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# Local and regional variations in conditions for agriculture and food security in Kenya

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# AgriFoSe2030

Agriculture for Food Security 2030

- Translating science into policy and practice



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.

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## Summary

Agricultural production is the main livelihood to a majority of the population and a lead contributor to economy in most sub-Saharan countries. In Kenya, agriculture accounts for 65% of the national exports and 70% of informal employment in rural Kenya. The study sought to establish key crops and livestock keeping in Kenya, constraints and opportunities along the value chain are critiqued and the role of institutions is discussed. In this report, a review of literature, desktop survey, was conducted. The study established that key crops grown in Kenya are maize, wheat, beans, tea, coffee and horticulture. While the main livestock kept in Kenya are cattle, sheep, goats, chicken and camels. The distribution of crops and livestock in Kenya is influenced by geography (agro-ecological zones) distance to market, and cultural diversity of the Kenyan people. In Kenya, the agricultural value chain is influenced by financial services, value chain suppliers and supporting services. However, the type of interaction in the value chain depends on the type of value chain at play. It is established that multi-national companies and government policy shape the agricultural value chain in Kenya. Agriculture and livestock keeping in Kenya is constrained by climate variability, inadequate agricultural extension and technology adoption, deterioration of land resource, poor infrastructure, limited farm-level resources and weak institutions to implement policies. The agriculture and livestock sectors can however look to improved skills in climate forecasting, devolution of the agriculture sector to county government and the growth of information communication technology in ameliorating these constraints. The Kenyan government has in the recent past re-organized the institutional framework through a variety of legislations. Financing of these institutions and implementation of policies should offer a spring board for up-scaled agricultural productivity and improved food security.

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## 1. Introduction

In Kenya, agricultural performance in the first two decades after independence (1963-1986) was widely regarded as good. According to Poulton and Kanyingi (2014), the strong performance of the sector was attributed to effective agricultural institutions and extension service that provided services to producers. Both were state sponsored. The period mid-1980s and 1990s witnessed government led reforms (under the influence of the Structural Adjustment Programme of the World Bank) in the agricultural sector. The reforms were to pave way for market-based economy where farm input distribution was largely in the hands of the private sector (Brook 2014).

Apparently, the reform period coincided with a decline in the overall agricultural growth. It became apparent for the government agricultural technocrats that the reforms had not worked well for the sector – triggering policy reforms in the agriculture sector. At a national level, the Strategy for Revitalizing Agriculture (SRA) and Vision 2030 – policy documents of the government of Kenya were in place in the years 2003 and 2008 respectively. At the international level, there was the Alliance for Green Revolution in Africa (AGRA) and Comprehensive African Agricultural Development Program (CAADP). Both initiatives underscored collaboration between the public and private sector and increasing agricultural productivity (Brook 2014; Kibaara et al., 2009). Although implementation of these reforms faced challenges (Poulton & Kanyingi 2014), there is evidence that they bore results for some crops and for the livestock sector (Kibaara et al., 2009; Republic of Kenya 2015a). Improvement in agricultural production (for some crops) in the first decade of the 21st century was attributed to increased use of fertilizer, increased adoption of high yielding seed varieties and increased density of fertilizer retail outlets (Kibaara et al. 2009). Indeed, these are a demonstration that parts of the cornerstone programmes and policies in the agricultural sector mentioned above, have been implemented effectively.

Despite the achievements, there are concerns that the national level narrative in the implementation of these policies and programmes ignored the important regional agro-ecological and socio-economic variations that characterize Kenya (Brook, 2014; Radeny & Bulte, 2011). This is best reflected in two ways. First, the variables of famine (these are production, market access, and response failure) are omnipresent in Kenya as articulated by Devereux (2009). As a result, cases of famine in one part of the country and lack of market for farm produce and post-harvest losses in the other part are frequently reported in Kenya. Secondly, productivity of crops and livestock is highly varied at regional levels. Food security can be sustained through boosting local and regional agricultural productivity (Ogundari & Awokuse, 2016). Against this background, the aim of the study is to examine the local and regional variations in conditions for agriculture and food security. Specifically, the study will discuss the distribution of crops and livestock in Kenya, constraints and opportunities in the agriculture sector, and agricultural policy arrangement in Kenya.

## 2. The Study Area

Kenya is located in East Africa and has a total area of 580 370 km<sup>2</sup>. Administratively, the country is subdivided into 47 counties following the promulgation of the 2010 Constitution of Kenya. The altitude of the country significantly varies with the high points being Mt. Kenya and the Rift Valley, while the low altitude areas are north Eastern, South Eastern and Coastal areas of the country.

The country's climatology is highly varied especially in terms of annual rainfall distribution and temperature. The country's rainfall is bimodal with March to May and October to December rainfall season (Kisaka et al., 2015). Kenya's rainfall is mainly influenced by sea surface temperatures of the Indian, Pacific and Atlantic Ocean (Mutai et al., 1998; Hasternrath et al., 2004) inter-tropical convergence Zone, relief and hinterland (Camberlin et al., 2009; Shisanya 1996).

The soils of the country are highly varied as presented by Jaetzoldt et al. (2007). The soils in western Kenya are mainly acrisols, cambisols and their mixtures, highly weathered and leached with accumulations of iron and aluminium oxides. The soils in central highlands are mainly the nitosols and andosols, which are young and of volcanic origin. North eastern and south eastern Kenya (predominantly arid and semi-arid) have vertisols, gleysols and phaeozems and are characterized with pockets of sodicity and salinity, low fertility and vulnerability to erosion. Coastal soils are coarse textured and low in organic matter and the common types are the arenosols, luvisols and acrisols. The Rift Valley has andosols, arenosols, cambisols ferralsols and fluvisols, luvisols as the main soils. The soils of the Rift Valley are characterized by salinity due to irrigation, a characteristic that adversely affect irrigation development, particularly the area around Lake Baringo.

Kenya has five drainage basins with a national volume of 20,291m<sup>3</sup> per year (Kenya Water Report 2005). Although

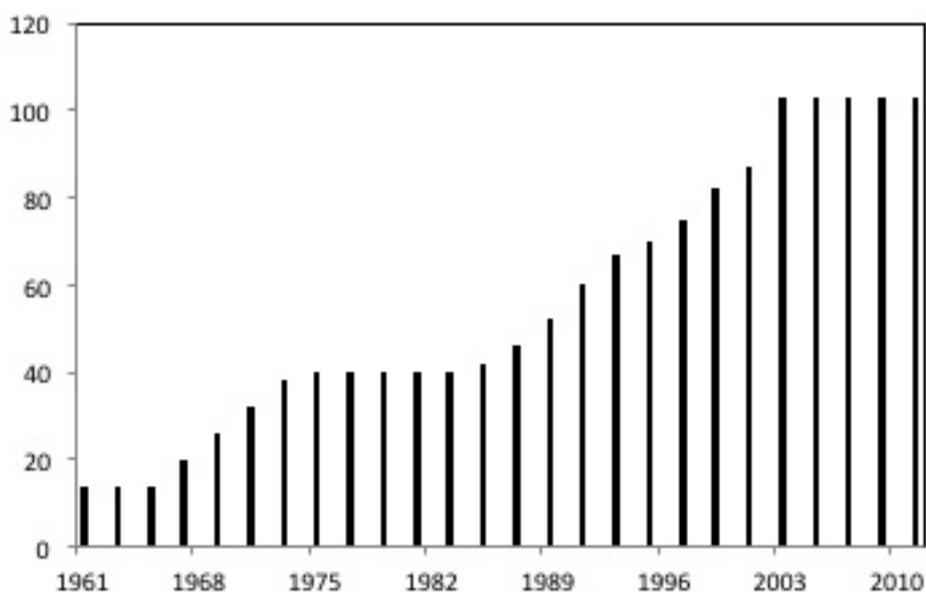


Figure 1: Total Area (in 000 ha) equipped for irrigation in Kenya for the period 1961-2010. (Source of data: <https://www.quandl.com/data/FAO-Food-and-Agriculture-Organization-of-the-United-Nations?keyword=irrigation%20kenya> )

Kenya's agriculture is mainly rainfed, there is a relative increase in land area equipped under irrigation (Fig 1). This is an indication of increased dependency on blue water. Kenya's forest cover is currently estimated at 7.2%. Though this is an improvement (UNEP 2009), it remains below the UN requirement of 10%. The Kenya government is aware of the ecosystems services provided by forests most of which have a direct effect on agriculture. As a result, there are policies and institutional level reforms and programs that are aimed at conserving and protecting the forest cover. Notably is the Water Act of 2016 and the Forest Act of 2005.

Kenya is broadly divided into seven agro-climatic zones as shown in Table 1. Agro-climatic zones I–III are classified as high-potential areas due to their high level of precipitation (with a moisture index of greater than 50% and annual rainfall of over 800mm), while IV–VII are categorized as semi-humid to arid (marginal areas) due to the low agricultural potential. Agro-ecological zones I-III account for 12% of Kenya's land area, while marginal areas of Kenya account for over 80% of Kenya's area (Orodho, 2006; Mati, 2000). The variation in agro-ecological zones has provided a variety of cropping system and livestock keeping.

Table 1: Agro-ecological zones of Kenya.

<b>Agro-ecological zone</b>	<b>Moisture Index (%)</b>	<b>Climate Classification</b>	<b>Average annual rainfall (mm)</b>	<b>Average annual potential evaporation (mm)</b>	<b>Vegetation</b>	<b>Farming System</b>
I	>80	Humid	1100-2700	Humid	Moist forest	Dairy, sheep, coffee, tea, maize, sugarcane
II	65-80	Sub-humid	1000-1600	Sub-humid	Moist and dry forest	Maize, pyrethrum, wheat, coffee, cotton, coconut, cassava
III	50-65	Semi-humid	800-1400	Semi-humid	Dry forest and moist woodland	Ranching, cattle, sheep, barley
IV	40-50	Semi-humid or semi-arid	600-1100	Semi-humid to semi-arid	Dry woodland and bush lands	sunflower, maize cotton, cashew nuts, cassava
V	25-40	Semi-arid	450-900	Semi-arid	Bush lands	Ranching, livestock, sorghum, millet
VI	15-25	Arid	300-550	Arid	Bush lands and scrubland	Ranching
VII	<15	Very arid	150-350	Very arid	Desert scrub	Nomadism and shifting grazing

Source: Kabubo-Mariara & Karanja (2007: 321)

For the purpose of this study, the country has been divided into nine (9) regions as shown in Fig 2. Crop farming is commonly practiced in most parts of the country except in North Eastern region, the very north of the North Rift (Turkana County) and Nairobi regions. Pastoralism is the mainstay livelihood in North Eastern and Turkana County - while urban agriculture and livestock farming is practiced in Nairobi County - Kenya's administrative capital. For most households in Kenya, agro-pastoralism is widely practiced – keeping of livestock and crop farming. However, there are counties which have a bias for either of these. For instance, Narok, Kajiado (in the South Rift), Tharaka-Nithi (Eastern region), West Pokot, Baringo and Laikipia (in the North Rift) counties are inclined towards pastoralism with a significant population practicing crop farming. For the Central, Western, Nyanza, Eastern regions, crop farming is the main livelihood with dairy farming also emerging as an important livelihood.

Since its inception as a Republic, Kenya has largely depended on the agricultural sector as the base for economic growth – accounting for 65% of the national exports and 70% of informal employment in rural Kenya (Poulton & Kanyingi, 2014). Crops grown in Kenya can be classified as food crops, oil crops, horticulture and industrial crops (Rep. of Kenya 2015a). Over time, yields have fluctuated depending on existing policies such as Food Policy of 1981, Vision 2030, Strategy for Revitalization of Agriculture 2010, Agriculture Sector Development Strategy (ASDS) 2010-2020. Despite these efforts, agricultural productivity has remained well below the level necessary to contribute fully to food and nutritional security and poverty reduction goals (Kibaara et al., 2009). This has been attributed to

policy failure and the ethnically-based patronage politics that undermine reforms in Kenya (Poulton & Kanyingi 2014; Devereux 2009).

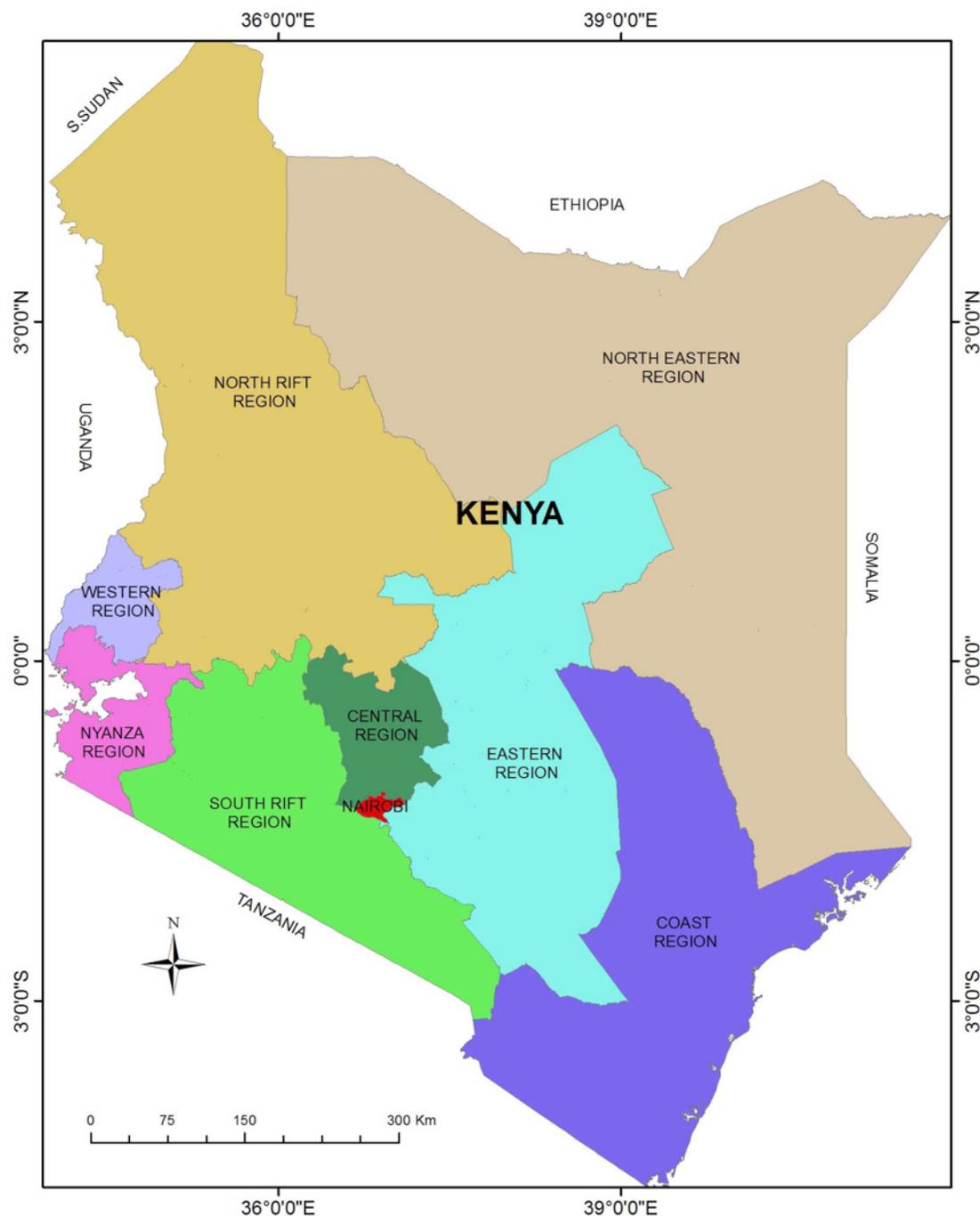


Figure 2: Regions of Kenya.

Notwithstanding, some industrial crops such as tea and horticultural produce have experienced a rise in production in the recent past. For horticulture, this has seen a rise in demand for water for irrigation (Kenya Water Report, 2005). Although livestock production in Kenya has recorded an increase in the period 2010-2014 (Rep. of Kenya, 2015a) and the dairy sub-sector recorded growth in 1997-2007 (Kibaara et al. 2009), demand for livestock product is likely to be moderated by socio-economic factors such as human health concerns and changing socio-cultural values (Thornton, 2010). Besides agriculture which accounts for 24% of the Gross Domestic Product (GDP) and 19% of the formal wage employment; the country's (Maina et al., 2013) economy also depend on relatively well developed manufacturing, mining, tourism and service sectors, forestry and non-wood forest products.

### 3. Distribution of Key Crops Grown and Livestock Kept in Kenya

#### 3.1 Key Crops Grown in Kenya

Crops grown in Kenya can be categorized as cereals, legumes, roots and tubers, industrial, fibres as shown in Table 2. This sub-section presents key crops and their distribution in Kenya.

Table 2: Distribution of key crops grown in Kenya.

Crop	Region
<b>Cereals</b>	
Maize	Whole country except Northern Kenya
Wheat	South Rift, North Rift, Central (Nyeri)
Rice	Eastern (Mwea) Nyanza (Ahero and Yala), Coast (Bura)
Sorghum	Nyanza, Eastern, Western, North Rift and Coast
Millet	Eastern, Nyanza
<b>Legumes</b>	
Beans	Eastern, Western, Nyanza and Central
Cowpeas	Eastern and Nyanza
Pigeon peas	Central, Eastern, Western and Nyanza
Green grams	Eastern and Coast
<b>Oil seed crops</b>	
Sunflower	Nyanza (southwest), Eastern
<b>Root/tuber crops</b>	
Cassava	Nyanza, Western, Coast
Sweet potatoes	Western, North Rift (Trans Nzoia, El-geyo-Marakwet, West Pokot), Central and Eastern
<b>Fibre Crops</b>	
Sisal	Coast, Eastern, North Rift
<b>Other cash crops and fruits</b>	
Tea	South Rift, North Rift, Central, Western.
Coffee	Central, Eastern Western, South Rift Nyanza, North Rift and Coast
Sugarcane	Western, Nyanza, Coast
Cashew nuts	Coast
Mangoes	Coast, Eastern and Central.
Oranges	Coast and Eastern
Avocadoes	Central, Eastern, Coast
Bananas	Nyanza, Central, Eastern and Western

#### **Cereals**

Maize is the staple food crop in the country and its production is tied to food security. Given its significance at a national level, it is grown in almost all parts of the country except in northern and north eastern Kenya which are arid. The crop is mostly produced in the North Rift with Trans Nzoia and Uasin Gishu counties producing large surplus on medium and large scale farms (Rep. of Kenya, 2015a). The popularity of the crop and the diversity of the country by agro-ecological zones has necessitated the development of genotypes. The country is estimated to be having 164 maize varieties released for planting in different part of the country (Wambugu & Muthama, 2009). The country's short and medium term objective for maize is maintaining availability and affordable prices for Kenyan consumers. The

long-term policy has focused on increasing production through research and extension, evidenced in the different maize varieties and input subsidy initiatives of the Kenyan government. Annual production of dry maize in the period 2010 - 2014 was estimated at between 3,464,541 and 3,513,171 tons (Republic of Kenya, 2015a). A comparison of maize production and consumption for the period 2015/2016 and 2016/2017 show that Kenya is a maize deficit country (Global Agricultural Information Network, 2016) According to Jayne et. al (2008) only about 15% of the maize produced is sold to the National Cereals and Produce Board (NCPB), suggesting the reminder is sold to private millers and consumed at household levels.

Wheat is the second most important cereal grain in Kenya, after maize. The country produces an average of 300,000 metric tons annually (Gitau et al., 2010). The crop is mainly grown on medium and large farms - accounting for 75% of planted area. Wheat is grown in areas above 1500 m above sea level, namely, Uasin Gishu, Nakuru, Trans-Nzoia, Narok and Laikipia counties of Kenya. Although the demand for the crop has continued to rise (surpassing maize), production has fluctuated mainly due to rainfall variability. Kenya's wheat production is about 40% of its annual demand, which leads to imports from Russia (32%), Argentina (27%), Ukraine (20%), USA (11%) and other countries (10%) (Gitau et al., 2010). The Kenyan government has protected wheat producers with a 25-35% tariff under Common Market for Eastern and Southern Africa (COMESA). Small-scale wheat farmers in Kenya sell to the NCPB, while medium and large scale farmers have the option of selling to NCPB or directly to millers.

Rice is the fourth most important staple food in Kenya after maize, beans and wheat. The crop is mainly produced in paddy schemes of Mwea, Ahero, Bunyala and West Kano under irrigation – managed by the National irrigation Board. Rice production from these schemes accounts for 95% of the total national production (Export Processing Authority, 2005) (Mwea accounts for 78% of the irrigated area and 88% of production). The remaining 5% is cultivated under rain-fed conditions in Kwale, Kilifi and Tana River Counties of the Coast region. Rice consumption has been on the rise - 12% per year – way a head of wheat (4%) and maize (1%) (MAFAP, 2013). The country is far from achieving self-sufficiency – producing an estimated 152,000 metric tones against a national consumption of 660,000 metric tons (as at 2016) (Global Agricultural Information Network, 2016). Thus the country can only meet 20% of its requirements. To meet the rising demand, the Kenyan government country a long-term objective of self-sufficiency for rice through maintenance and expansion of irrigated production. The country further meets the consumption deficit through importation; and Pakistan (accounts for 74% of total rice imports) is Kenya's main rice supplier.

Sorghum and millet farming in Kenya have progressively increased in the recent past ((Rep. of Kenya, 2015a). These are drought tolerant crops that have thrived in marginal areas of south Eastern and Nyanza. The lower Eastern (Machakos, Makueni, Kitui, Embu and Meru counties) and Nyanza regions account for account for 42.5% and 40.5% of the total national production of sorghum (Kiambi and Mugo, 2016). Notwithstanding, significant quantities of sorghum are also produced in Western (8.5%), Rift Valley (6.6%), Coast (1.5%) and others (0.4%). Similarly, Eastern Kenya is the lead producer of millet, accounting for more than 50% of national production (Onyango, 2016). For both, millet and sorghum, production remains well below the consumption. The Ministry of Agriculture and Kenya Agricultural and Livestock Research Organization (KALRO) have since the year 2010 been promoting traditional high value crops and sorghum and millet are among them. The Agriculture Sector Development Strategy (ASDS) classifies sorghum as one of Kenya's main food crops and put in place strategies to increase productivity and marketing.

### **Legumes**

A variety of legume crops are grown in Kenya. These include beans, cowpeas, pigeon peas and green grams. Beans are the second staple food in Kenya after maize and boasts of 28 cultivars (Wambugu & Muthama, 2009). The crop is mainly grown in Eastern, Western and Central regions of the country. Although area under production has increased since the 1990's, yields have fluctuated (Katungi et al., 2010; Rep. of Kenya, 2015a). Cowpea is the second most cultivated legume crop in Kenya; with 85% of the area under cultivation (Wambugu & Muthamia, 2009) and 91% of the total production (Kiambi and Mugo, 2016) in the semi-arid of Eastern Kenya. Pigeon peas and green grams are the other legume common crops cultivated in Kenya. Like the cowpeas, pigeon peas and green grams are mainly grown in the semi-parts of the country-usually in the lowlands.

### **Roots and Tuber Crops**

There is an increasing demand and popularity for sweet potatoes in Kenya a healthy food. The crop is mostly grown by small scale farmers in most parts of the country – namely North Rift, Western, Nyanza and Eastern Kenya. Cassava is another important tuber that is grown in the marginal low fertility soils (Fermont et al., 2008) of Western, Nyanza and Coast regions. Although there is no strong market for cassava, farmers set a side cultural and dietary preference (for cereal) and grow the crop. Its complimentary role to cereals and farmer perception that cassava 'rests' the soil (Fermont et al., 2008) presents the entry point for sustainable agriculture and food security.

## **Industrial Crops**

Tea is Kenya's principal agricultural sub-sector. The crop is cultivated in the highland areas of the country – mainly in central, south rift, north rift and western Kenya. It is estimated that 62% of the total productions comes from the west of the Great Rift Valley (Kericho, Nandi, Bomet, Nyamira, among others), while the remaining 38% is grown in the East of the Great Rift Valley (Kiambu, Nyeri, Embu, Meru, Kirinyaga etc) (FAO, 2015a). The tea industry in the country is dominated by two types of producers - small scale growers and large scale plantations. Although the area planted has increased since the 1960 to present, production has fluctuated mainly due to climate variability. For the period 2005-2011, there was no specific government policy to support tea production – despite being the most important export for the country. Support (extension, marketing and regulation) for the tea industry mainly comes from the private-sector stakeholders. Government participates in the sector through the Tea Board of Kenya (TBK) and Kenya Tea Development Authority (KTDA) – both of which seek to improve input supply, extension service, tea processing and marketing

Coffee, like tea, is a highland crop - grown in regions that receive more than 1000mm of rainfall and at an altitude of 600-1800m a.s.l. Thus, the crop is grown in Central, Eastern (Meru, Machakos, Tharaka Nithi, Makueni), Western and Nyanza (Kisii and Nyamira). Coffee is regarded as the fourth leading foreign exchange earner after tourism, tea and horticulture. Production of coffee has increased in the recent past and this is attributed to better management of the institutions in the sectors (Rep. of Kenya, 2015a). Significantly is the role of county governments in production, processing and marketing of coffee. The national government, on its part, has retained the core function of agricultural policy, regulation of international trade of coffee and other industrial crops.

Sugarcane farming is predominantly carried out in Western and Nyanza regions of the country. In addition, there is consideration (by Tana and Athi Rivers Development Authority and Mumias Sugar Company) to re-introduce sugarcane irrigation farming in the Coast region (Tana River County). The crop was recognized as a cash crop in the country in the 1970's for two main reasons. First as an import substitution to the country's sugar needs; and second, a response to political pressure to introduce a cash crop in Western Kenya (Wanyande, 2001). Although sugar cane farming has remained the main source of livelihood to cultivating farmers, it is bedeviled with numerous challenges – bringing to question its viability as an economic venture (Ndii, 2015). Notwithstanding, the crops remains closely linked to government with strong influence from domestic and international policies. The Kenyan Government (GoK) has introduced a 4% Sugar Development Levy (SDL) to both domestic and imported sugar. This is in addition to government's substantial investment in sugar mills. Internationally, the government has requested COMESA to continue protecting the sugarcane industry as it (GoK) works towards improving the competitiveness of the sector and reduce the adverse effects of a liberalized market. Despite the efforts, Kenya's sugar industry continues to under-perform due to the high cost of production.

## **Fibre Crops**

The country has two main fibre crops – sisal and cotton. Both crops are drought tolerant and mostly cultivated in the country's semi-arid regions. However, cultivation of cotton seems to have stalled following the implementation of Structural Adjustment Programme of the World Bank and the importation of second hand clothes (Mitumba) into the Kenyan market. According to FAO (2015b), Kenya is the third largest producer of sisal after Brazil and the United Republic of Tanzania. In Kenya, like in Tanzania, sisal is a plantation crop. It is mainly grown in Taita Taveta, Makueni (Kibwezi) and Baringo counties.

Besides the crops listed above, horticultural crops (fruits, vegetables and floricultural crops) have gained popularity and are among the lead foreign exchange earners. Very often, these are grown in green houses. Horticulture, like most other agricultural ventures in Kenya, are undertaken by both smallholder farmers and commercial companies – with the later controlling a larger share of the export market. Although horticulture is mainly developed in Central and South Rift of the country, it has expanded to other parts of the country such Laikipia, Machakos, Kajiado. Fruit crops such as mangoes (Eastern and Coast), bananas (Meru and Kisii) and oranges (Eastern and Coast) are significant cash crops at household levels.

The country is also a producer of oil crops (mainly for the local market) – notably sunflower and coconuts. Sunflower farming is commonly practiced in western Kenya; while coconut is commonly found in the coastal region of the country.

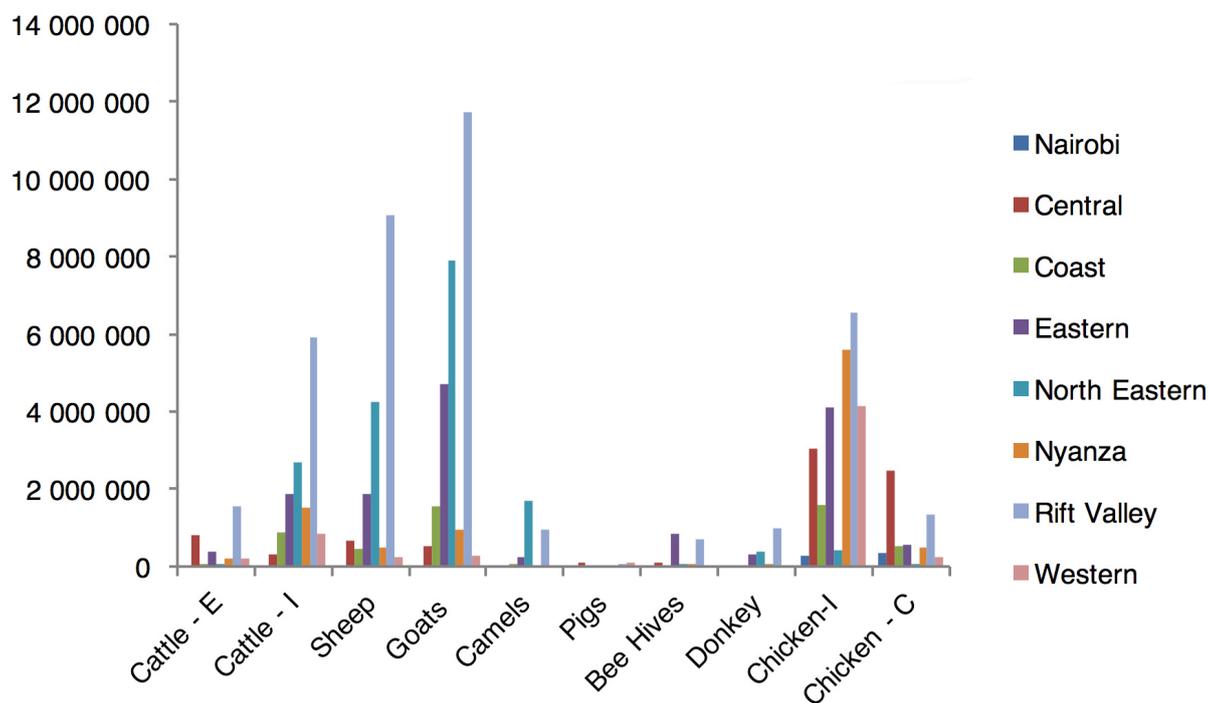
## **3.2 Livestock Farming in Kenya**

The livestock sector contributes to about 10% of the GDP and 52% of the agricultural sector contribution to the GDP in Kenya (Gerber et al., 2010). Overall, the livestock sector contributes to food security, employment, agricultural

inputs (manure and draught animals) and income to most rural households – with a varied regional and livestock type proportion. The Kenyan livestock sector is dominated by smallholder farmers and livestock population is concentrated in the arid and semi-arid lands. There are three main livestock production systems in Kenya; pastoral, mixed agro-pastoral and mixed farming (Cecchi et al., 2010). Pastoral system is found in northern Kenya, parts of the North Rift (West Pokot and Baringo), parts of South Rift (Narok and Kajiado) and parts of Coast region (Tana River). Agro-pastoral system is predominant in South East Kenya, and in parts of North Rift, South Rift and northern Kenya (Marsabit). Mixed farming production systems is found in Western Kenya, Central Kenya, and parts of Coast and Rift Valley regions.

Figure 3 shows the main livestock and their distribution in Kenya. According to the 2009 Livestock Census, Kenya has the highest population of cattle (exotic and indigenous combined) among the ruminants; and chicken among the non-ruminants (<https://www.knbs.or.ke/category/census-2009-summary-of-results/>). The Rift Valley (RVP) and North Eastern (NEP) region (former provinces) account for 42% and 19% of the indigenous cattle respectively. The two former provinces still account for the highest proportion of goats (RVP -42%, NEP- 28%), sheep (RVP-53%, NEP – 25%) and camel (RVP – 33%, NEP – 57%). Rift Valley and Central account for 46% and 24% of exotic/dairy cattle in Kenya.

Dairy farming is practiced in the highland areas of the country – mainly Central, South Rift, North Rift, parts of Eastern (Meru and Embu counties) and Western Kenya. The dairy industry is the single largest livestock sub-sector. There are variations in dairy animal keeping and milk productivity across the country. For instance, although a majority of households in western highlands (Kakamega, Bungoma, Uasin Gishu, Trans Nzoia, Bomet Nakuru and Narok) had the highest number of improved dairy cows, it is Central Kenya (Nyeri, Murang’a and Meru) that had the highest productivity of milk (Wambugu et al. (2011). Before 1992, the dairy industry was controlled by government, setting prices and determining players. The Kenya Cooperative Creameries (KCC) enjoyed the monopoly of processing and marketing milk and dairy products. With the liberalization that followed, there are currently many other players in the dairy industry who have significantly reduced the dominance of KCC (now renamed New KCC).



Livestock distribution in Kenya  
 Figure 3. (Key: E- Exotic; I- Indigenous; C – Commercial)  
 Source: Census, Livestock Population, 2009; KNBS

There are two types of beef production systems in Kenya; small-scale and large scale meat production (Kahi et al., 2006). The small scale beef production system is mainly found in the high potential areas, and marginal areas produce the highest number of animals for beef. The small scale beef production system is mainly found in Western, North Rift, South Rift and Central regions of Kenya. While the large scale meet production system is found in the marginal areas of Rift Valley (South and North), Eastern, North Eastern and parts of Coast regions.

Sheep and goats keeping, like cattle, are characterized by mixed crop-livestock and pastoral/extensive production systems and are found in both high potential areas (agro-ecological zones I-III) and marginal areas (agro-ecological zones IV-VII). For instance a study by Kosgey et al. (2008) show that sheep and goat are kept in Nakuru, Nandi, Bomet and Nyeri counties (high potential areas) under mixed crop-livestock production system; and in Baringo, Likipia, Narok and Transmara counties (marginal to medium potential areas) under extensive/pastoral system. Similarly, Moore et al. (1991) and Bett et al. (2009) show that goats and sheep are kept in Western Kenya and Northern regions of Kenya respectively. Marsabit, Mandera and Wajir counties have the highest concentration of camels (Wako et al., 2016). Other camel producing counties are Baringo, Turkana, Garissa and Samburu counties. Given the harsh climatic realities of northern Kenya and the camels' ability to thrive in these areas, camel rearing is a rational practice.

Central (inclusive of Nairobi City), Western (including the Lake Victoria region), Rift Valley, Eastern regions have significant proportions of pig population as shown in Fig 3. North Eastern Kenya have negligible population of pigs – mainly due to the religious influence (the two regions are predominated by Muslims). Pig production in Kenya is mainly under two systems – traditional/backyard and commercial. According to FAO (2012), there are more pigs under the traditional/backyard system in Western and Rift Valley regions, while the commercial system is common in Central and Eastern Kenya.

Most rural families in Kenya keep poultry and this account for 90% of the national production. There are two main production systems in Kenya –indigenous backyard and commercial. Indigenous production system is mostly practiced in rural homes and is estimated to account for 81% of the total chicken population; while commercial (broilers and layers) account for about 19% (Census, 2009). It is observed that Rift Valley, Nyanza and Western account for the largest proportion of indigenous chicken. While Central and Rift Valley have the highest proportion of chicken under commercial production system.

### **3.3 Factors Influencing Distribution and Production of Crops and Livestock**

The distribution and production of key crops in Kenya is largely determined by geographic and institutional factors (Radeny & Bulte, 2011). Geography has affected crops in Kenya through the direct link with agro-ecological zones. For instance, industrial crops are mainly grown in the upper highlands and lower midlands zones of the country (Jaetzold et al., 2010; Jaetzold et al., 2006a), while legumes are mostly found in the lower midland and upper midland zones (Jaetzold et al. 2006b).

Distance to major market is a factor that influenced the distribution and production of some crops. For instance, horticulture farming that is largely dependent on foreign market, is predominantly practiced in Central Kenya and central Rift Valley (Naivasha). The proximity of these regions to international airport in Nairobi city and a well established road network, make it possible to export the produce on time. The political environment and economic performance (inclusive of institutions and the legal framework) has influenced the current distribution of crops. For instance, cotton – a crop that was grown in Eastern, Coast and Western regions of the country in the 1970s, has almost ceased to exist following the macro-economic policies that Kenya found herself operating in after the Structural Adjustment Programme in the late 1980s.

Kenyan crops are also classified on the basis of length of growing season – short, medium and long. The country has two main growing seasons – determined by the rainfall regime discussed earlier. These are March – May (MAM) and October-December (OND) rainfall seasons. The value and effectiveness of each of the season varies from one region to the other. For the greater western part of the country (West of the Great Rift Valley), March- May is the main growing season – with planting starting in the months March/April (depending on onset) and harvesting in the month of September/October. Although the long rain season is commonly received in the months of March- May, in Western Kenya, it extends to June-August due to the influence of the Atlantic Ocean and Congo Basin (Shisanya 1996). Save for its relevance in the growth of perennial crops such as tea, coffee and sugarcane, the October-December season is largely underutilized in western Kenya.

On the other hand, October –December rainfall season is considered the main growing season in the East of the Great Rift Valley (central, eastern and coast) (Hansen & Indeje, 2004; Amisshah-Arthur et al., 2002) given its relative reliability (Cooper et al., 2008). Although households engage in farming during the March-May season, the high frequency of dry spells (Ngetich et al., 2014; Barron et al., 2003) limits meaningful crop yields. The length of growing season has influenced the choice of cultivars. For instance, maize - a staple food crop, has different cultivars for the highland regions of Lower highland and Lower midland agro-ecological zones.

The cultural diversity of the Kenyan people has also influenced the choice of farming activities – even when they have operated within the same policy and legal framework and agro-ecological zones. To illustrate this is the finding of Amwata et al. (2016) who established that livestock accounts for most of the income in Kajiado county; while

in Makueni county crops are the lead source of income. Although Kajiado and Makueni are found in the same geographic location, the two counties are predominantly inhabited by Maasai (Nilotic speaking) and Akamba (bantuspeaking) communities respectively. The same views are echoed by Kosgey et al. (2008) who points at the need to investigate the influence of socio-cultural characteristics in the adoption of breeding programmes among small ruminant small-scale farmers.

#### 4. The Agricultural Value Chain and Food Security in Kenya

A value chain is a set of linked activities that work to add value to a product. It is a set of actors (private, public and including service providers) at the sequence of value adding activities involved in bringing a product from production to the final consumer (Miller and Jone, 2010). A value chain also entails the flow of products, knowledge and information, and finance needed to organize producers and communities as shown in Figure 4 below. It is observed that there are three major actors in the agricultural value chain - value chain suppliers, financial and support service providers. Within the value chain, the players in the value chain receive financial and support services at different levels of interaction depending on the *produce* and *region*.

It is also notable that within the value chain, there is a provision for a direct linkage between farmers and local traders (including being in direct interaction with local producer groups such as co-operatives). The type of interaction depends on the type of value chain at play. For instance, in bilateral oligopolies (Lee et al., 2012) or contract farming (Wendimu et al., 2016) models, farmers supply their produce directly to a specialty firm. In Kenya, this is best reflected in sugarcane (western Kenya) or pineapple (Thika) farming. On the other hand, smallholder tea farmers may have to rely on producer groups such as cooperatives to sell their produce in a producer-driven chain (Miller & Linder, 2010).

These variations in the value chain structures create divergent outcomes on the wellbeing and food security status of farmers. For instance, Wendimu et al. (2016) established that smallholder participation in the sugarcane out-grower schemes in the Oromia region of Ethiopia had a negative effect on the income and asset stocks of households. In Liberia however, Rutherford et al. (2016) established that a non-governmental organization facilitated-value chain contributed to positive farm outcomes and social assets. In Kenya Opondo (2000) established that reliance on one crop under contract farming to earn a livelihood exposed farmers to manipulation by the contractor and undermined sustainable land management practices. These cases serve to underscore the need for policies and regulations of government to assure smallholder farmers of their meaningful engagement in the agricultural value chain and to

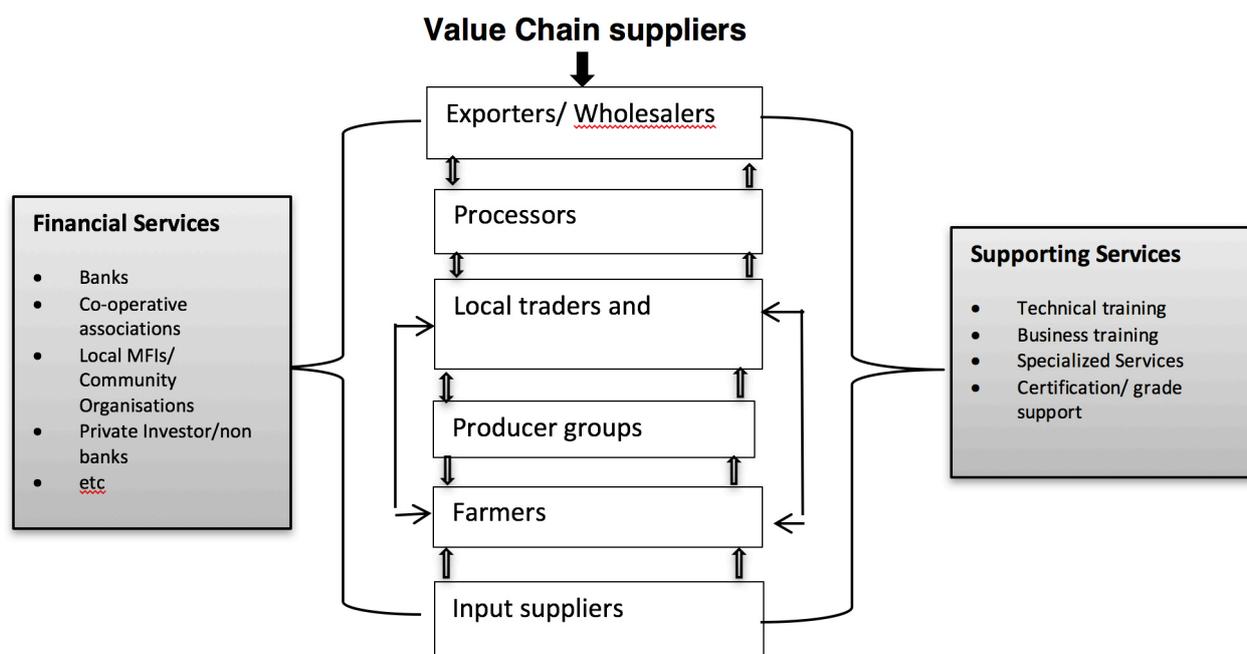


Figure 4: A schematic representation of an agricultural value chain (Source: Miller and Linda, 2010: 9)

sustain the environment. But given the far reaching effect of policies and regulations, their formulation attracts the attention of different agents along the value chain who join to influence the overall policy set-up. Evidence to this is the finding by Alonso et al. (2016) who established that wheat policy in Pakistan had benefitted flour consumers and wheat traders at the expense of wheat farmers. The British American Tobacco Company (B.A.T), being an important player in the tobacco value chain, has been able to influence public policy on tobacco production and marketing (Patel et al., 2007). On a global scale, the global value chain seems to have specified the role and position of a smallholder farmer by mapping the geographic and organizational integration of the existing value chains (Lee et al., 2012). This has given multi-nationals an upper hand in their engagement with farmers. Poulton and Kanyingi (2014) observed that majority of Kenya's smallholders were not involved in the drafting of Strategy for Revitalizing Agriculture Policy of 2004. Notwithstanding, public institutions - government and non/governmental, in some cases, have played a key role in agricultural value chain and improved households' well-being and food security (Rutherford et al., 2016; Choudhary et al., 2015; Miller and Linder, 2010).

It is instructive to note that food security, especially in developing countries such as Kenya, is dependent on the performance of the agricultural sector. Cultivated land area is a key determinant of agricultural production. In Kenya, there are variations in cultivated land area; a decline in high potential areas and an increase in semi-arid land (Rep. of Kenya, 2015a). Despite the variation in cultivated land area in both highland and semi-arid lands in Kenya, there is improvement in agricultural productivity (Kibaara et al., 2009). Although these are positive signs, food security – in its sense of '...physical and economic access to sufficient, safe and nutritious food...' (Muzari, 2016, 1769-70) remains a mirage to a majority of Kenyans – especially in the ASAL areas. Indeed in the year 2016, it was widely reported that most counties in the ASALs of Kenya were facing famine. This will require policies that safeguard the interests of stakeholders along the agricultural value chain. Amidst all the players and vested interest in the agricultural value chain, the government of Kenya has to encompass social protection (Devereux, 2016) especially of the marginal and vulnerable groups in its effort to realize food security. Within the value chain, agricultural input subsidy, price interventions and food management are key to food security.

## **5. Constraints and Opportunities in the Agricultural Sector along the Value Chain**

The agricultural sector of Kenya faces a myriad of challenges stemming from the physical and the socio-economic environments. These range from climate variability and soil quality; to households' characteristics, micro and macro level policies that influence inputs and market environment, access to and use of information and technology, and the state of infrastructure. In this section, these constraints are discussed and effort is made to identify their effect at specific intersections of the value chain. The section further presents existing opportunities for each of the identified constraint.

### **5.1 Climate Change and Variability**

There is evidence showing that temperature and rainfall trends for both March-May and October-December growing seasons have changed in the recent years in Kenya (Rep. of Kenya, 2013; Rep. of Kenya, 2015b). Climate change and variability has the potential to alter patterns and productivity of crops and livestock. Indeed, Kabubo-Mariara and Karanja (2007), Miriti et al. (2015) and Ochieng et al. (2016) are examples of studies that demonstrate the effect of climate variability on agricultural production (on both cash and food crops) in the different agro-ecological zones of Kenya. Besides the effect on agricultural production, climate variability has been found to influence participation in markets of agricultural produce (Olwande et al., 2013). Linke et al. (2015) further established that worsening drought conditions at local levels were associated with increased support for violence in selected parts of Kenya – a factor that directly affects food security. Frequent droughts in semi-arid lands with the most recent ones being 1999-2000, 2009-2010, 2016-2017, have led to degradation of pasture and subsequently severe herd losses.

Farmers will need to invest in technologies that counter the unfavourable climate. This will include use of drought tolerant varieties. It is fair to say that for most of the main crops cultivated in Kenya, there are several varieties (Wambugu and Muthamia 2009) suitable for the different agro-ecological zones. The scientific community has been successful in developing and assessing the efficacy of plant and animal genotypes in the different agro-ecological zones. Unfortunately, farmers may not have knowledge of these cultivars and livestock due to their limited exposure to extension (McCord et al., 2015; Zanders et al., 2013). Moreover, farmers' attitudes in some cases have hindered adoption (Recha et al., 2008). These factors, have limited farmers adaptation to climate change and variability. To improve adoption of drought tolerant varieties in light of climate variability, stakeholders in the agricultural sector will need to engage in the co-production of knowledge. According to Newsham and Thomas (2011), farmers' blend of agricultural science (acquired from extension workers) and agro-ecological knowledge is a catalyst for adaptation to climate change. This subsequently strengthens resilience to impacts associated with drier conditions. In Kenya, there

is evidence that development agencies are supporting farmer-extension service engagement (Recha et al., 2015). This needs to be up-scaled. Better agricultural practices such as outlined above will have to be complimented by use of seasonal climate forecast in agricultural decision-making and food security planning. Noting that the quality of climate forecasts has improved over time (Cooper et al., 2008), and farmers are practising promising management responses (Hansen et al., 2011), climate forecasts offers a platform to reduce climate-related risks in the crops and livestock sectors. This will, however, only be achievable if climate forecasts will be used to coordinate input and credit supply, food crisis management, trade and insurance (for both crops and livestock). To make seasonal climate forecast effective, the Kenya Meteorological Services, extension service providers, farm input suppliers and farmers will need to work together. Acknowledging the ongoing efforts to support climate change adaptation, these are still at their infancy. This study echoes the sentiments of Maina et al. (2013) that a huge amount of funding is required for climate-specific initiatives that will address climate change threat to food security in Kenya.

## 5.2 Agricultural Extension and Technology Adoption

Adoption of new technologies is crucial in enhancing agricultural production and improving food security. In developing countries, this remains a challenge. There is evidence of innovations in agriculture and livestock sectors over time. However, widespread adoption of these new technologies remains a challenge. In most cases, farmers are still stuck with the traditional farming technologies. A few examples should suffice. Conservation agriculture and hybrid maize (*Katumani composite* and *Makueni composite* – both drought tolerant) were introduced in semi-arid Eastern Kenya in the 1950s (Tiffen et al., 1994). We are into the 21st century and farmers in eastern Kenya remain less receptive to the hybrid drought tolerant maize varieties (Recha et al., 2008). Farmers continue to rely on seeds saved from previous season for planting (Smale et al., 2009). In Kenya, adoption of conservation agriculture remains minimal and scattered. Yet conservation agriculture has been found to assure a more sustainable agricultural production and reduced production costs while increasing profitability (Cairns et al (2012). Despite the merits of conservation agriculture, it is important that such assessment takes into account labour costs if farmers have to make profits. As Zander et al. (2013) noted, problems associated with adoption of new technologies are not always inherent in the technology itself. Most of these factors are 'external' and include limited resources, cultural orientation and farmers' socio-economic characteristics. To drive adoption of technologies and innovation, a vibrant agricultural extension is required. Unfortunately, extension service in Kenya declined throughout the 1990s due to inappropriateness of the training and visit extension model and sharp reduction in the operational budgets of the responsible ministry (Salami et al., 2010). The liberalization policies of the 1980s and 1990s significantly reduced government provision of support services such as extension. This exposed farmers to market forces and cost sharing in acquiring extension services – a factor that contributed to poor performance of the agricultural sector in the 1990s (Gitau et al., 2008).

After change of government in 2003, there was consensus among Kenya policy-making elite that institutional and policy reforms were required to improve agricultural performance. Among the changes, was a shift towards demand driven extension visits and an increased budget allocation to employ more extension service providers. Extension and development agencies are promoting awareness and giving advice on adoption of existing technologies (Recha et al., 2015; Zander et al., 2013). Farmers are increasingly relating use of modern technologies to improved productivity and higher profits – a sufficient incentive for adoption. According to Mathenge et al (2014), use of hybrid seeds in Kenya has been found to contribute to higher annual income and raised asset value. Kathuli and Itabari (2015) established that use of in-situ soil moisture conservation technologies such as zaipits, negarims and contour bands improve soil fertility and increase crop yields. Such findings can be used to build trust in farmers on existing technologies. This can be achieved when extension and development agencies commit to undertake more training of farmers in up-scaling adoption. Extension officers and farmers can tap into the opportunities presented by information & communication technology (ICT) to access and use farm inputs, management of livestock and crop diseases, and identification of market for their produce.

## 5.3 Deterioration of Land Resource

Land resource is a constraint to agricultural production and food security in Kenya (Kibaara et al., 2009). This can be examined at two levels - degradation of soil quality and decreasing farm size. Soil fertility is key to agricultural production. But due to unsustainable farming practices, soils are depleted. Very often, soil nutrients are not adequately replenished. Among the constraints to improvement of soil fertility are limited access to and use of fertilizer; and a general lack of knowledge and understanding of specific nutrient limitations (Lagerkvist et al., 2015; Katungi et al., 2010). The resulting decline in soil fertility is a key constraint to agricultural productivity. On the other hand, the problem of access to land and the shrinking size of smallholder farms has been a key constraint in the agricultural sector for some time in Kenya. According to Kirimi et al. (2011) over half of the smallholder farms in Kenya are less than 1.5 hectares. This size is much smaller is counties as Vihiga, Kisii and Central Kenya where population densities are high (Rep. of Kenya, 2010). In these areas, there is little scope for increasing farm production based on increasing land size holding. However, in the semi-arid that are dominated by agro-pastoralism, such as Tharaka-Nithi, Kitui,

and Kwale Counties, average land-size per farming household is more than 1.5 hectares. But due to erratic rainfall, agricultural production is constraint.

Farmers need to be encouraged to engage in sustainable agronomic practices (such as improved tillage, use of cover crops). For instance, the practice of fanya-juu terracing – especially in erosion prone areas can improve soil organic matter (Saiz et al., 2016). But this is only realistic if the labour input is reasonable and production is profitable. Similarly Muli and Musila (2015) established that maize yield significantly improved when cultivated under zaipits and tied ridges – soil water moisture conservation technologies. For the densely populated areas, agricultural intensification should be encouraged as it has been found to improve the economy, food security and employment opportunities of households (Raut et al., 2011). Despite the merits, implementation of agricultural intensification needs to remain conscious of the environmental effects that come with it – soil acidification (caused by use of chemical fertilizer) and, as a result, fertility decline. At a national level, agricultural production will be increased with investment in irrigation – especially in Kenya's ASALs. The Kenyan government, in its the Second Medium Term Plan (2013-2017), has planned to develop ASALs by putting 404,800 hectares under irrigation. So far about 1000 hectares in Galana-Kulalu (in Tana River County) is under maize farming irrigation. Such projects will not only tap into the 'surplus' land found in the ASALs to improve agricultural production, but also mitigate the effects of drought that are frequent in Kenya. Notwithstanding, the country's irrigation potential is only partly exploited, with about 7% of the cropped land under irrigation (MAFAP, 2013). Further, the national government and some county governments (e.g Kakamega) are providing subsidized fertiliser. This is expected to address the declining soil quality and increase agricultural production.

## 5.4 Poor Infrastructure

Development and maintenance of physical infrastructure are prerequisites to economic development. For agriculture-dependent economies such as Kenya physical infrastructure is an important determinant of agricultural investment, production cost, and access to market. According to Wasike (2001), although Kenya's road network is fairly well developed, the operating condition has suffered from inadequate maintenance, repair and rehabilitation. The current state of roads - especially in Kenya's ASALs, has imposed significant burdens on smallholder farmers. For instance, Mahmoud (2008) established that transport cost, alongside insecurity, account for as much as 33-40% of the price of cattle in northern Kenya. Abdi (2004) established that poor road network raised farm-to-market transaction and lowered farm income in Kisumu and Nyandarua districts. In Narok South and Mt. Elgon sub-Counties, tomato and maize farming are hampered by poor road network. These findings are corroborated by Salami et al. (2010) who established that underdeveloped roads and other key physical infrastructure such as electricity have led to high transport costs for agricultural products to the market as well as for farm inputs, reducing farmers' competitiveness in Kenya.

According to Obare et al. (2003), transport cost is a composite of physical distance, travel time and transport fare. Paving of roads especially in Kenya's ASALs could bring down the cost and time of trucking livestock to market destinations. The government has since 2003 invested in rural infrastructure improvement. The coming into effect of county governments (devolution), a revised road policy and institutional framework ([www.transport.go.ke/infrastructure.html](http://www.transport.go.ke/infrastructure.html)) has seen many dilapidated rural roads brought to maintainable standards in Kenya. According to Kiprono and Matsumoto (2014), use of hybrid seed, chemical fertilizer, maize productivity and milk market participation has since increased in areas that had better road access. Improvement of rural roads should however be viewed as work in progress that require more funding for construction and maintenance. Development agencies and non-governmental organizations can also work towards the formation of farmers associations that aim at reducing travel time and transport fare. At the same time, these organizations can adopt the facilitation value chain model (Miller and Jones 2010) that has been found to open up market opportunities for smallholder farmers.

## 5.5 Markets for Agricultural Produce

Agricultural market related constraints are an outcome of domestic, regional and global level factors; all of which may overlap to influence the well being of farmers. For each of these scales, different factors come into play to determine market access. For instance, at domestic and regional levels, liberalised market systems may offer strong competition in high potential and accessible areas (mainly in urban and border areas); while producers in rural-remote areas may face little choice of service providers (Poulton et al., 2006). On the other hand, smallholder farmers engaged in cultivation of crops that operate in the global value chain (e.g tea or fruits) may find themselves disadvantaged as the power has shifted in favour of retailer (Lee et al., 2012). Compared to crop farming, Kenya's livestock industry has the weakest of the value chain support service providers. Notably, stocks often trade hand, two to three times, en-route to the end market, generating transaction cost and exploitation by middle men (Mahmoud, 2008).

One way to address market related challenges to agricultural produce is through certification. This will particularly be critical for farmers engaged in cash crop farming - including horticulture that relies on bilateral oligopolies or contract farming. Through certification, producers and exporters in Kenya can find themselves operating within the global value chain and enhance their position in the global market. Adoption of international standards such as GlobalGAP, Fair-trade and BRC (Zhou 2015) has facilitated an expansion of the export market – especially for horticultural produce, coffee and tea in Kenya. Very often, certification will take into account on-farm improvement of the produce in terms of management practices and even yield. Certification has been found to have varied implication on household welfare and livelihood effects (Rijsbergen et al., 2016) - depending on certification parameters and the agricultural produce. Importantly, it guarantees market to farm produce. Unfortunately, government facilitation of certification, value addition and marketing programmes has focused primarily on export cash crops. More effort is required to support value-addition and promotion of non-export/indigenous crops such as sorghum, green grams, pigeon peas, beans, among others. Research on processing and nutritional value of local foods will lead to utilization of indigenous crops. Another limitation of compliance with international standards is that entry requirements are stringent. Growers are required to meet standards of environmental management, food product safety, workers' health and safety among others. These requirements have implications on cost and yield of produce. The adverse effects of certification can be mitigated by government policy which can play apart in safeguarding farmer interest and sustaining the environment (Opondo, 2000). While still on markets for horticulture, Kenyan producers and exporters should take advantage of globalization and seek to penetrate new markets in the USA and Asia. The horticulture sector will benefit from the recent achievement of Category One status of Jomo Kenyatta International Airport by the US Federal Aviation Administration (FAA). There is going to be direct flight from Nairobi to USA – paving way for direct access to the American market.

It is important that existing information channels (local radio, mobile phones and internet) can be accessed by small holder farmers. These communication channels have increased timely and wider delivery of useful market information. A case in point are the findings of Ogutu et al (2014) who established that smallholder farmers' participation in ICT project enhanced participation in agricultural input markets in Kenya. At a national level, the Kenyan government and the East African region at large will have to sensitize citizens on the benefits of the East African Community. Promotion of regional trade will potentially improve market performance. According to Poulton et al. (2006) agricultural growth in West Africa has been realised as a result of regional trade liberalization. The East Africa Community can borrow a leaf from this. If the effort put in the horticulture sector (targeting European, Asia and American markets) (Zhou, 2015) can be replicated by Kenyan producers and exporters for legumes (cowpeas, pigeon peas and green grams), tubers (cassava and sweet potatoes) and fruits, the Kenyan farmer will significantly benefit from the larger East African market.

## **5.6 Limited Farm-level Resources**

In Kenya, and indeed the larger sub-Saharan Africa, agricultural production is dominated by smallholder farmers. Smallholder farmers are often affected by limited access to resources which often translates into low agricultural productivity. A case in point is a study in Central Kenya where rice farmers were found to be faced with high cost of production and low yields (Cairns et al., 2012). Similarly, Ali-Olubandwa et al. (2011) found that more than one third of maize farmers in western Kenya identified lack of finance to purchase farm inputs as a constraint to maize farming. Access to farm input and adoption of technologies is a constraint that limits expansion of opportunities among low incomes smallholder farmers. Although the banking sector is the lead source of credit in Kenya, the share of commercial banks' loans to agriculture remains very low compared to manufacturing, trade and other service sectors (Salami et al., 2010). In part, this state of affair can be attributed to lack of collateral and/or credit history of a majority of smallholder farmers. Secondly, the highly variable climate, and the subsistence farming that characterize smallholder farmers, serve to discourage lenders. It has also been established that socio-economic factors such as education and salaried employment influence access to credit financial services (Kiplimo et al., 2015).

To improve resource access at farm-level, it's suggested that social protection programmes be put in place. Social protection has the potential to reduce household vulnerability through alleviation of credit constraints, increases certainty and improve access to technology. Social protection has been found to increase agricultural input use, asset accumulation and to some extent agricultural yield (Tirivayi et al., 2016). In Kenya, social protection has been implemented for many years in various forms. Social protection interventions are provided by many different stakeholders including government ministries and agencies, the private sector and other non-state actors. The Kenyan government has developed the Kenya National Social Protection Policy (Republic of Kenya, 2011). The policy aims at reducing poverty and vulnerability of the population to economic, social and natural shocks and stresses. Very often, social protection in Kenya has taken the form of cash transfer, food distribution, public work and grants to resource-limited households. The existing policy and institutional framework are an opportunity to improve agricultural production and contribute to food security. What remains to be done are efforts to evaluate the impact of social protection on agricultural production and food security among households.

Smallholder farmers may need to tap into the Savings and Credit Co-operatives (SACCO) and the success of financing initiatives such as Equity Bank of Kenya which are providing banking services to the poor including smallholder farmers (Poulton et al., 2006; Salami et al., 2010). This will however mean that the smallholder farmer evolves (through trainings) from subsistence to commercially oriented farming. The Kenyan government may need to undertake land reforms that will facilitate access to title deeds which can be used as collateral for the loans. For financial institutions, agricultural lending will have to be preceded by use of specialized credit officers (with knowledge in agriculture), knowledge of the client (smallholder farmer activities), and flexible products (adaptable to the profiles of smallholder farmers). The Ministry of Agriculture, Livestock and Fisheries (Kenya), will need to upscale the National Accelerated Agricultural Inputs Access Programme (NAAIAP). The NAAIAP programme, started in 2007-2008, supplied fertilizer and seeds to vulnerable households. The programme succeeded in the creation of demand for extension, inputs, markets, credit, increased production and reduced distance to input source (Ochola and Fengying, 2015). Although such programmes will require a high level of investments government partnership with private sectors and international development agencies could increase the impact at a national level.

## **5.7 Institutional and Policy Related Constraints**

Government-formed agricultural institutions were at the heart of agricultural growth and development in the 1970s and 1980s. These institutions were set up to support production and marketing of major crops such as coffee, tea, maize, pyrethrum, sisal, cotton, as well as livestock products (milk and beef). Among the institutions formed during this period were the Kenya Tea Development Authority (KTDA), Pyrethrum Board of Kenya, Kenya Grain Growers, Co-operative Union (KGGCU), Kenya farmers Association (KFA), Kenya Meat Commission (KMC) and National Cereals and Produce Board (NCPB). Although the establishment of these institutions was noble, they were characterised by bad governance (Poulton and Kanyingi, 2014, Gitau et al., 2009). This, in addition to liberalization of markets in the late 1980s and 1990s, led to the collapse or non-performance of these institutions.

Subsequent reforms in the agricultural sector at the turn of the century led to revival of some of the institutions. A case in point is the revival of Kenya Co-operative Creameries (KCC) and Kenya Meat Commission (KMC) when the National Rainbow Coalition (NARC) government took power 2003 This presented hope to producers as it provided a route away from what was perceived as middle-men and private companies' exploitation (Poulton & Kanyingi, 2014).. But failure to privatize and reduce bureaucracy in these institutions did not improve service delivery. Worse, the change of government in 2013 slowed the revival of some of the institutions such as KCC and KMC. Apparently, the Jubilee government seemed to favour the role of private sector and at the same time gave impetus to expansion of irrigation programmes as articulated in the Second Medium Term Plan (SMTP) of 2013-2017. Although the private sector has grown in Kenya since the 1990s in the advent of liberalization, its capacity to take over the role of parastatals, especially in marketing of farm produce, remains low and therefore needs to be developed further (Gitau et al., 2009).

The launch of the Strategy for Revitalization of Agriculture (SRA) led to formulation of fifteen policies and six pieces of legislation. Although these policies have covered a wider spectrum of the agriculture and livestock sectors, including food security, they have suffered from lack of common objectives and coordination among the implementing ministries (Maina et al., 2013). For quite some time, the agricultural sector has suffered from outdated legal and regulatory that has served to constrain agricultural development, trade and effective competition (Gitau et al., 2009) To address policy and institutional challenges in the agricultural sector, the government of Kenya has adopted the 'systems approach' (Maina et al., 2013). It means, the agriculture sector institutions are viewed as components whose synergistic functions should lead to attainment of the set objectives.

## 6. Institutional and Policy Arrangements in the Agriculture Sector in Kenya

### 6.1 Institutions in the Agriculture Sectors

#### ***Kenya Agricultural and Livestock Research Organization (KALRO)***

The Kenya Agricultural and Livestock Research Organization (KALRO) – formerly Kenya Agriculture Research Institute (KARI), is a creation of the Kenya Agricultural and Livestock Research Act 2013. KALRO’s main functions are to promote, streamline, coordinate and regulate research in crops and livestock; and expedite equitable access to research and technology and application of the same. KALRO has a Scientific and Technical Committee which provides technical, financial and legal expertise to the Board and serves as an advisory arm of the organization. The institution has its centres distributed country-wide, with a view of addressing agriculture and livestock research issues specific to the region. KALRO has sixteen research institutes established to address issues that range from mechanization, to crops (industrial, horticulture, and food) and livestock (dairy and beef), arid and rangelands to biotechnology.

#### ***The Agriculture and Food Authority***

The Agriculture and Food Authority was established as an Act of parliament in 2013. The Agriculture and Food Authority Act 2013 (No. 13 of 2013) provides for the consolidation of the laws on the regulation and promotion of agriculture generally. The Act specifically establishes the Agriculture and Food Authority, and, makes provisions for the respective roles of the national and county governments in agriculture (excluding livestock). The coming into effect of the Act repealed institutions earlier established to address production of specific crops such as tea, coffee, sisal, coconut and sugarcane (Table 3). Under the Agriculture and Food Authority Act 2013, these institutions were converted into directorates but continued with their broad mandate (<http://www.agricultureauthority.go.ke/>).

Table 3: Agriculture parastatals that were converted into directorates under the Agricultural and Food Act 2013.

<b>Repealed Institution</b>	<b>Year established</b>
Coconut Development Authority	-
Kenya Sugar Board	2012
Tea Board of Kenya	1950
Coffee Board of Kenya	1934
Horticultural Crops Development Authority	1967
Pyrethrum Board of Kenya	1934
Cotton Development Authority	2006
Sisal Board of Kenya	1946
Pest Control Products Board	1983
The Kenya Plant Health Inspectorate Service	1964

### 6.2 Policies in the Agriculture Sector

Kenya’s agricultural policy can be categorized into three broad bands; post-independence (1960-1980), liberalized period (1980-1990s) and stakeholder participatory approach period (2000 – present). Policies of the post-independence period were characterized by increased allocation of government resources to agriculture to improve productivity, market control and pricing, and government support for agricultural and livestock services. The period was further characterized by effective institutions such as Kenya Cooperative Creameries (KCC), Kenya Meat Commission (KMC), Agriculture Finance Cooperation (AFC), and Kenya Grain Growers Cooperative Union (KGGCU) among others (Poulton and Kanyingi, 2014; Gitau et al., 2009). The liberalization period coincided with the Structural Adjustment Programme (SAP) in the 1980s. Key features of the liberalized period were removal of price control on agricultural products and inputs, and reduced government provision of support services. The rationale for these reforms was to build a competitive economy. Unfortunately, the era was characterized by a collapse of government institutions and lack of stakeholder consultation (Gitau et al., 2009). Lastly, there was the stakeholder participatory period – a period that coincided with political reforms and change of government in Kenya. Key policies that defined this period are discussed below:

### ***Economic Recovery Strategy (ERS) 2003-2007***

The Economic Recovery Strategy for Wealth and Employment Creation (ERS) was a blue print for the National Rainbow Coalition (NARC) government that took power in 2003. ERS was to guide the government economic policies for the period 2003-2007. The strategy noted the declining agriculture performance in previous years and set to undertake reforms. Among the identified reforms were legal and institutional reforms, agricultural extension service, and access to credit and irrigation development among others. Indeed the legislation of the Tea Act (2012), the Sugar Regulations (2003 & 2008), and the Cotton Act (2006) can be seen as some of the outcomes of the ERS.

### ***Kenya Vision 2030:***

The Kenyan government developed Vision 2030 in 2007 as a successor of the ERS (Gitau et al., 2009) and was implemented in June 2008 (MAFAP, 2013). Vision 2030 is the blue print for development in Kenya – a road map for Kenya’s social and –economic development developed in 2008. The Vision 2030 initiative aims at transforming Kenya into “a newly industrialized, middle-income country providing high quality of life to all citizens in a clean and secure environment”. In achieving this, agriculture is identified as a key sector where smallholder agriculture is to be transformed from subsistence to an innovative, commercially oriented and modern agriculture. In Vision 2030, four challenges facing the agriculture sector are identified; productivity, land use, markets and value addition. Strategies to overcome these challenges is further provided (Gitau et al., 2009).

### ***Strategy for Revitalizing Agriculture (SRA) - 2004-2014***

The government of Kenya launched the Strategy for Revitalising Agriculture (SRA) in the year 2004 – a ten year programme to guide agriculture sector development. SRA’s overriding objective was a progressive reduction in unemployment and poverty. The policy further aimed at providing a policy and institutional environment conducive to increased agricultural productivity, promote investment, and encourage private sector involvement in agricultural enterprise. The SRA is associated with some success. First, there was an increase in employment of extension officers which contributed to improvement of the extension service system. Second, agricultural institutions were revamped. These included Agricultural Finance Co-operation (AFC), Kenya Meat Commission (KMC) and the Kenya Co-operative Creameries (KCC). The revitalization of these institutions improved access to credit, marketing of milk and livestock. SRA is also considered to have led to formulation of policies and legislations supportive of the agricultural sector. Overall, the agricultural sectors grew at the rate 3.1% per year for the period 2003-2007 (Poulton and Kanyingi, 2014) and had reached 5.6% by 2010 (MAFAP, 2013). This growth can be attributed to growth of government approved expenditure to support agriculture and rural development which grew by 122% (MAFAP, 2013). In addition, there was enhanced dissemination of agricultural technologies, provision of subsidized inputs to farmers and increased area under irrigation.

The success of the policy is believed to have been hampered by varied interests of stakeholders in favour of or against the reforms proposed by the policy. For instance, whereas the political elite, donors and private sector favoured the implementation of SRA; agricultural parastatal workers and rural elite (medium-to large scale farmers) were against the reforms as they feared loss of jobs ((Poulton and Kanyingi, 2014). The policy was also criticized for lack of a monitoring and evaluation component, as is the lack of people with the right skills to implement it (Alila and Atieno, 2006). The revival of KCC and KMC breathed life into the dairy and livestock sectors and offered farmers an alternative market for their produce. But the approach appeared to reincarnate the policies of the 1970s and 1980s when Kenya had strong institutions in the agriculture sector. Privatization of these institutions would perhaps been the best as it would not only align agricultural production with the liberalized market, but improve service delivery.

### ***Agriculture Sector Development Strategy (ASDS) 2010-2020***

In the year 2010, four years before the expiry of the Strategy for Revitalizing Agriculture (SRA), the Kenyan government developed the Agriculture Sector Development Strategy (ASDS, 2010-2020). ASDS had six thematic areas namely,

1. Sustainable land and natural resource management
2. Agribusiness, access to markets and value addition
3. Food and nutrition security
4. Research and Extension
5. Inputs and financial services
6. Legal, regulatory and institutional reforms

A departure from the Strategy for Revitalization of Agriculture was “the legal, regulatory and institutional reforms” to create an enabling environment for competitive agricultural sector, and “Agriculture Sector Reform Bill” aiming to consolidate and harmonize existing legislation in the sector (MAFAP, 2013). ASDS aimed to achieve a paradigm shift from subsistence to agriculture as a business.

### **Crops Act No. 16 of 2013**

The objective of the Crop Act 2013 is to accelerate growth and development of crop agriculture in general, enhance productivity and incomes of farmers and the rural population, improve investment climate and efficiency of agribusiness, and develop agricultural crops as export crops that will augment the foreign exchange earnings of the country. The objective is meant to reduce unnecessary regulatory bureaucracy, reduce levies and taxes, reduce overlap and duplication of institutions in crop agriculture, promote competitiveness, and attract and promote private investment in crop agriculture. The Crop Act of 2013 outlines registrations of crops, creates Commodities Fund and incentives to growers, and establishes county crop officers and crop inspectors. The Crop Act 2013 further categorizes crops as those requiring compulsory certification and voluntary certification. It's observed that Kenya's key crops (those produced mainly for local consumption and lead export crops) are classified as requiring compulsory certification. However, most export horticulture crops such as french bean, chick peas, dolichos beans, pigeon peas are under voluntary certification. This could be interpreted to mean that the Act seeks to protect the quality of locally consumed and lead export crops (tea and coffee), while leaving control of horticulture produce to private sectors and multi-nationals. The Crop Act 2013 consolidated fourteen (14) Acts (of different Crops) – leading to their repeal. The Act vests powers to develop scheduled crops with the Agriculture and Food Security Authority.

## **7. Conclusion**

This aim of this study was to establish local and regional variations in conditions for agriculture and food security. The specific objectives of the study were; to establish the distribution of key crops and livestock in Kenya, discuss constraints affecting, and opportunities in agriculture along the value chain, and review the institutional and policy arrangement in Kenya. This was a desktop survey carried out by review of secondary data.

In Kenya, a variety of crops (cereal, legumes, roots & tubers, industrial crops, horticultural, and fibres) are cultivated but productions of most remain below consumption. The country is characterized by three livestock production systems; pastoral, mixed agro-pastoral and mixed farming, with indigenous breeds accounting for majority of livestock. The distribution of these crops and livestock is influenced by agro-ecological zones, distance to market, climate, political environment and the cultural diversity of the Kenyan people. The clear pattern of what is found where should be a guide in defining the mandate of Kenya Agricultural and Livestock Research Organization's (KALRO's) regional centres; and indeed in the location of relevant institutions within the agricultural value chain.

The agricultural sector has a myriad of challenges that stem from physical and socio-economic environment. Although the country experiences two rainfall seasons (March-May and October-December), climate change and variability has negatively impacted on the agriculture sector. This has necessitated collaborative efforts between private and public sectors in the design and implementation of adaptation to climate change. Use of farm-level technologies has been another challenge and in part this has been attributed to a non-vibrant extension services. Demand-driven extension and Information Communication Technology (ICT) have the potential to help farmers relate use of modern technologies to improved productivity and income. Deteriorating land fertility and size has undermined agricultural productivity especially in high potential areas of Kenya. Promotion of sustainable agronomic practices and expansion of irrigation farming in Kenya's semi-arid lands have the potential to improve soil quality and improve productivity. The poor state of Kenya's infrastructure (especially in rural Kenya) and agricultural market have undermined productivity of arrange of crops and livestock. The coming into effect of county governments is expected to open up Kenya's rural areas; while deliberate efforts to support value addition can go along way in promoting the marketing of non-export indigenous crops (such as sorghum, millet, pigeon peas) that are gaining popularity in the local market. Like most parts of sub-Saharan Africa, small-holder farmers in Kenya are faced with the challenge of limited financial resources to support farming. There is notable success where some financial institutions are providing loans to smallholder farmers. Smallholder farmers will however need to change their farming orientation from subsistence to commercial and make farming a viable venture. Taking into account these challenges and opportunities, a deliberate effort is required by government to protect farmers from market exploitation; while at the same time scaling up social protection programme among the vulnerable. These should eventually, increase agricultural production.

On her part, the Kenyan government has over time established and reviewed policies aimed at increasing agricultural production. Notable is the repeal of agricultural institutions to form the Agricultural Food Security Authority and the implementation of the Agriculture Sector Development Strategy (ASDS) in the recent past. The systematic approach adopted by government is plausible. It is expected to create an enabling environment for competitive agriculture

and livestock sectors. Clarity is however required on specific components of the 'system' right from farm inputs to marketing of farm produce. This will help pinpoint the specific role of institutions and indeed other players in the agriculture sector.

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