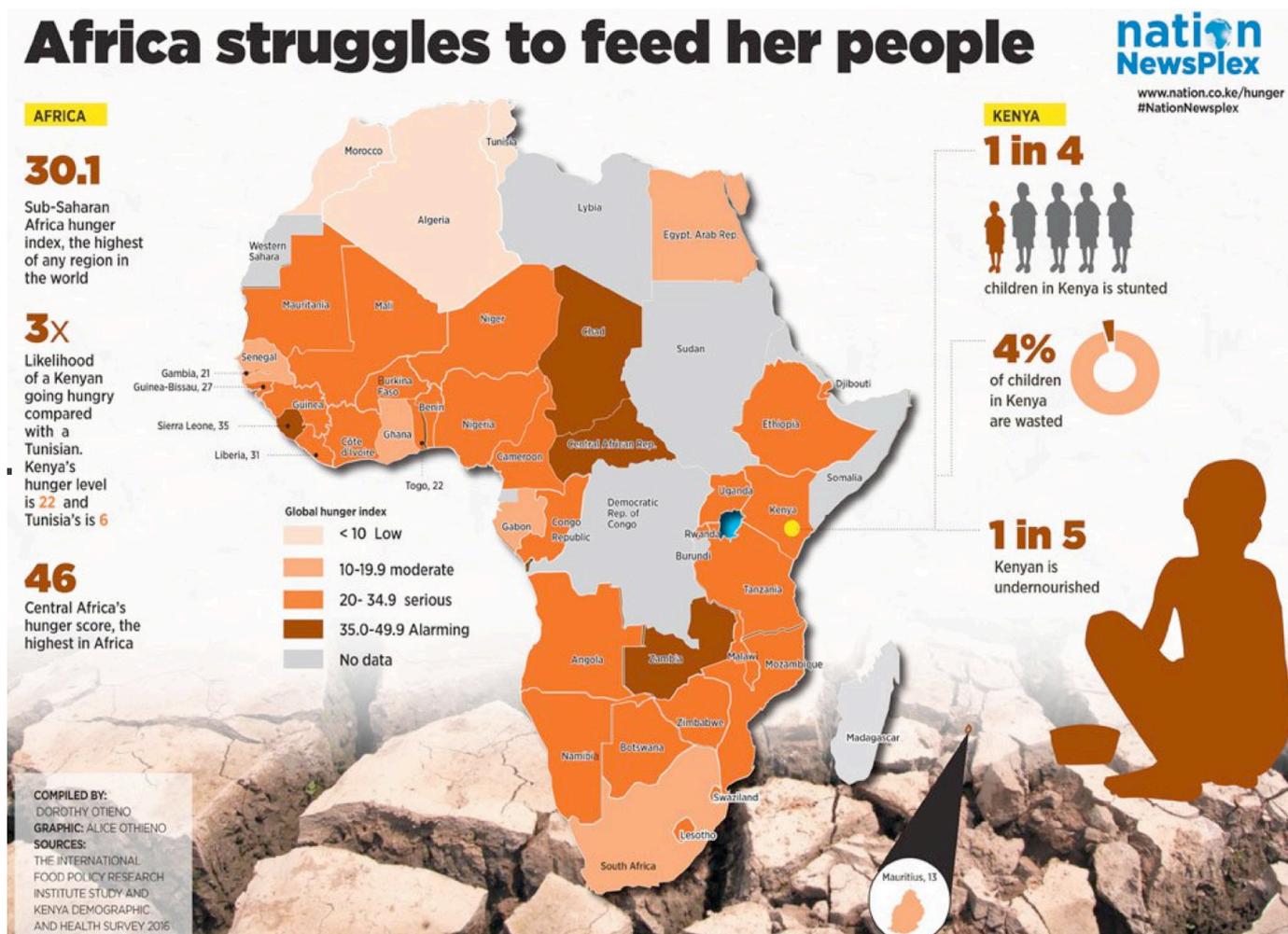


Figure 1: Empirical evidence on Kenya’s food insecurity.
 Source: The International Food Policy Research and Health Survey (2016). Global Food Policy Report.

Despite the progress Kenya has made in reducing hunger, it is among 50 countries where levels of hunger remain serious or alarming, a recent global report reveals (Figure 1). Kenya's hunger score of 22 places it at number 72 out of a list of 118 countries. The study does not include developed countries because they have extremely low hunger levels. Even with talk of rising investment in agriculture, Kenya continues to struggle to feed its people, especially its children. One in five Kenyan children is undernourished while roughly one in four children is stunted and wasted (IFPRI, 2016). In September 2016 the National Drought Management Authority (NDMA) issued drought alerts for 23 out of 47 counties and an alarm for one. According to the authority's early warning bulletins, Narok, Kajiado, Taita-Taveta, Kilifi, Kwale, Tana River, Kitui, Makueni, Marsabit and Garissa counties are experiencing a decline in food and livestock production as well as water supply.

This report is being written at a time when the Kenya government imported about 60, 000 tonnes of maize from Mexico to curb high prices of maize flour. Maize and Maize flour forms the staple food of most Kenyan communities and its inadequacies render most households food insecure. The current food insecurity problems are attributed to several factors, including the frequent drought in most parts of the country, low agricultural productivity, high costs of domestic food production due to high costs of inputs especially fertilizer, displacement of a large number of farmers in the high potential agricultural areas following the post-election violence which occurred in early 2008, high global food prices and low purchasing power for large proportion of the population due to high level of poverty, low adoption of traditional crops that are drought tolerant and in fact loss of identity. This study aims to provide useful insights to inform policy makers, address the realistic intervention programs to improve the food security and wellbeing of women and youth in Kenya.

To this end, it's not arguable that smallholder farmers have a vital role to play in Kenya food security and supporting sustainable agricultural production. Thus strengthening the environment resilience within the production, marketing and consumption frontier particularly women and youth, can increase their capacity to contribute to sustainable agricultural production and food security.

1.2 Characteristics of smallholder agriculture and implications on food security

Kenya covers 576,000 square kilometres in total land area and only 16 % is of high and medium agricultural potential with adequate and reliable rainfall (GoK, 2009). This potentially arable land is dominated by commercial agriculture with cropland occupying 31%, grazing land 30%, and forests 22% (GoK, 2009). The Arid and Semi-Arid Land (ASALs) constitute 86% and not suitable for rain-fed farming but rather used by ranchers, agro-pastoralists and pastoralists. Kenya's agriculture is mainly rain-fed, making the sector vulnerable to weather variability which leads to fluctuations in production and incomes, especially in rural areas (Alila and Atieno, 2006). Over reliance on rain-fed agriculture is one of the major causes of the country's food insecurity (UNEP, 2015). Farming in Kenya is usually on a small scale. About 75% of total agricultural output and 70% of marketed agricultural production comes from farms around two to three hectares in size (UNEP, 2014).

Adoption of improved inputs such as hybrid seed, concentrate feeds, fertilizers and pesticides or machinery by smallholders farmers is low. This indicates that there is huge potential for increasing productivity for farmers who adopt modern and green farming practices (GoK, 2009). However, population increase and extreme weather changes are the most severe challenges for smallholder agriculture sector. For instance the sub-division of land, resulting from population pressure and the relative scarcity of productive agricultural land, has resulted in small uneconomic farm sizes, which cannot be managed sustainably (UNEP, 2014). The problem is expected to increase, with available land per capita in Kenya decreasing from the present area of approximately 1.5 ha to 0.3 ha by 2050 (GoK, 2007). In addition, the smallholder farming is vulnerable to more frequent and prolonged droughts and major floods due to climate change. The increased frequency of these weather extremes is leading to intensified soil erosion, deforestation, loss of soil fertility and biodiversity and reduced productivity. These factors aggravate food insecurity. The following section provides specific syntheses of the socio economic factors that characterize women and youth performance in agriculture.

1.3 Gender inequalities and food security

The last few years have witnessed a dramatic increase in global attention to gender, its role in development and inequalities that exists between men, women and youth (World Bank, 2012; GoK, 2007). In the present Kenya political arena, the view is widely shared that addressing gender imbalances hold the potential to reduce poverty and food insecurity in Kenya while delivering on sustainable development. Women and youth issues in agricultural production have been well documented (Adeleke et al., 2010; FAO, 2012). However, little is known about gender and generational sustainable intensification. For instance, women and youth are integral part of smallholder agricultural production because they provide more than 70% of agricultural labour. Unravel the social-economic factors that influence agricultural productivity among youth and women for policy and practice is therefore imperative. Research has shown that women and youth have less access to land, labour, education, technology, extension and financial services; yet, armed with the same resources as their male counterparts, women and perhaps youths could increase yields by 20-30% (FAO, 2012)

1.4 Youths and agricultural development

The definitions of youths are contextual, depending on the social, cultural, political and economic environment (Muthee, 2010). The United Nations (year) defines youth as persons between 15 and 24 years. Kenya National Youth Policy-KNYP defines youth as persons aged 15-30 years but the Kenyan constitution gives a limit of up to 35 years (GoK, 2010). The youth development programmes which the government are implementing target persons aged 15 to 35 years. Lack of consistency in the definition of Kenyan youth reflects the difficulty that most African societies have in specifying the age bracket of youth. The youthful population in Kenya make 75% of the total population and 70% of them are unemployed (KNBS economic survey 2013). Youth are seen as Kenya's foremost social capital which presents the country with an opportunity to accelerate growth, reduce poverty and build a sustainable and peaceful

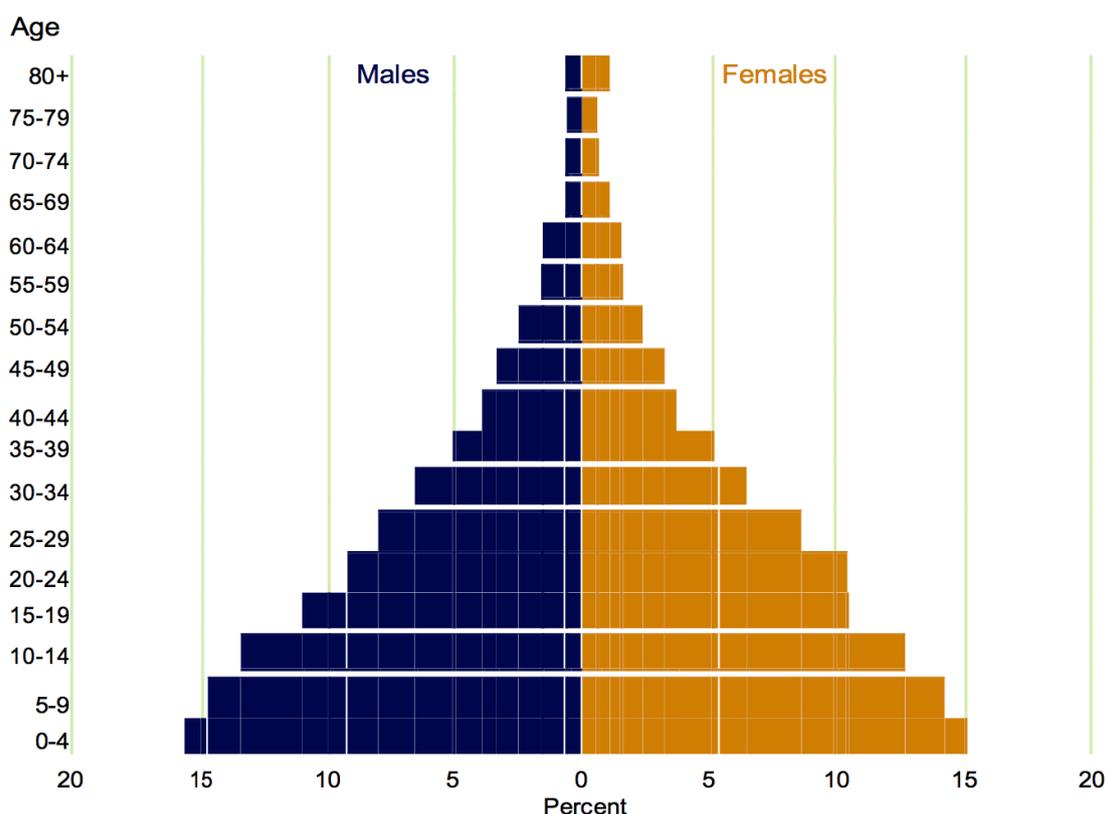


Figure 2: The age-sex structure of the Kenyan population.
Source: Kenya Population Data Sheet, 2011.

future (UNESCO, 2010). However, a large youth cohort demands adequate resources in order to meet their social and economic needs, and make a smooth transition from dependence to independence (Muthee, 2010). Empirical evidence has shown that investing in the needs of youth for education, jobs, health care and information is not only beneficial to individual youth, but to the society as a whole (Knowles and Behrman, 2003 cited in UNFPA, 2005). The youths constitute the largest population base in the country as depicted in Figure 2 below. Notably the population of women is higher than that of men as shown in Figure 2. This means that if Kenya is to achieve its food security and sustainable development, then resources allocation and distribution should be shifted more towards women and youth.

Youths possess energy, creativity and networking capacity, making them a significant resource for contributing to national development and addressing the social, economic and political impediments confronting them (UNESCO, 2010). Youth organizations and associations continuously contribute towards political stability, social cohesion and economic prosperity (Boeck and Honwana, 2005). Youth participation in the agriculture sector in many parts of Kenya is low, largely because the sector is highly unattractive due to risks, costs, inefficiency and its labour intensive nature (Irungu et al., 2015). Agricultural incomes are seasonally related to rainfall and harvest cycles, suggesting that for long periods of time, the youth would have no income (Irungu et al., 2015). As such, motivating the youth to view agriculture as a career opportunity will require a multi-level intervention. Continuous initiatives to support youth in agricultural enterprises and widen the opportunities to showcase their successes in order to attract more young people are paramount.

2. Methodology

The study used both qualitative and descriptive techniques in analysing secondary data focussed on Kenyan smallholder agriculture particularly women and youth. The analysis enabled identification of socio-economic of agricultural productivity among youth and women, adaptation strategies of youth and women to changing macro-economic and environmental policies and identification of gaps that can be addressed through policy prescription. This study was restricted to the relevant, available data and information on agriculture, food security, policies, youths and women. Literature was sourced from published journals, book chapters, grey literature, government reports and policies/laws. The work was carried within the AgriFoSe2030 for 3 months comprising between November 2016 and February 2017 involving guest research at Lund University, Sweden for the first month of the task.

3. Socio-economic factors that characterize youth and women performance in agriculture

3.1.1 Land Access and Management

Land in Kenya is owned either by the state, individuals or community. The uncertainties regarding land ownership and the inadequate access to land have been a critical challenge to smallholder farming in Kenya. In particular, access to productive land is an impediment for both the youth and women in agriculture since traditional systems bestow land ownership to family heads, invariably the senior male of a household restricting the ability of youth and women to have access to land on which they can invest (Aphunu, 2010). For married young women they may have legal access to productive land through their husbands, but they often do not have control over its usage (Tafere & Woldenhanna, 2014).

The youth face a challenge of limited access to the most crucial asset of agricultural production because it is the parent that holds the ownership of land (Justine et al., 2011). Most of the youth end up with no or small pieces of land, yet for agriculture to be profitable they need large pieces of land (FAO 2010). Farming on a large tract of land enhances economies of scale. Hence, the youths farming on small pieces of land opt to find alternative work which is hard to find (Sharma et al., 2010; Brooks et al., 2013). Furthermore, the available land in Kenya is overly subdivided into small and uneconomic units, resulting generally in fragmented production systems and low productivity. In fact, the farm sizes are as low as about 1.5ha in per household (UNEP, 2015).

Land tenure systems that discriminate women and youth in the acquisition and ownership of the agricultural land not only enhance inequality but also negatively impact on agricultural production and productivity. Some studies reveal that women who enjoy equal land rights as men experience an increase in farm productivity as there is no tenure insecurity (Karugia, 2003). The tenure security enhances practices that contributes to long term agricultural sustainability e.g. improved soil conservation that have positive implications on land productivity and food security. The Kenya Constitution 2010 provides equal rights for men and women over land ownership, though superficially. However, access to land by women and youth remains a key factor in agricultural production because land rights in many communities are mostly governed by customary laws rather than statutory (FAO, 2010). Traditional/customary laws deny women and youth right to own land. By tradition, men inherit land and women gain user rights through their relationship with a male relative (Cotula, 2011). Most of the youths cultivate the family land and many times they get no or little income from this work (Lucy et al., 2012). In rural Kenya, many people are unaware of the new constitution and entire communities' lives under the old constitution, which puts women and female youths at a disadvantage in terms of property rights.

3.1.2 The role of education among youth in agricultural productivity

Despite agriculture sector having huge a potential and to become a thriving business a great percentage of youth do not aspire for a career in agriculture due to its poor profitability and low professional status. This has led to that many youth leaves the agricultural sector for other forms of employment. In particular, the dream of most young Kenyans is to get a "white collar job" after completing education and hence they will not settle for anything less than what they have trained for (Lucy, 2010).

Youths remain an important asset for Kenya and the government has developed appropriate strategies and policies to fully engage the youth (GoK, 2007; GoK, 2006). Among the efforts include revitalization of the National Youth service; Kazi Kwa Vijana-KKV and Creation of the Kenya National Youth Policy-KNYP (GoK, 2006). One of the priority strategic areas for the KNYP was employment creation which was addressed by implementation of the Youth Enterprise Development Fund-YEDF. Kenya's KKV and YEDF activities are however overlapping and their objectives are too broad which makes them unachievable. They are also constrained by heavy government control.

As a consequence the programs are driven by politics rather than professionalism (Muthee, 2010). The policies rarely translate to practice and hence they remain rhetoric in the empowerment of youth.

A review of the YEDF revealed that the funding is mostly concentrated on non-agricultural businesses with limited mention of any agricultural enterprises. This could be expected because agriculture as an economic activity has not been embraced by the young generation who perceive it as an occupation for the old, illiterate, poor rural people (FAO, 2006). Consequently, agriculture in the country is mostly done by the older age since most Kenyan youths are moving from rural to urban areas in large numbers in search of office work. However the urban areas are not able to generate jobs as fast as the growth in population (Leavey and Hossain 2014). As a matter of fact young farmers are needed to replace the ageing farmers (Valerie, 2009). Youth are more open to new ideas and practices thus have the potential to overcome some of the major constraints to expanding agriculture such as pest control, modern technology and genetically improved seeds (Gitau, 2011). Therefore the formulation of specific policies that view youth as an important resource in agricultural production creates a favourable environment for youths to contribute to food security and create employment in a more effective manner. This is echoed by UNESCO (2004) arguing that a supportive policy framework creates common goals and collective action which serves as a basis for equitable and concerted distribution of resources to meet the needs of youth.

In order to enhance youth performance and productivity in agriculture there is need to create an environment which can foster youth talents, creativity and resilient spirit in seeking to improve their well-being (Muthee, 2010). One way of doing this, is through formulating youth-specific policies that support them to better access opportunities, credit facilities and platforms for participation in public affairs and decision making.

3.1.3 Information and Communication Technology and market participation

Information and Communication Technology in Agriculture (e-Agriculture) involves the use of internet, radios, television, mobile phones, GIS in the agricultural rural domain to enhance farm productivity. Situations of information asymmetry still prevail in the developing countries. For instance adverse selection occurs when there's a lack of symmetric information prior to a deal between a buyer and a seller, whereas moral hazard occurs when there is asymmetric information between two parties and change in behaviour of one party after a deal is struck (Okello et al., 2012). As a result, the foregoing information-related (i.e. moral hazard and adverse selection) increase transaction costs, hence limit market participation by some farmers particularly women (Fafchamps and Hill, 2005; Svensson & Yanagizawa, 2008; Okello et al., 2012). Generally, women use lower levels of technology than men because of difficulties of access e.g. cultural restrictions.

Access to education continues to be a greater barrier for women than men and youth; an estimated two thirds of the world's illiterate are women (UNESCO, 2009). Education in science and technology is considered a male domain in many cultures. Training in ICT skills is rarely gender sensitive or tailored to women's needs and is sometimes delivered by a male trainer who has embedded perceptions about women's capabilities inconsistent with a research-based understanding of women's competencies and contributions in these fields (World Bank, 2005).

However, much of the information and research on ICT and gender is more generalised which is often country specific, and more often from developed rather than developing countries, and is often not disaggregated by gender (Odame, 2005; Melhem and Tandon, 2009). For instance, much of the content on the Internet has not been developed to address the needs of women and girls in rural areas nor is it available in the languages they speak (Melhem and Tandon, 2009). Thus, there is a need for research to fully understand the complex issues of women, youth and ICTs in agriculture.

Youths cherish technology and have used ICT to transform the economy. For instance, Mkulima (meaning farmer) Young Champions have led digital initiatives, which has attracted youth to farming, stimulating trade, knowledge exchange to, overcame agricultural challenges (Irungu et al., 2015). Using ICT e.g. radio, short message services and social media youths discuss agricultural topics and share successes (Irungu et al., 2015). As an example, Mkulima Young's Facebook is a vibrant communication platform where youth posts photographs, videos, asks questions and discuss various agricultural issues and. They use internet and social media to learn about and share production technologies and market information. Most commonly used tools were MS Office and spread-sheets for record keeping (Irungu et al., 2015). This way the ICT-savvy youth operate profitable farms, intensively, efficiently producing diverse and branded products for niche markets contributing to a transformation in the economy.

3.1.4 Agricultural extension services

Extension services is one of the critical change agent required in transforming subsistence farming to modern agribusiness that promotes households food security, incomes and reduced poverty. However, there is limited access to extension services in most parts of Kenya with the National extension staff: farmer ratio standing at 1:1,500 (GoK,

2005c). The situation is particularly worse for women because women farmers have less contact with extension services than men (Chimoita, 2014). Extension is often provided to men on the erroneous assumption information and knowledge will trickle down to women. In fact, agricultural knowledge is transferred inefficiently from husband to wife. The situation has hindered most farmers, both youth and women from keeping pace with the technological advances which promote agricultural productivity. For instance, the limited facilitation of knowledge from extension officers to women and youth has resulted in lack of information on the right type of inputs and appropriate timing of application. Moreover, youth in agriculture find the extension officers out-dated and cannot identify with them (Bandara, 2011).

Besides the private extension provision is generally skewed towards well-endowed region and high-value crops (Muyanga and Jayne, 2006). This has the implication that women and youth especially those growing low-value crops with little marketable surplus are poorly served. However, non-profit private extension provided by NGOs is targeting them but their scope is limited. Thus, to improve the livelihood of smallholder farmers, private and public partnership is imperative to offer services that go beyond production and include markets and value addition (Muyanga and Jayne, 2006). The universities and other colleges have a role to play as far as equipping extension workers with relevant scientifically-derived messages is concerned. The higher learning institutions need to fine-tune their curriculum to meet the needs of the emerging realities in agricultural extension with up to date knowledge relevant for all types of small scale farmers because agricultural productivity largely depends on these services.

3.1.5 Access to financial services

One of the major socio economic factors that influence smallholder performance in agricultural production is lack of access to credit (Kosgey, 2013). Less than 10% of farmers have access to formal credit, with women faring far worse than men. Yet access to financial services is an important factor in enhancing performance and agricultural productivity among smallholder farmers.

Women and youth have less access to formal financial services because of high transaction costs, limited mobility, social cultural barriers, the nature of their social roles and collateral requirements such as titles they can't meet (Fletschner, 2009). Financial capital is important for securing farm inputs such as fertilizer, seeds, artificial insemination, and other farming technology. In cases of credit acquisition, women are often not able to get these facilities without a male/husband guarantor (Fletschner and Kenney, 2011). The cost of key inputs such as seed, pesticides, fertilizer, drugs and vaccines is high for resource-poor farmers. Most farmers therefore do not use them. This greatly reduces the yield that the farmers get.

There is evidence that male farmers access more agricultural credit than female, for instance, in Uasin Gishu about 79% and 21% of male and female farmer's respectively accessed financial credit. The implication is that male headed households had more access to agricultural credit than their female counterparts due to the fact that land ownership was dominated by male. This is attributed to collateral security which is a requirement by financial institutions and is traditionally owned by male farmers (Kosgey, 2013). Therefore, it would be imperative to design financial credit facilities where women have direct access without male/husband guarantor. The credit should also be sensitive to the farming scale of women.

Some financial institutions take the farmers age important parameter in approving loan applications (Kosgey, 2013). Age is considered as a measure of maturity and ability to work efficiently. For instance, in Uasin Gishu Kenya a study found out that 34% of those farmers with over 50 years had accessed agricultural credit as compared to 4% of 20-29 years of age who accessed credit (Kosgey, 2013). The middle age farmers are presumed by the financial institutions as more responsible and mature, hence given a loan they are presumed to invest wisely, resulting to prompt repayment. The young farmers on the other hand are considered less responsible by the financial institutions and have high chances of defaulting loans. However, older farmers of over 50 years are considered to be experienced in farming and utilizing credit.

Policy-makers have long understood that farmers who cannot meet their needs for capital must settle for suboptimal production strategies (Fletschner and Kenney, 2011). When smallholder farmers are unable to make the necessary upfront investments or cannot bear additional risk, they have to forgo opportunities to boost their agricultural productivity, enhance their income and improve their well-being (Boucher et al., 2008, and; World Bank 2008a). Conversely, producers who have access to well-designed credit, savings and insurance services can avail themselves of capital to finance the inputs, labour and equipment they need to generate income; can afford to invest in riskier but more profitable enterprises and asset portfolios; can reach markets more effectively; and can adopt more efficient strategies to stabilize their food consumption (Zeller et al., 1997). In the aggregate, broader access to financial services provides opportunities for improving the agricultural output, food security and economic vitality of entire communities and nations.

3.1.6 Returns to agricultural Labour

Globally, women constitute about 43% of agricultural labour force compared to 70% of that in Kenya (Anríquez et al., 2011). Overall the labour burden of rural women exceeds that of men, and includes a higher proportion of unpaid household responsibilities such as nurturing children, preparing food, collecting fuel and water. The contribution of women to agricultural and food production is significant but it is impossible to verify empirically the share produced by women. Actually, many of these activities are not defined as “economically active employment” in national accounts but they are nevertheless essential to the wellbeing of rural households.

Women’s participation in rural labour markets varies considerably across regions, but invariably women are over represented in unpaid, seasonal and part-time work. Studies suggests that women are often paid less than men, for the same work (Kiptot and Franzel, 2011; Kosgey, 2013; Kiptot et al., 2014).

As regard to agricultural output ownership, men and women have separate rights. Women rights are mostly confined to livestock and crops that are considered subsistence. Whenever the crop/livestock become valuable or economically lucrative in generating cash, they are taken over by men. Some studies on agroforestry (Kiptot and Franzel, 2011; Kiptot et al., 2014) revealed that men and women have separate rights to different parts of the trees; women rights are confined to by products such as branches, fodder and fruits because these products are considered secondary with insignificant economic importance but whenever they start becoming valuable they are taken over by men.

In regard to small holder agricultural calendar planning and implementation (such as timing for sowing, harvesting etc), the women crops never receive a priority, yet such crops have a large impact on household food and income security. For instance, Andrede et al. (2009) indicated that the orange-fleshed sweet potato varieties, predominantly grown by women and rarely have a priority in crop planting cycle. Sweet potatoes an important source of beta carotene a Vitamin A precursor which can be used to combat vitamin A deficiencies which if not addressed can lead to increased child mortality.

3.2 What are the riskt associated with smallholder farming by women and youth

Risks that are mostly associated with agricultural production particularly for smallholder agriculture fall under two categories namely, production risks and marketing risks (D’Alessandro et al., 2015). The production risks involve those related to climate changes and variability, pest and diseases; this report will mostly dwell on the former. The marketing risks discussed are mostly associated with agricultural product price volatility, influence of imports and postharvest handling.

3.2.1 Climate variability related risks

Kenya’s smallholder agriculture dominated by women and youth and evidence is strong that climate change will continue to have negative impacts on agriculture, increasing the vulnerability of smallholder farmers, especially in tropical regions (Ochieng et al., 2016). Climate change exacerbates the production challenges faced by smallholders and increases the likelihood of agricultural income losses, pests and diseases, and asset depletion. For example, yields of staple crops grown by smallholders, such as maize, rice, and wheat, are expected to decline in the coming years as a result of climate change.

The smallholder farmers in developing countries are particularly vulnerable because their livelihoods are directly dependent on natural resources. According to Kabubo-Mariara and Kabara (2015) the women and perhaps youths are most vulnerable to climate change risks because they have few resources with which to adapt to the anticipated change. Moreover, lack of planning and poor management at the central level impedes or delays recovery from climate-related shocks and in some cases even leads to increased economic and social damage (Kabubo-Mariara and Kabara, 2015). Climate change exacerbates the production challenges faced by women and youths and increase the likelihood of agricultural income losses, due to droughts, pests, diseases and asset depletion (Nwanze and Fan, 2016).

The size of land tied with varying temperatures and rainfall patterns and poor soil fertility impact pose a real risk to smallholder farmers’ productivity of the various crops (Ainsworth and McGrath, 2010). For instance, some crops become more vulnerable and susceptible to pest attacks and disease that lead to reduced crop yield, poor quality produce and sometimes contribute to total crop failure. The increased incidence of droughts across Kenya’s arid and semiarid lands (ASALs), where most smallholders farming is undertaken, in recent years means that affected communities have less time to recover and rebuild their assets. This has weakened traditional coping mechanisms, handicapping household resilience against future shocks (D’Alessandro et al., 2015). Most smallholder farmers are particularly vulnerable to the effects of droughts and floods.

Erratic rainfall has resulted to moisture stress particularly for maize which is highly susceptible to drought. Kenya's crop production is heavily rainfed and the unpredictable and unreliable rainfall patterns has rendered the country increasingly vulnerable to supply disruptions and food shortages and this has significant implications for the country's food security (Kabara and Kabubo-Mariara, 2011; D'Alessandro et al., 2015). For example, yields of staple crops grown by smallholders, such as maize, rice, and wheat, are expected to decline in the coming years as a result of climate change (IPCC, 2001; Nwanze and Fan, 2016).

In response to the changing climate, the GoK has initiated efforts to improve climate risk management within the agriculture sector through its National Policy for the Sustainable Development of Arid and Semi Arid Lands of Kenya (2007) and Agriculture Sector Development Strategy 2010–2020 (GoK, 2010). Some of the government commitments to climate risk management actions include climate smart agriculture strategy, expansion of irrigation infrastructure, investments in water storage and rainwater harvesting (GoK, 2010; Ikiara et al., 2009).

Many subsistence crops, such as cassava, sorghum, sweet potatoes are more drought tolerant than maize. Given that these crops are grown by small scale farmer, and particularly by women, one could argue that women farmers are important from a climate change resilience perspective and that support to these crops and farming systems around them can make the agricultural system more resilience. This could increase the resilience and viability of smallholder farming and contribute broadly to the reduction of hunger and poverty. Therefore, to avert negative consequences of climate variability risk, and for climate change management to be successful, an effective policy framework should address the specific pathways to enhance smallholder agricultural productivity and resilience.

3.2.2 Market related risks

Studies have evidenced that at the market level, price volatility is the most significant risk. Producer prices in Kenya for key crops e.g. maize, rice, coffee are subject to moderate to high levels of price variability (D'Alessandro et al., 2015). The domestic maize prices tend to be more volatile than international maize prices, as domestic prices are highly sensitive to uncertainty. Moreover, the Kenya's growing cereal imports bring added uncertainty to the country's food security situation (D'Alessandro et al., 2015). Imports today make up 37 % a higher proportion than they did a decade ago. This exposes the country to external pressure that can adversely impact domestic food prices, availability and access.

The negative attitude youths have towards agriculture could be a major causes of non-engagement in agriculture (Bandara, 2011). The image created around agricultural pursuits as a means of livelihood is not encouraging as only elderly people are involved while the youth are absent in the value chain. The negative stigma of pursuing agriculture as a career together with the market risks influences youth to stay away from it (Bandara, 2011). The aforementioned factors could expose the youths to market based risks and put them off the track of ever engaging in agriculture.

3.2.3 Minimal participation of youths and women in policy processes

Minimal participation of youths and women in agricultural policy dialogue is a risk to those who farm. Participation and representation of youth, women as well as men in the decision making process is critical for effective implementation of policies that affect a nation's economy growth and development. On many occasions, the youth and women voices are not heard during the policy process, and so their complex needs are not met. Policies often fail to account for the heterogeneity of youth and women, and so do not provide them with effective support. For instance, although population of women and youth at all levels is almost equally matched, the political representation is heavily skewed in favour of men. Women made up barely 9.8% of the members of the 10th parliament in 2008-2013. This compares poorly with the global average of 18.8% (Mwatha et al., 2013).

According to (Institute of Economic Affairs, 2008) the lack of involvement of women and youth in decision making processes can be attributed to:

1. Social customs and diversified social roles that women play i.e. agricultural activities, nurturing children and many of the household chores limiting their participation in decision making
2. Negative stereotypes and socio-cultural attitude reinforced with strong patriarchal family system that work against women and youth
3. Limited access to financial base to sustain competitive political campaigns in favour of women and youth empowerment.

These have resulted to low participation, poor representation and lack of appreciation of women's and youth's roles in agriculture. Consequently, these have given rise to lack of specific and misdirected policies which are opposed to the process of mutual learning that reflects the real and specific needs of women and youth.

3.2.4 School-to-work transition

School-to-work transition puts the youth in a risky position. The obvious indicator is unemployment that has been a prominent risk factor among the youth not because they don't have the motivation, the ambition or the energy: the real barriers facing unemployed young people are inexperience and a lack of specific employment skills (Ombagi, year not cited).

Most employers will ask for years of working experience that expose the youth to the cycle of "no job, no experience, and no job". This ultimately exposes youth conflicts, drug abuse, poor health, nutrition and housing. However, these problems can be addressed with appropriate government and private sector interventions and society contribution (Ombagi, year not cited).

With the perspective that agriculture isn't lucrative, the youth have tended to alienate themselves from pursuing it. This has resulted in the negative effects of the youth study-to-work transition, which has been more extensive in the agricultural sector than in any other sector. When youths venture into agriculture they often lack inadequate knowledge making it more difficult to undertake it. One way of making it agriculture more attractive to youth is to increase the emphasis on agribusiness and value additions opportunities in agricultural training curricula.

3.3 Factors that influence adoption of technologies among women and youth smallholder farmers in Kenya

The Green Revolution which dramatically boosted the yields of Asia and Latin America bypassed Africa, is a clear manifestation of the potential of agricultural technologies in improving livelihoods particularly in the developing world (Kasirye, 2010).

Globally, agricultural transformation has been attributed to improved technologies such as fertilizer, improved seeds, sustainable soil and water conservation technologies (Gabre-Madhin and Johnston, 2002). Thus adoption of these technologies by farmers provided opportunities for increasing agricultural productivity, household incomes and employment opportunities (Sunding and Zilberman, 2001; Doss, 2006; Kasirye, 2010; Mutune et al., 2011). However, over 70% of maize smallholder farmers rely on traditional methods of production, which has lowered the level of productivity (Muzari et al., 2012). Though the factors that enhance or impede technology use may vary by crop or region there are some universal factors that influence the adoption of agricultural technologies.

Reviewed studies have evidenced that there are many categories for grouping determinants of technology adoption (Rogers, 2003; Uaiene, 2009; Akudugu et al., 2012; Ogada, 2014), There is no clear distinguishing feature between institutional and technology variables in each category. Rather, categorization is done to suit the current technology being investigated, such as location, and researcher's preference or clients' needs (Bonabana- Wabbi 2002). This study will review the determinants of technology adoption and categorized them into technology, economic, institutional and household specific factors. Notably, factors that affect technology uptake cut across gender.

3.3.1 Technology factors

Characteristic of a technology is a precondition of adopting it (Mwangi and Kariuki, 2015). These could involve the trialability, suitability/relevance and perception of the particular technology by the farmers. In studying determinants of adopting Imazapyr-Resistant maize technology in Western Kenya, Mignouna et al. (2011) stated that, the characteristic of the technology play a critical role in adoption decision process. They argued that farmers who perceive that the technology is consistent with their needs and compatible to their environment are likely to adopt it since they find it as a positive investment. Farmers' perception about the performance of the technologies significantly influences their decision to adopt them. Sinja et al. (2004) found out that the farmers' perception of the two fodders legume; calliandra and desmodium, in Central Kenya highlands had a significant impact on their adoption of the technology. A study by Adesina and Zinnah (1993) showed that farmers' perception of characteristic of modern rice variety significantly influenced their decision to adopt it. It is therefore important that for any new technology to be introduced to farmers, they should be involved in its evaluation to find its suitability to their circumstances (Sinja et al., 2004).

The use of modern technologies for example of improved crop, livestock varieties and fertilizers by smallholder farmers are always expected to increase production efficiencies. However, the majority of smallholders are unable to afford the high prices of these inputs, which leads to lack of adoption of new technologies and reduced agricultural production.

3.3.2 Economic Factors

Farm size plays a critical role in adoption of agricultural technologies and can be affected by other factors influencing adoption (Lavison, 2013). Some studies have reported a positive relation between farm size and adoption of agricultural technologies (Gabre-Madhin and Haggblade, 2001; Ahmed, 2004; Uaiene et al., 2009; Mignouna et al., 2011). Farmers with large farm sizes are likely to adopt a new technology as they can afford to devote part of their land to try new technologies unlike those with small sizes (Uaiene et al., 2009). In addition sustainable soil conservation technologies for example conservation tillage are likely to be adopted by farmers with larger farm size. Farmers with bigger farm sizes may have extra land to try out new practices before they decide to switch from conventional practices (Mutune et al., 2011). However, small farm size may provide an incentive to adopt a technology especially in the case of an input-intensive innovation such as, a labour-intensive or land-saving technology. Farmers with small land may adopt land-saving technologies such as, greenhouse technology, zero grazing among others as an alternative to increased agricultural production (Yaron, Dinar and Voet, 1992).

The cost of agricultural technology can enhance or inhibit adoption, for instance, the elimination of subsidies on prices of seeds and fertilizers in the 1990s due to the World Bank-sponsored structural adjustment programs in SSA widened the low adoption of this technologies (Muzari et al., 2013). Previous studies (Makokha et al., 2001; Mutune et al., 2011) on determinants of technology have reported high cost of technology as a hindrance to adoption. A study undertaken by Makokha et al. (2001) on determinants of fertilizer and manure use in maize production in Kiambu county, Kenya reported high cost of labour and other inputs, unavailability of demanded packages and untimely delivery as the main constraints to fertilizer adoption. The cost of hired labour was one of the factors constraining adoption of fertilizer and hybrid seed in Embu county Kenya (Ouma et al., 2002). Wekesa et al. (2003) analysed determinants of adoption of improved maize variety in coastal lowlands of Kenya and found high cost and unavailability of seeds as one of factors responsible for low rate of adoption. Their findings are consistent with those of the International Maize and Wheat Improvement Centre (CIMMYT) studies as summarized by Doss (2007). Other cross-sectional studies that focused on different technologies such as, dairy and soil and water conservation found similar results (Ogada et al., 2010; Oostendorp and Zaal, 2011).

Off farm income has been shown to have a positive impact on technology adoption because it acts as an important strategy for overcoming credit constraints faced by the rural households in many developing countries (Reardon et al., 2007). Off-farm income is reported to act as a substitute for borrowed capital in rural economies where credit markets are either missing or dysfunctional (Ellis and Freeman, 2004; Diiro, 2013). A study by Diiro (2013) revealed that off-farm income is expected to provide farmers with liquid capital for purchasing productivity enhancing inputs such as improved seed and fertilizers. A study on conservation tillage by Mutune et al. (2011) argued that the financial resources obtained through off farm employments enables a household to acquire farm implements, herbicide, sprayers and other inputs needed for adoption of conservation tillage practices.

Mignouna et al. (2011) reported that when one belongs to a social group it enhances social capital to allow trust, idea and information exchange. Farmers within a social group learn from each other the benefits and usage of a new technology. Uaiene et al. (2009) suggests that social network effects are important for individual decisions, and that, in the particular context of agricultural innovations, farmers share information and learn from each other. Mutune et al. (2011) found that at the mean score, a unit increase in group membership increased the likelihood adopting conservation tillage by 34%. These findings confirm work done by Grootaert (2001) who described social groups as one way of generating social capital which positively contributes to farm and non-farm economic activities in the rural communities. In Kenya, women have a higher likelihood of being in social groups than their male counterparts. The groups are mostly referred to as merry-go-rounds, for instance, the rotating savings and credit organizations have been closely associated with improving household's livelihoods and resilience to shocks. The downside of social groups in technology adoption is free riding (Bandiera and Rasul (2002) especially when the technology advances.

Direct contact with extension services enhances agricultural technology adoption because farmers are kept informed about the existence as well as effective use of new technologies (Mutune et al., 2011). Moreover, exposing farmers to information based upon innovation –diffusion theory is expected to stimulate adoption (Uaiene et al., 2009). The influence of extension agent can counter balance the negative effects of lack of years of formal education in the overall decision to adopt technologies (Bonabana- Wabbi, 2002). However, the farm visit extension service usually target specific farmers who are recognized as peers (farmers with whom a particular farmer interacts) exerting a direct or indirect influence on the whole population of farmers in their respective areas (Genius et al., 2010). Most of the time these peer farmers are male and commercial farmers that seldom characterizes Kenyan smallholder farmers. There's a transformation in the use of Kenya's mobile network and technologies among smallholder farmers meant to bridge the extension service gap in rural areas. For instance, the mfarmer is a unique and innovative service that provides phone-based agricultural information, advice and support to smallholder farmers including women and youth (<http://www.cabi.org/projects>).

Access to credit has been reported to stimulate technology adoption among farmers (Mohamed & Temu, 2008). Access to credit promotes the adoption of risky technologies through relaxation of the liquidity constraint as well as boosting household's risk bearing ability (Muthee, 2010). In addition, access to credit has been found to be gender biased where youths and female-headed households are discriminated against by credit institutions, and as such they are unable to finance yield-raising technologies, leading to low adoption rates (Muzari et al., 2013). When youth and women are provided with an option to borrow, they can concentrate more on efficient investments that improve productivity and household income (Muthee, 2010).

Though the government of Kenya has designed programs that offer free interest loans to youths and women (UWEZO fund), access to these funds are influenced by multiplicity of factors for example, corruption and lots of paper work that make the funds inaccessible to most youths and women in the rural areas. Thus, there is need for policy makers to ensure that wider spectrums of rural smallholder women and youth farmers are able to access credit in the current programs (Muzari et al., 2013). This will empower youths and women to adopt agricultural technologies that enhance economic growth and development.

Decisions about technology adoption are affected by access to land and tenure security and these often vary by gender and regardless of how access of land is gained. Women tend to have smaller land holdings than men (Doss, 2001; Kabubo-Mariara, 2011). Generally, poor farmers and those with least secure tenure are less likely to adopt agricultural technologies. Similarly women who obtain land through marriage may hesitate to invest in it when she perceives her marriage as precarious (Doss, 2001). On the other hand, investing in land such as planting trees, constructing terraces may be a means for women to consolidate their claim over land. Kabubo-Mariara (2011) confirms that land tenure insecurity hinder the adoption of soil conservation strategies and adversely affect agricultural productivity. Therefore, policy reforms on land that ensure women direct land access and secure tenure are important in ensuring incentives to women and youth of technologies that result to economic, social and environmental sustainability.

3.3.3 Household-specific factors

The household characteristic factors that have been studied and influence adoption of agricultural technologies include; education, age and household size. Some formal level of education has been assumed to have positive influence on farmer's decision to adopt agricultural technologies because education levels increases his/her ability of farmers to obtain, process and use relevant information (Mignouna et al., 2011).

Age is assumed to be an important factor in adoption of agricultural technology. Older farmers' are assumed to have gained knowledge and experience over time and are better evaluators of technology information than the younger farmers (Kariyasa and Dewi 2011; Mignouna et al, 2011). On contrary, younger farmers are typically less risk-averse and are more willing to try new technologies. For instance, Alexander and Van Mellor (2005) found that adoption of genetically modified maize was higher among younger farmers but declined with age for those farmers closer to retirement.

Household size is simply used as a measure of labour availability. It determines adoption process in that, a larger household have the capacity to relax the labour constraints required during introduction of new technology (Mignouna et al, 2011; Bonabana- Wabbi 2002) .

Gender issues in agricultural technology adoption have been investigated for a long time and most studies have reported mixed evidence regarding the different roles men and women play in technology adoption (Bonabana-Wabbi, 2002). African women farmers are less likely than men to adopt new agricultural technologies (Doss, 2001). Adoption of technology decisions depend primarily on access to resources, rather than on gender. For example, adoption of improved maize depends on access to land, labour, or other resources, and if men tend to have better access to these resources than women, then the technologies will not benefit men and women equally (Mwangi and Kariuki, 2015). In particular, the household head is the primary decision maker and men have more access and control over vital production resources than women due to socio-cultural values and norms (Mignouna et al., 2011). Ogada (2014) found that the male-headed households had a higher probability of 4% to adopt both inorganic fertilizer and improved maize variety compared to the female-headed households. This possibly indicates that female-headed households are more resource-constrained. Otherwise, some development organizations that promote sustainable agriculture e.g. World Agroforestry Centre have an active recruitment of women and youth. Many organizations offer continuous supervision and support for women and youth that enable them to uptake particular technologies. Therefore, new technologies and practices to promote smallholder agricultural productivity will be adopted more successfully when

they are appropriate to women and youth interests, resources and demands (Huyer et al., 2015).

3.4 Youth/women cope with the ever changing factors in the economic, policy, physical and political environment

3.4.1 How youth and women cope with changing macro-economic policies

In 2008, the GoK launched Kenya Vision 2030 as the new long-term development blueprint for the country whose focus is to create a “globally competitive and prosperous country with a high quality of life by 2030” (GoK, 2007). Kenya has the potential to be an industrial middle income country that provides a high quality of life to all its citizens in a clean and secure environment. The overarching challenge that Kenya is facing today is to generate economic growth that is more inclusive to effectively reduce poverty across the country. Lack of inclusiveness is predominant among women youth, rural smallholder farmers. Cognizant of the youth and women challenges, the government has instituted policies to procure goods and services from women and youth owned enterprises. The Uwezo Fund is a flagship programme for vision 2030 aimed at enabling women, youth and persons with disability access to finances to promote businesses and enterprises at the constituency level. The object of the Uwezo Fund is to empower and employ youths and women in order to reduce hunger and poverty (Ministry of Devolution and Planning, 2017)

Cognizant of the youth unemployment problem and vulnerability of women, the Kenyan government has instituted policies to procure goods and services from youth and women-owned businesses. Kenyan government spends an estimated 70% of its budget on procurement expenses, the government’s “preferential procurement policy” has reserved 30% of these expenses to be paid to enterprises owned by youth, women and the disabled (Njiraini and Wangombe, 2013). As a result, youths and women have become entrepreneurs. In fact, more than 70% of small- and medium-size enterprises (SMEs) in Kenya are owned by young people and women (Njiraini and Wangombe, 2013). The policies have good intention of empowerment and employment but have criticisms. Muthee (2010) was categorical that:

Kenya’s KKV YEDF fall short. Their activities overlap, and their objectives are too broad, which makes them unachievable within a reasonable time-frame. They are also constrained by heavy government control ... As a consequence; the programs are burdened by politics rather than professionalism (Muthee, 2010).

In the view of the author, the process of registration and filling up the tender documents is cumbersome, complex and time consuming which is a perfect condition for rent-seeking behaviour and elite capture. Furthermore, the delays in government making its payment to the youths and women can be prohibitive. Lack of government promptness to pay reduces youth and women participation in the government procurement opportunities.

According to Njiraini and Wangombe (2013), there are also disincentives for government agencies to contract SMEs. For example, the costs of evaluating many bids from small and informal enterprises are much higher than fewer bids from larger, formal companies. However, this hurdle could be overcome by encouraging the youths to organise in groups or associations and bid collectively and set up avenues for subcontracting within these groups.

3.4.2 Education policies

Access to education is entrenched in the Kenyan constitution 2010. Educating and developing women and youth skills have positive influence on agricultural productivity, enabling them to engage in contract farming and sustainable agriculture technologies.

In regard to education and macro policies, this report tried to depict the role of education among smallholder farmer households in rural Kenya. For instance, what does the free primary and subsidized secondary education mean for youth and women in agriculture?

A reduction in youth and women inequality is determined by the quality of education and training they receive (UNHSP, 2010). In 2003 and 2008 the GoK instituted free primary and secondary school education respectively. In response to this, nearly 3 million more students were enrolled in primary school in 2012 than in 2003 and the number of schools has grown by 7,000 (Collins et al., 2015). The secondary school gross enrolment ratio increased from 43% to 67 % between 2003 and 2012 (Collins et al., 2015).

Despite the GoK introduction free and compulsory primary education and subsidized secondary education, Kenyan education is not entirely free. Households still face education related expenses for school uniform, textbooks, lunch, transportation, registration fees for standardized tests and hiring of teachers to cope with the shortage. These costs are rising every year with the burden falling to the low income households, mostly women headed households. According to Collins et al. (2015), having more children (at the median 4 children compared with other segments),

smallholder agriculture households spend disproportionately more on education. At the median, they spend just under 10 USD per month, per child, compared with 6 USD spent by part-time farmers and 9 USD spent by urban households (Collins et al., 2015). Consequently, some youths are forced to drop out or get held back in school until the substantial expenses of secondary tuition expenses are settled. The high cost of Kenyan education not only dims the realization of a holistic human capital but also the Kenya Vision 2030 goal that aims to provide competitive education and training to reduce illiteracy.

The government also has policy on technical and vocational education and training (TVET) institutions. Majority of Kenya youths need access to skill based training (Simiyu, 2010). Skills-based training is an area that must be scaled up by the government. It has been a neglected area of education and training policy. Skills-based training is best pursued through the Technical Vocation Education and Training (TVET) institutions. Globally, the TVET model remains an effective means of empowering the youth to engage in productive and sustainable livelihoods and is quite familiar to Kenyans.

In the first quarter of 2011, Kenya had a total of 554 TVET institutions that could legally offer training to the youth and others (GoKa, 2011). The TVET have introduced entrepreneurship education in its education and training systems, and this has helped to increase awareness among TVET graduates about the current demands of the employment sector (Simiyu, 2010). By integrating entrepreneurship into the TVET curriculum, trainees are taught business techniques such as costing, pricing, preparing financial statements, keeping business records, marketing and preparing business plans (Simiyu, 2010).

The objectives of TVET in Kenya are to (GoK, 2005):

1. Provide increased training opportunities for school leavers that will enable them to be self-supporting;
2. Develop practical skills and attitudes which will lead to income earning activities in urban and rural areas;
3. Provide technical knowledge, vocational skills and attitudes for necessary manpower; and
4. Produce skilled artisans, craftsmen, technologies for both formal and informal sectors

More than five million youths are unemployed. At the same time, complaints by the private sector particularly over the lack of able technicians for the emerging oil, gas and mining sectors, led the government to rethink the neglect of the technical training field, which has been overshadowed by the booming university sector (Simiyu, 2010). The government is setting up 200 technical colleges in every constituency and has allocated Sh2.5 billion for the development of technical training institutes in the country.

The enrolment of women in vocational institutions has increased by 17.4% compared to a decrease of 18.6% in males. The economic survey shows that there were 443,800 and 507,700 students in universities in 2014 and 2015 respectively. However, TVET (Technical Vocation Education and Training) had an enrolment of 148,100 and 155,200 in 2014 and 2015 respectively.

The enrolment of youth in polytechnics grew by 5.1 % from 2014 to 2015 due to the expansion of the polytechnics and development of infrastructure. Nationally, 246,215 adults were enrolled under the adult education program, of which 68.2 % were females and 31.8 % males.

The TVET should be vigilant in also investing heavily in agricultural technology that plays a key role improving agricultural productivity and realization of the Kenyan vision and Global Agenda 2030. According to Obonyo (year not cited), Kenya requires comprehensive policies and programs that provide training, appropriate skills, resources and market support for youths. If policy makers can harness the entrepreneurial ideas of youth people, they will be doing a great service to the youths and Kenya at large.

3.4.3 Coping strategies of women and youth in climate change policies

There is evidence that climate change is likely to increase food insecurity in Kenya, with the greatest effect on maize insecurity, predicted to increase by 8.56% to 21% by 2100 (Marjory-Anne, 2012). There are various initiatives to help smallholder farmers in Kenya to adapt to the changing climate, for instance, use of evergreen agriculture (Marjory-Anne, 2012), The Climate Change Act 2016, that mainstreams biodiversity and agriculture (Muigua, 2017), Climate smart agriculture and community participation in governance (Mutune et al., 2016) of natural resources for instance water and forests that provide essential ecosystem services to agriculture are increasingly crucial. Through such methods/or climate smart agriculture farmers have been able to reverse deforestation and landscape restoration thus increased agricultural productivity.

Climate change policies are also advocating for use of improved cook stoves that reduce the expenditure of poor households on charcoal and enhance indoor air quality (Marjory-Anne, 2012). Improved cook stoves benefit women

because fuel-wood collecting is predominantly the task of women and health impact of indoor air pollution from wood-fuels falls mainly on women and youths.

Smallholder farmers are among the most vulnerable groups to climate variability. Agroforestry or the intentional use of trees in cropping systems is a potential strategy to help farmers reduce their vulnerability. According to Climate Change Agriculture and Food Security (CCAFS) annual report (2015) by implementing agroforestry households particularly women can reduce the time they spend collecting fuel wood or the need to purchase. Fodder shrubs, fruit trees and fertilizer trees contribute to food security, incomes and environmental services. Even though there are no specific statistics across gender involvement in agroforestry, women are as actively involved as men, but their level of participation is constrained by cultural norms and lack of resources. Armed with the same resources as their male counterparts, women farmers could increase their yields by 20-30% reducing the number of hungry people worldwide by 12-17% (Kiptot et al., 2014).

Adaptive measures by women pastoralists is that some now prefer keeping goats and sheep but not cattle because goats and sheep can survive at least one week without water while camel can go for 12-30 days a duration impossible for cattle.

3.5 Collective actions and agricultural productivity

Collective action arises when people collaborate on joint action and decisions to accomplish an outcome which involves their common interest (Gyau, 2012). Collective action has been applied to group activities that directly or indirectly enhance the production and marketing of agricultural and food products, and reflects a global trend caused by the increased market competition, integration, and marginalization of minorities into modern markets (Kirsten et al., 2009; Gyau, 2013). Case studies are used in this report in order to understand how this collective action is being promoted as a strategy to improve productivity.

3.5.1 Case 1: Collective action in promoting and improve productivity of orange fleshed sweet potatoes (OFSP)

By linking health with agriculture, the CIP and KARI, Sweet potato Action for Security and Health (SASHA) and other stakeholders are working collectively to promote the orange fleshed sweet potatoes (OFSP). Expectant mothers are given vouchers at hospital for obtaining sweet potatoes planting materials and farmers link up with SASHA project to provide planting materials. The Dissemination of New Agricultural Technologies in Africa (DONATA) has been doing the follow up to monitor uptake and adoption of the OFSP technologies in western Kenya.

The Farm Concern International (FCI) has initiated sweet potatoes promotions in Nairobi grocery stores to assist in developing the urban markets for OFSP; this way, farmers produce for markets instead of marketing what they produce. The public and private sector have all played a collective role in making OFSP a success. Approval of funding by public sector of research and development agenda and registration of NGOs; KARI and CIP spearheaded the research efforts; MoA and NGOs were part of innovation platforms and technology dissemination; private traders purchase the crop where commercialization has taken root and FCI links traders to markets; several cottage industries process sweet potatoes with Busia Framers Training Institute a government institution training farmers in many aspects of sweet potatoes utilization; financing of the enterprises by private arrangements; transport is handled by private traders who also engage in marketing and market information; NGOs, like Community Research in Environment and Development Initiative, Rural Energy Food Supply Organization, Appropriate Rural Development Agriculture Program have been involved in coordination of activities and mobilization of community groups, documentation of activities and outcomes, coordination of planting materials multiplication and post harvest processing; Representatives of the various groups handle their interests in innovation platforms (Mababu et al., 2014).

Lessons learnt:

1. Women are responsible for generating food security for their families and also play a vital role in agricultural production, producing both food and cash crops. Women farmers have shown that they can be experts in their own domain.
2. Agricultural production by smallholder farmers can be successful if there are contract markets to provide market stability and sufficient uptake for increasing yields.
3. Successful agricultural production by smallholder farmers requires collective action by different players for funding, breeding, research, production, marketing and utilization.

3.5.2 Case 2: collective action in agricultural technology

Collective action and the partnership by Amiran Kenya, Chase Bank and Rafiki DTM involve youths in Agribusiness

particularly the rural ones creating employment. For instance, Amiran Foundation Kits (AFK) spurs new agribusiness projects among the youth (Amiran Kenya, 2016). The AFK initiative is aimed at smallholder farmers and beginners in agribusiness with limited access to land, water, and finance to test, practice smart farming and technologies. The AFK gives a chance to youth and women farmers to start small and grow bit by bit until they are able to afford modern greenhouses and enjoy the benefits of modern agribusiness. The high prices for technologies like green houses have barred many small scale farmers to engage in modern farming. The AFK package includes drip kit of 15 by 6 meter, a 250 litre solid water tank, a one litre sprayer, instructional growing guides, fertilizer, agro chemicals and high quality seed types. A farmer with this kit can choose to grow various types of crops like cabbage, water melon, kales, and spinach among others. The drip kit can last for over 8 years if well maintained as it is manufactured by Netafim, a multinational company that invented drip irrigation.

Another initiative is by Chase Bank and Rafiki Diamond Trust Fund offer the financial support for the seeds and irrigation kits. There are also youth concerts, for instance the one duped farming is cool a campaign to encourage youth to embrace agribusiness and support them. The youth concerts promoting agriculture among the youths are supported by Kenya Red Cross, Amiran Kenya and implemented among 500 schools in rural areas of Kenya. This way innovations and technology are transferred and has a long-term effect on food security and self employment.

3.6 Identification of gaps in policy and recommendation for a priority policy research agenda

Reviewing and harmonizing existing policies:

Creating a new policy framework is necessary in order to make the agricultural sector more profitable, competitive and sustainable. The current policy environment is not fully supportive of private sector-led agricultural development. Multiple and complex laws and regulations in Kenya's agriculture sector are not properly aligned for investment in a liberalized economic environment. Most of the agricultural sectors laws and policies overlap and are diverse, because of the diversified rural livelihoods undertaken by women and youth. Harmonization of the legislations would be imperative if Kenya wants to compete in the international market place and attain food security.

Effective climate change policies must be gender sensitive

Climate change (CC) impacts more on women than men (IPCC, 2001), however, 15 years later a review of CC policies and institutions from CCAFS revealed that gender is still not well integrated. Research on vulnerability of women to changing climate is well documented; however, the role of women to design and implement effective climate change adaptation and mitigation strategies for themselves and families is not well documented. Therefore, there is a need for concrete actions to tangibly engage women and youth in policy design on issues that affect them, particularly those of agriculture and food security.

Encourage and support youth entrepreneurial ideas and innovations

The Kenya National Youth Policy, KNYP, (2006) recognizes that the majority (75%) of Kenya population are youths and the myriads of challenges that youth face such as unemployment. The policy endeavours to address issues affecting young people by including broad-based strategies that would provide the youth meaningful opportunities to realize their potential. The problem is that the policy is too broad, not specific enough and does not recognize or support the entrepreneurial ideas that the youths have. The policy is more focused on consumption than production and innovation needs.

The emphasis is frequently placed on entrance to labour market with little attention on the poor working conditions of the youths. Consequently, youths are prone to work longer hours under informal, insecure and intermitted work arrangements characterized by low productivity, low wages and reduced social protection. Furthermore, it focused on the capacity of companies and the country as a whole to innovate and develop competitive advantages (Ombagi, year not cited).

Furthermore, the government does not support or even encourage innovations held by the youths. For instance, Forbes Africa recently released the list of Africa's best 30 entrepreneurs and 7 of them were Kenyans which is representative of the energy, talent, creativity that abound the country. Yet the government and its policies have failed to recognise, encourage and support this kind of creative thinking. If policy makers can harness the entrepreneurial ideas of youth people, they will be doing a great service to the youths and Kenya at large. The government has launched several policies and programs to address the issue of youth policies e.g. the KNYP (2006). Therefore, there is need to undertake research and assess the impact of KNYP on youth based skills and empowerment and how policies such as this could support youth entrepreneurship in agriculture.

Education policies:

The provision of subsidized primary and secondary school education is an important step towards increasing literacy level in Kenya. However, the education policies are too general, considering that particularly youths and women have differentiated needs. Thus, there is need for the government to design more specific education policies and education systems that take into consideration the needs of the low income small-holder farmers so that their children attend all levels of formal education in Kenya.

3.7 Conclusion and way forward

Women and youth face a diversity of constraints that include tenure insecurity, inadequate extension and financial services, information asymmetry, and exclusion from policy processes, climate change risks, low profitability and long working hours. Overcoming these socio-economic constraints that women and youth encounter in agriculture provides an excellent opportunity for the sector transformation and ensures sustainable and resilient rural livelihoods. Collective action has been promoted as a strategy to improve productivity. The following are the suggested policy and institutional interventions.

1. Training institutions such as TVET, universities, schools should have comprehensive programs that provide agricultural training and appropriate skills for youths.
2. The process of agricultural policy design and development should involve women and youth
3. The indigenous knowledge and creativity held by women and youth should be integrated with science through mutual learning in design and development of knowledge based policies.
4. Equip all agricultural extension staff with the knowledge and skills to address male and female farmers equitably
5. Targeting women groups and link them to micro-credit institutions, agricultural markets and agricultural value chains
6. Technologies that ensure women resilience and food security such as agroforestry should be promoted together with crop and livestock agricultural production extension services.
7. Policy makers should take into account the differential vulnerabilities of men, youth and women farmers to economic, social and environmental policies.
8. Institutions should target women owned farm enterprises to facilitate their engagement in collective action

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List of Acronyms

AFK	Amiran Foundation Kits
ASALS	Arid and Semi-Arid Lands
FAO	Food and Agricultural Organization of the United Nations
GoK	Government of Kenya
GDP	Gross Domestic Product
IFPRI	International Food Policy Research Institute
KFSSG	Kenya Food Security Steering Group
KKV	Kazi Kwa Vijana
YEDF	Youth Enterprise Development Fund
KNYP	Kenya National Youth Policy
OFSP	Orange Fleshed Sweet Potatoes
UNFPA	United Nations Population Fund
UNESCO	United Nations Education, Scientific and Cultural Organization
UNHSP	United Nations Human Settlements Programme
USD	United States of America Dollar
SASHA	Sweet potato Action for Security and Health (SASHA)
SMEs	Small and Medium Enterprises
SSA	Sub-Saharan Africa
TIVET	Technical and Vocational Education Training Institutions