Review of Public Investments in the Agricultural Sector in Kenya and Modelled Returns on Investments over the Last Ten Years (Special Focus on Organic Farming)

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Report for Biovision Africa Trust

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Executive Summary

The study was commissioned by Biovision Africa Trust to review public sector investments to the agricultural sector, with a focus on organic agriculture (OA) in Kenya. The period under consideration was 2010-2020. Public investment referred to annual budgetary allocations for agriculture in the state departments of crops, livestock, fisheries, and cooperatives. In some years, other departments such as irrigation and rural development were included in agriculture budget to support increased agricultural production and to develop agricultural enterprise. In such years then the departments mentioned/added were considered to be under agriculture. Public investment to agriculture includes expenditures for national agricultural capital and undertakings, operating expenditure for the departments' agricultural production, appropriation for rural development and subsidy to agriculture. Using a mixed methods approach (document search, key informant interviews and a participatory process using the KESHO tool), findings show that public investments for organic agriculture are very low. Current estimates indicate that about 3% and 5% of the agricultural budget is allocated to organic agriculture at National and County level, respectively.

This study considered the scope of public investment in organic agriculture to be all the interventions by the Ministry (ies) including projects and programs that implement activities in the organic agriculture landscape. For the period of 2010 to 2020, the Government of Kenya has invested over 425,100,000,000 Kenya shillings (USD 3,634,605,000) into Agriculture. of these, 12,753,000,000 (USD 109,038,150) was allocated to organic agriculture. At the County level, a total of Kenya shillings 206,686,976,706 (USD 1,767,173,651) and 10,334,348,835 (USD 88,358,683) were allocated to agriculture and organic agriculture, respectively.

The Internal returns on the investments over the last ten years show a consistent negative Internal Rate of Return (IRR). The IRR for Organic agriculture at both County and National level was negative 7.02 and negative 7.25, respectively. This shows that organic agriculture at both levels performed poorly. The Focus Groups Discussants (FGDs) proposed that budgetary allocations for organic agriculture should be increased by 10% or 20% for Kenya to realize the benefits of organic agriculture which include; maintaining a healthy ecosystem devoid of agrochemicals and inorganic fertilizers, improving soil fertility and water conservation, and sustaining healthy living systems that take advantage of biodiversity and recycling.

Using the Kesho Tool, a participatory and consultative process that entailed FGDs stakeholders (with representatives from national governments, NGOs, CBOs, Academia) immersing in discussions and providing views and preferences, a forecasting of prospects of investing in organic agriculture was conducted. The stakeholders identified four possible organic food production and security futures that they desired to have in Kenya by 2030. These were; Future 1: Increased food security and income through adoption of OA practices; Future 2: 10% Increased resource allocation/ public investment to organic agriculture; Future 3: Streamlined organic certification and labelling system and, Future 4: Increased availability, access, and affordability of safe and healthy foods. To achieve these four futures, agreed that several interventions and measures need to be done and they include: a) development and implementation of an organic policy and strategy for an enabling environment, b) increased political support through development of a policy for OA and increased direct funding for OA, c) increased public awareness of benefits of OA, d) increased funding to OA research and development activities, e) increased consumer education and awareness to stimulate demand for and production of organic products, and f) support development of stronger OA farmer organizations among others.

Since IRR for organic agriculture is negative, there is need for Kenya to develop a national and county level policy or strategy that support organic farming. This will ensure that significant public investments are allocated to organic agriculture. Non-governmental and Community based organizations that are implementing organic agriculture initiatives need to engage in policy advocacy initiatives and awareness creation around organic agriculture with both National and County governments as well as farmers and the private sector. Overall recommendations are;

a) Further modelling is needed for investment appraisal for organic agriculture at County level using Net Present Value (NPV) and Internal Rate of Return (IRR) to determine the leverage point at which organic agriculture can lead to a positive IRR and thus a profitable investment.

b) Demand for organic produce is rapidly increasing in Kenya, hence it is necessary to stimulate its production. However, some very important aspects still need to be addressed, such as development of a national organic agriculture legislation, national quality standards' implementation, increase knowledge and data availability on OA, how to offset the higher cost, both for producers and consumers, of organic production and certification and how to effectively market organic products.

c) Research on consumers' awareness, use and preferences on organic food products will be an essential element for farmers, agricultural and food policy makers, researchers and and food marketing agencies to successfully plan production that can capture greater investments for OA and a greater market share for products.

d) Mobilization of social movements by advocates from CSOs and NGOs to champion for setting of agendas and formulation of policies favourable to organic agriculture. Advocacy work can exert health, environmental and social pressures to County and National governments and influence them about the importance of issues such as public health and food security. This will in turn lead to initializing of organic agriculture legislations and increased funding for OA at National and County levels.

e) Implementation of organic agriculture certification system and programmes for marketing of organic products. This will allow organic farmers to market their organic products in various types of outlets

f) Increased consumer awareness programs on health, soil and environmental benefits of organic agriculture and organic food products.

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Acronyms

ASALs	Arid and Semi-arid lands
AU	Africa Union
BvAT	Biovision Africa Trust
CBO	Community Based Organization
CSA	Climate Smart Agriculture
EOAI	Ecological Organic Agriculture Initiative
GAP	Global Advocacy Project
GoK	Government of Kenya
MoALFC	Ministry of Agriculture, Livestock, Fisheries and Cooperatives
NDCs	Nationally Determined Contributions
NGO	Non-Governmental Organization
OA	Organic Agriculture
PELUM	Participatory Ecological Land Use Management
SDC	Swiss Agency for Development and Cooperation
SSNC	Swedish Society for Nature Conservation

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1 Introduction

This report is prepared for the Global Advocacy Project (GAP) under the Ecological Organic Agriculture (EOA) Initiative supported by Swedish Society for Nature Conservation (SSNC) and Swiss Agency for Development and Cooperation (SDC). The overall aim of the GAP project is to support efforts towards increased food security, resilient production systems and better incomes for small (and medium) scale farmers in Africa while at the same time safeguarding the environment for the future. The project further aims to stimulate and strengthen capacity of partner organizations to catalyze change with respect to greater policy attention to EOA programs and investments. This expected to enable the establishment of relevant legislation and regulations and to allocate resources to various key areas including extension, education, market development, entrepreneurship, applied research, information sharing and communication among others. Majority of Kenyan farmers, who are small scale in nature practise organic agriculture in one way or another without realizing it. In recent years, the emergence and development of organic agriculture in Kenya have been uncoordinated, disjointed and without any legitimacy in the form of legal and regulatory frameworks to guide the sector and spur its integration in agricultural systems as well as planning and budgeting processes.

One of Kenya's key challenges is how to feed 2.3 million people who are currently facing levels of acute food insecurity caused by the low crop productivity (USAID, 2020). Feeding this large number of hungry people will require sustainable, resilient, and profitable agricultural systems. Organic agriculture is a promising green[1], resilient and sustainable agricultural system with high environmental protection, and human and livestock welfare (Lim, 2019). It is considered potential to contributing towards the Sustainable Development Goals (SDGs) 2, 12, 13 and 15 on sustainable agriculture, sustainable consumption and production, climate change and the sustainable use of ecosystems (UNCTAD, 2016). Organic agriculture in Kenya has been practiced for a long time with the aim of cultivating crops using ways that maintain the good health and life of the both the soil flora and the soil fauna (Anyango et al. 2020). Organic agriculture entails compliance with the following practices; no use of chemical pesticides, no use of artificial fertilizer, no use of genetically modified seeds and responsible use of energy and natural resources (Biovision 2019; Morgera et al. 2012). There are no national policies for organic agriculture in Kenya, even though there is an increasing public interest and recognition of organic agriculture (Leippert et al. 2020). It is important to note that the organic sector has developed to date without any explicit official government policy support. In recent years, the Ministry of Agriculture, Livestock, Fisheries and Co-operatives (MoALFC) has established an organic desk to lead in the development of an organic policy under the Department of Food Security and Early Warning Systems. MoALFC's approach is to develop both a policy for organic agriculture as well as to incorporate it into other policies relating to agriculture, food security and the environment.

So far, practices of organic agriculture has been incorporated in some policies including National Agricultural Soil Management Policy (2020); Kenya Climate Smart Agriculture Strategy (2017-2026); National Food and Nutrition Security Policy (2011); Agriculture, Fisheries and Food Authority (AFFA) Act of 2013. Specifically, the National Agricultural Soil Management Policy (2020) aims to a) promote making of organic farm inputs, b) develop a legal and regulatory framework for the organic agriculture sub sector, c) develop standards and quality control procedures for organic agriculture and d) enhance research and technology development in organic agriculture at the national level. At the county level, governments will a)

[1]As a green technology, organic agriculture mitigates the effects of global warming by sequestering carbon into the soil and making farming more environmentally sustainable.

strengthen research-extension-farmer linkage on organic agriculture, b) promote use of organic farm inputs and c) build capacity of extension officers and famers in organic agriculture. The OA practices contained within these legislations include crop rotation, green manure, compost, mulching, biological pest control, and mechanical cultivation to maintain productive soil and control pests and maintain soil biodiversity.

The organic industry is one of the fastest growing agricultural segments in the Kenya. Organic agriculture yields such vital benefits as preservation of soil's organic composition, maintaining and improving fertility, soil structure and biodiversity, and reducing erosion, reducing the risks of human, animal, and environmental exposure to toxic materials and fine tuning farming practices to meet local production conditions and satisfy local markets (Tankam and Djimeu, 2020; Adamtey et al. 2016; Njeru, 2015; Durham and Tamas, 2021). Some of the organic farming practices include conservation tillage, compositing, Integrated Pest Management (IPM), integrated nutrient management, agroforestry, use of indigenous Seed Saving, growing of indigenous crops, ecological land use management, rainwater harvesting and aquaculture.

> Kenya Vision 2030 aims to undertake Agriculture Policy, Legal and Institutional Reforms aimed at facilitating the sustainability of agriculture and guide the county governments in developing their policies. One of the policies that will be developed and implemented is the Organic Agriculture Policy.

There is a lack of awareness about organic agriculture among Kenyan policymakers, particularly on its potential to tackle multiple challenges such as declining soil fertility, increasing crop pests and diseases and climate change, and contribution to achieving Kenya's Vision 2030 and the Big Four Agenda. Multiple partners including Biovision Africa Trust (BvAT) and Participatory Ecological Land Use Management Association (PELUM) Kenya, through the Global Advocacy Project (GAP) are working towards remediating the situation by bringing the organic agriculture agenda to the attention policymakers in Kenya. Therefore, the purpose of this consultancy is to provide evidence on the potential of organic agriculture, status of its institutional recognition, proffer recommendations generating greater buy-in by Kenyan policymakers. This will culminate in increased support towards implementation of the African Union (AU) Council's Decision on Organic Farming passed during the Eighteenth Ordinary Session, 24-28 January 2011, EX.CL/Dec.621 (XVIII) through the development of a policy brief for effective advocacy and lobby.

1.1 The Ecological Organic Agriculture (EOA) Initiative under the Global Advocacy Project

This report is an output of the Global Advocacy Project (GAP), under the Ecological Organic Agriculture Initiative (EOAI) supported by Swedish Society for Nature Conservation (SSNC) and Swiss Agency for Development and Cooperation (SDC). The review was commissioned by Biovision Africa Trust (BvAT) in collaboration with PELUM Kenya on behalf of the AU chaired Continental Steering Committee (CSC), SSNC and SDC. The overall aim of the GAP project is to support efforts towards increased food security, resilient production systems and better incomes for small (and medium) scale farmers in Africa while safeguarding the environment for the future. The project aims to stimulate and strengthen partner organizations in their capacity to catalyze change with respect to greater policy attention to EOAI programs and investments, in order to enable the establishment of relevant legislation and regulations and to allocate resources to build capabilities in various key areas including extension, education, market development, entrepreneurship, applied research, information sharing and communication among others**.** *This study recognizes that presenting concise evidential synthesis pragmatically to the real world of policymaking to minimize cognitive biases, deal with natural tendencies to resist change, and to ensure political buy-in inevitably requires the partner project implementing organizations position to see the world from the perspective of their target groups as well as understand processes*

and structures in which they engage to develop and legislate on policy issues. This study is therefore important to EOA Initiative given its focus on implementing a political decision by the African Union Summit of 2011.

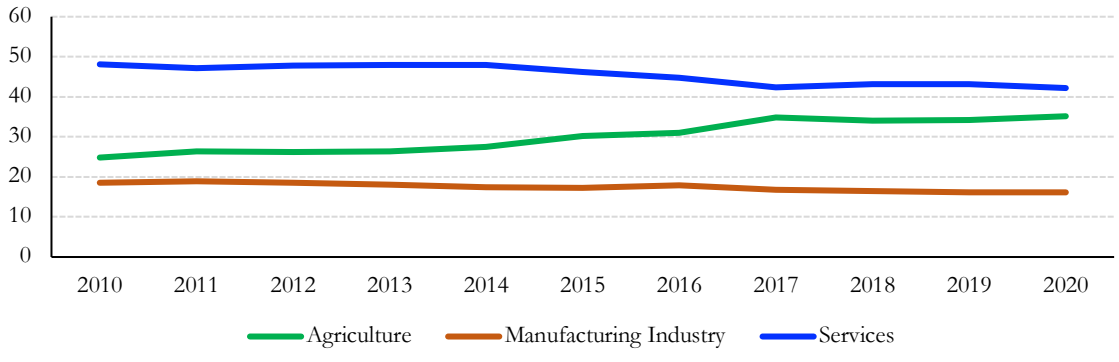
The key four objectives of the EOA Initiative are:

a) To increase documentation of information and knowledge on organic agricultural products along the complete value chains and support relevant actors to translate it into practices and wide application.
b) To systematically inform producers about the EOA approaches and good practices and motivate their uptake through strengthening access to advisory and support services.
c) To substantially increase the share of quality organic products at the local, national, regional and global markets.
d) To strengthen inclusive stakeholder engagement in organic commodities value chain development by developing national, regional and continental multi-stakeholder platforms to advocate for changes in public policy, plans and practices.

1.2 Characteristics of Kenya's Agriculture Sector

Kenya's development agenda as embraced in the Vision 2030 identified agriculture as a key economic sector and is thus central to the achievement of *"a globally competitive and prosperous country with a high quality of life by 2030"* (GoK, 2007). The sector is further expected to contribute to the projected annual 10 percent economic growth (GoK, 2018). Agriculture is central to food security, livelihoods, and economic development in Kenya. The agricultural sector is mostly based on rural production systems and directly or indirectly support livelihoods for about 75% of the population (ASTGS, 2019). It is the largest sector contributing to the Gross Domestic Product (GDP), making a contribution of 34.15% to the GDP in 2019 as indicated in Figure 1 (Plecher, 2020; World Bank, 2020)) and therefore it is the driver of Kenya's economy. Consequently, agriculture is critical both to economic development and poverty reduction. The sector comprises of crop production (food, export and industrial crop), horticulture, livestock, fisheries and forestry. Production of crops and horticulture contributes 76.5% of Agriculture GDP followed by livestock, fishing and forestry at production at 4.9%, 0.5% and 0.7%, respectively (ASTGS, 2019). Justifiably, the Kenya Government spending to agricultural and its associated value chains is one of the most important instruments for promoting economic growth and alleviating poverty across the country.

Figure 1: Share of Kenya's economic sectors to the GDP 2009-2019 (Plecher, 2020)



Majority of Kenya's rural populations derive their livelihoods from small-scale agrarian and natural resource-based systems. These systems are facing a myriad of challenges such as disruptions from climate change,

demand increases for food from growing populations, and degrading agricultural and natural landscapes and resources. The challenges affect interlinked sectors such as forestry, water, energy, ecosystem, and health and thus further exacerbating the fragile agricultural systems. The current COVID-19 pandemic is also affecting agricultural value chains highlighting agriculture and food security's links to nutrition, stability, and even national security. Yet these small-scale farming systems need to be at the forefront in stabilizing agricultural and food systems, since they are the backbone of Kenya's economy.

The agricultural sector employs more than 40 per cent of the total population and more than 70 per cent of Kenya's rural people (ASTGS, 2019). Furthermore, most of the vulnerable groups like pastoralists, women, the landless, and subsistence farmers depend on agriculture as their main source of sustenance (Alila and Atieno, 2006). Overall, it is estimated that there are 9 million Kenyan mixed crop-livestock farmers, pastoralists, and fishing folk across Kenya (ASTGS, 2019). Therefore, a vibrant and profitable agriculture sector can ensure food security, create employment, and reduce poverty in Kenya.

Agriculture is practiced under different systems that are influenced by climatic factors and altitude. Based on rainfall amounts received annually, the country is divided into three main production zones namely, high rainfall zones, medium rainfall zone and semi-arid to arid lands (ASALs) (ASTGS, 2019). The high rainfall zones receive more than 1,000 mm of rainfall annually. These highlands are occupied by 50% of Kenya's population and farmers practice semi-intensive and intensive mixed crop-livestock farming systems (ASTGS, 2019). Export crops such as tea, pyrethrum, potato, coffee, and fresh vegetables are intensively cultivated (ASTGS, 2019). Land size in this zone is small-scale with ranging between one and two hectares in size (ASTGS, 2019). The second zone is the medium rainfall zone that receives between 750 mm and 1,000 mm of rainfall annually and supports about 30 per cent of the population. Livestock and drought-tolerant crops are grown in this zone. The ASALs receives about 200 mm to 750 mm of rainfall annually and support about 20 per cent of the Kenyan population, mostly agro-pastoralists and pastoralists and ranchers. These ASALs support over 80 per cent of the country's livestock and 65 per cent of Kenya's wildlife.

Overall, the agricultural sector is dominated by smallholder rain-fed production farming systems of between 0.2 and 3 hectares (World Bank, 2015). These small land sizes account for 78% of total agricultural production and 70% of commercial production (World Bank, 2015). However, production from these smallholdings is hampered by various factors including poor land use practices; low levels of investments; limited access to factors of production namely inputs, credit, technologies, markets; that are fundamental for inclusive growth; limited value addition; and weak institutional coordination (GoK, 2019; AGRA, 2018). In recent decades, the changing climate is further exacerbating the situation (NCCAP, 2018) and the recent Covid-19 pandemic is creating an unsustainable future.

In Kenya, climate change is threatening farming systems and consequently the livelihoods and food security of millions of Kenyans who depend on agriculture and natural resources. The reliance on rain-fed systems is making the agriculture sector vulnerable to weather variability which leads to fluctuations in production and incomes and food insecurities especially in rural areas. The effects of climate change such as increased temperatures, erratic rainfalls, and increased frequency and intensity of droughts and floods are negatively contributing to low agricultural production. For example, since 1993, Kenya has declared six national disasters due to droughts that affected communities living in arid and semi-arid lands (Parry et al. 2019). The increased frequency of these weather extremes is leading to intensified soil erosion, deforestation, loss of soil fertility and reduced productivity.

Farming, fishing, and livestock keeping communities are aware of the short-term climate changes, especially temperature rise, erratic rainfall patterns and increased floods and droughts (Kabubo-Mariara and Karanja, 2013; Bryan et al. 2013; Ochieng et al. 2016). Some of them are using various adaptation measures such as sustainable and organic agricultural practices to counter the changing climate (Ochieng et al. 2016; Bryan et al. 2013). To ensure resilient productive and profitable agricultural systems, it depends to a great extent on the preparedness and adaptation actions taken by all key stakeholders (including farmers, providers of weather and Agro-advisory services, technical agricultural experts, researchers, and policymakers). Adaptation measures focusing on ensuring enhanced food security under a changing climate could have the most direct benefits on livelihoods of millions of Kenya as well as contribute to multiple benefits for food production, access to markets and resources, and reduced disaster risk.

As earlier mentioned, smallholder farmers operating under the cropping, livestock, and fisheries systems, are already adapting to observed climate change effectss, as well as reduced soil fertility and increased livestock and crop diseases and pests. For example, rural folks are shifting to organic/agroecological practices, altering planting times, sowing different crop varieties, switching to more resilient breeds of livestock and a myriad of different management approaches that can help to increase the resilience of agricultural systems. However, the shift by smallholder farmers to more sustainable farming systems is not formally documented or recognized by institutions of the agriculture sector except when the production is for commercial/export purposes.

On the other hand, the Government of Kenya has put in place policies that support sustainable and low carbon and climate resilient agricultural development. Some of the policies include the Kenya Climate-Smart Agriculture Strategy (KCSAS-2017) and the accompanying Kenya Climate-Smart Agriculture Implementation Framework Programme (2018-2027); National Livestock Policy 2015; National Oceans and Fisheries Policy 2008; National Agricultural Research System Policy, 2012; Strategic Plan for Agricultural and Rural Statistics 2015-2022; National Agricultural Sector Extension Policy 2011; and the Agricultural Sector Transformation and Growth Strategy (ASTGS) 2019 – 2029. Others are the National Climate Change Policy (NCCP) 2018; National Adaptation Plan (NAP) - 2015-2030; National Climate Change Response Strategy (NCCRS-2010); and Nationally Determined Contributions (NDCs) (2015 and 2020).

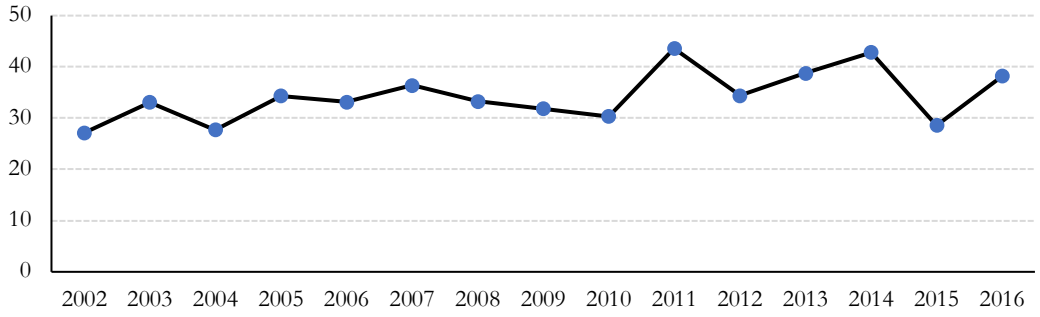
There is no policy and law for organic farming in Kenya yet. The production and marketing of OA is guided by the East African Organic Products Standard (2007). Elements of OA are embedded within national strategies such as NDCs, KCSAS and KCSAIF that incorporate elements of OA such as resilience, efficiency, diversity and synergies and recycling.

1.3 Status of Inorganic Fertilizer and Pesticides Use in Kenya

Use of inorganic inputs in Kenya's farming systems has fluctuated between years of 2002 and 2016 (Figure 2). In 2016, fertilizer consumption[2] was 38.2 kilograms per hectare (IFDC, 2016). However, this falls short by 11.8 kilograms to be at par with the international recommended standards of 50kg per hectare.

[2] Fertilizer consumption measures the quantity of plant nutrients used per unit of arable land. Fertilizer products cover nitrogenous, potash, and phosphate fertilizers, including ground rock phosphate. (FAO. 2016). Traditional nutrients, that is, animal and plant manures, are not included.

Figure 2: Fertilizer consumption in arable lands in Kenya in kg/ha between 2002-2016 (IFDC, 2016)



The low use of chemical fertilizers is due to the high cost. In 2019, the cost of 50 kg bag of DAP fertilizer cost ranged from KES 3,000 to 4,500 (that is USD, 30-45) and therefore most of the farmers could not afford and achieve the recommended rates of fertilizer application of about 8 tons/ha for the staple crop of maize (FAO, 2019). To support the farmers to purchase the fertilizers, the government of Kenya instituted input subsidy programmes, such as the National Accelerated Agricultural Inputs Access Programme (NAAIAP) (Ariga and Jayne, 2011). This input subsidy program cost the Kenya government an estimated USD 32.8 million annually targeting 2.5 million farmers (GoK, 2018). For example, for the 2020-2021 budget allocation to agriculture, about 3.0 billion Kenya Shillings were allocated to subsidize the supply of farm inputs through the voucher system to reach 200,000 small-scale farmers. This input subsidy program has led to increasing trends of direct and indirect Nitrogen dioxide (N_2O) emissions from managed soils. Statistics from the Ministry of Agriculture, Livestock and Fisheries (MoALF) show that there is an increase of direct and indirect N_2O emissions from managed soil in Kenya (MoALF, 2018). These emissions arise mainly from application of synthetic nitrogen fertilizers, nitrogen inputs from crop residues, and land-use practices associated with land-use change.

The government's efforts to increase productivity by subsidizing inorganic fertilizers and encouraging use of pesticides and herbicides have environmental costs and health impacts. Inappropriate use of inorganic inputs for agricultural production has far-reaching effects and, in some cases, excessive use of nitrogen fertilizer has led to increased damage to crops (drying out of the leaves and damage or even death of the plant), increased crop pest infestations, loss of soil fauna, contamination of surface water and groundwater (Kamau et al. 2019; Khan et al. 2018; Njeru, 2018; Russo et al. 2017; Muturi et al. 2011). A study by Wang'ombe (2014) found that farmers in Nyeri County applied pesticides without adequate understanding of pest ecology, economic injury level, and precautionary safety measures needed during routine application. The farmers reported ailments such as eye irritation, skin irritation and stomach irritation after applying fertilizers and agrochemicals. This has led to negative impacts on their health. Several authors have reported that use of fertilizers without other soil management aspects such as liming and organic matter incorporation eventually leads to soil and water acidification thus affecting plant nutrient uptake and microbial balance, contamination of surface and groundwater resources, and loss of biodiversity (Kiboi et al. 2019; Yan et al. 2018; Sheahan et al. 2013).

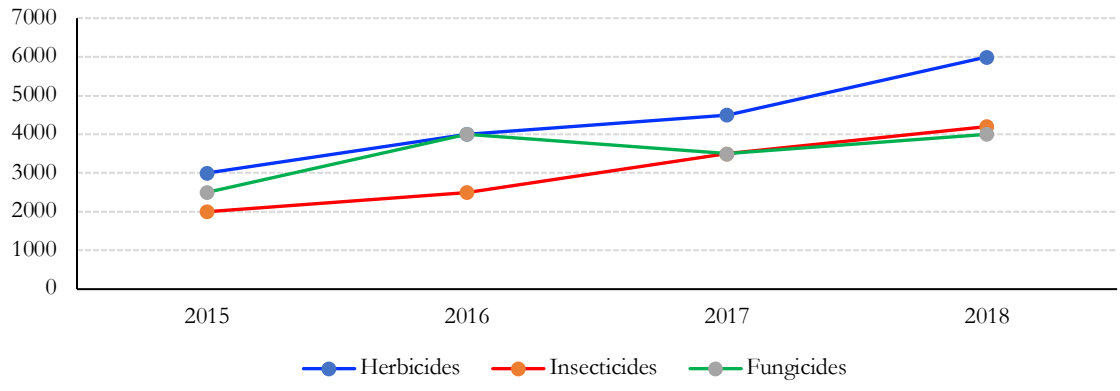
Kenya's fertilizer market is relatively well-developed and is dominated by the private sector with the government providing regulatory oversight and implementation of subsidy programs. Through this subsidy program, farmers have access to a wide variety of inorganic fertilizers for production of different crops including food crops, horticulture, and industrial crops. Diammonium phosphate (DAP), calcium ammonium nitrate (CAN), Urea, NPK 23-23-0, and NPK 17-17-17 represent nearly 90% of the fertilizer applied on Kenyan farms (Sanabria et al. 2018). Around the world, it is widely recognized that perverse

incentives in the form of subsidies and other economic incentives for farmers are a key driver of degrading soil and human health and environmental pollution. The 2020 Global Biodiversity Outlook report stated that there has been little progress in phasing out of perverse incentives and harmful subsidies to agriculture sector that are harmful to biodiversity, surface and groundwater and environment (CBD, 2020; OECD, 2019). Indeed, phasing out of fertilizer and pesticides incentives especially in Kenya would not only be one of the most effective measures to halt degradation of human and environmental health, but it could save the government a lot of money, that should be a welcome co-benefit of agricultural and environmental policies and measures now that the national governments is deeply indebted due to borrowing and the economic costs of the COVID-19 crisis.

Kenya's projected climate data for the 2020 - 2039 period, indicates that temperature will rise by 1.5°C thus altering planting and growing periods (Downing et al. 2008). Future modeling scenarios shows that future yields would drop by between 4 and 10% ($P \leq 0.05$) where the crop growth period will be reduced by an average of 15 days (Sibiko and Qaim, 2020; Downing et al. 2008). However, all is not lost, under the changing climate, studies shows that the combined use of organic and inorganic fertilizers (compost and animal manure) results on higher crop yield than singular use of either organic or inorganic fertilizers (Mbindah, 2018; Kawaka et al. 2018; Mahmood et al. 2017). Furthermore, Bryan et al. (2011) found that soil nutrient management (combining inorganic fertiliser, mulching, and manure) was a key triple-win strategy that increases soil carbon sequestration, boosts crop yields, and increases revenue. This demonstrates that the combination of inorganic fertiliser, mulching and manure has benefits not just for climate adaptation and mitigation but for productivity.

Kenya is one of the largest users of chemical fertilizers in sub-Saharan Africa (Kim et al. 2020). In Kenya, use of pesticides has been promoted to expand agricultural production and increase productivity. Import of pesticides has steadily increased over the years from 263 tons of pesticides in 2009 to 17,803 tonnes valued at 128 Million (USD) in 2019 (Route to Food Initiative, 2019; Macharia et al. 2009). These pesticides comprise of insecticides, fungicides, herbicides, fumigants, rodenticides, growth regulators, defoliators, proteins, surfactants and wetting agents, which all comes in 345 products registered for use in crop production in Kenya. Of these, insecticides, fungicides, and herbicides account for about 87% in terms of volume and 88% of the total cost of pesticide imports (Route to Food Initiative, 2019) (Figure 3).

Figure 3: Volume of herbicides, insecticides and fungicides imported from 2015 to 2018 in Kenya (tonnes) (KEPHIS, 2018)



The impacts of the pesticides on humans and environment are well documented. From the 345 products, 11 of the pesticides are classified as highly hazardous by the World Health Organisation and 237 as moderately hazardous. Some are classified as cancer-causing (24), prone to causing mutations in DNA (24), creating development disorders (35), disrupting the nervous system (140) and showing clear effects on reproduction (262). Unfortunately reports indicate that there is no comprehensive epidemiological health study related to pesticide exposure in Kenya, and only a few studies show that these pesticides are having a negative effect on our environment and our health such as sneezing, dizziness, headache and blurred vision, and skin irritations. Study by KEPHIS (2018) indicates that 46% of the fresh vegetables sold in Kenya have high levels of pesticides with harmful active ingredients with the most common vegetable, the kale (94%) being the leading culprit.

Pollutants and chemical from pesticides are found throughout the food chain in Kenya

The use of pesticides is governed by the Pest Control Products Act, Cap 346 of the Laws of Kenya, and many conventional chemical pesticides and biopesticides have been registered for use in Kenya (PCPB, 1985). The pesticides are found throughout the food chain from production (farmer level) to consumption (end user level). The pesticides are also found in domestic water, in the rain and in the air that leads to chronic health effects (Abong'o et al., 2018; Tsimbiri et al., 2015). Since many Kenyans work in agriculture and food production, millions of them are exposed to pesticides in their daily lives. The farmers and other agricultural workers do not use Personal Protection Equipment (PPE) for highly hazardous pesticides, due to several reasons including high costs, too uncomfortable to wear, lack of knowledge on proper application of pesticides (Route to Food Initiative, 2019). The consequences of this, is that there is high human and environmental exposures to all kinds of harmful pollutants and chemical from the pesticides.

1.4 Status of Organic Agriculture in Kenya

Organic agriculture has been practiced by small-scale farmers in Kenya for decades through composting, use of animal manure, minimal and conservation tillage, fallowing among others. *However, formal recognition of organic agriculture in Kenya dates back to the early eighties when the first pioneer organic training institutions were established with objective of assisting small-scale farmers address the declining productivity, low incomes, high poverty incidences and food insecurity.* The growth and development of organic agriculture in Kenya was an initiative of the Kenya Institute of Organic Farming (KIOF) whose aim was to develop a vibrant organic market - both locally and internationally. In 2022, the size of land under certified organic agriculture was 123,744 hectares, representing 0.4% of the agricultural land (Willer et al. 2022).

In 2015, the world organic agriculture covered 50.9 million hectares with Oceania (22.8 million) and Africa as the least regional producer (1.7 million hectares). In 2020, Kenya land size under certified organic agriculture is 173,000 hectares (KOAN, 2020; Willer and Lernoud, 2015)

Organic Agriculture (OA) is defined as the *'production system that sustains the health of soils, ecosystems, and people'* (IFOAM, 2008). OA espouses the interconnected principles of health, ecology, fairness, and care for the environment relying on sustainable ecological processes, biodiversity, and adaptability to the local condition (Pelum, 2015; KOAN, 2015; Heinze, 2020; FAO, 2017; Mie et al. 2017). Though implemented within local social-economic, climatic, and cultural settings, OA adheres to globally accepted principles (IFOAM 2000). OA discourages use of industrial products such pesticides, herbicides, and inorganic fertilizers (Rampa and Dekeyser, 2020; Baranski et al. 2017; Foley et al. 2011). OA combines use of tradition knowledge, innovation, and science to benefit people, the environment and adapt to the changing climate. In Kenya, the farmers practicing the crop-livestock mixed farming usually combine organic and inorganic practices. However, for the farmers who grow fruits and vegetables for exports, OA practices are very common and are rapidly gaining momentum as demands for organically grown foods is increasing locally and internationally (KNA, 2021).

Practicing organic agriculture leads to a circular bioeconomy that is powered by nature and use of its sustainable resources. It thus offers a unique opportunity to use renewable natural capital to holistically transform and manage our land, food, health, and environmental systems. If farming systems are managed sustainably and organically for people and the environment, it has the potential to decarbonize Kenya's economy and restore biodiversity in farm lands while providing jobs and achieving inclusive growth.

Over the years, OA has been promoted by non-government organizations (NGOs) and community-based organizations (CBOs) who aimed at addressing the high costs of fertilizers and pesticides, declining soil fertility, high food insecurity levels, poor nutrition, and low incomes. In recent years, the NGOs and CBOs are engaged with farmers to reorient to OA to assist them manage the fields, farms, ranches, and communal lands to achieve resiliency. OA is also geared towards improving natural resource management, including land, water, ecosystems, biodiversity and supporting nature-based solutions.

Advantages of organic farming

- Maintains a balanced ecosystem health due to organic nutrient cycles and soil health
- Efficient use of resources due to recycling and practicing crop rotation
- Low-cost production
- Higher incomes because prices for organic products are higher
- Minimized exposure to and intake of agrochemicals within the food chain (Eyhorn et al. 2019; Meemken and Qaim, 2018; Mie et al. 2017; Reganold and Wachetr, 2016; Seufert and Ramankutty, 2017)

Organic or ecological based crop, fishing and livestock systems also focus on water resource management, integrated pest management, sustainable agriculture, integrated soil management, agricultural system diversification and agroforestry (Lotter, 2015; Hertel, 2015). These practices are key components of improving productivity and resilience, buffering crop, fish, and livestock production from the effects of greater climate variability and extreme events, reducing pest outbreaks and pathogen transmission and increasing incomes. This is because OA comprises of crop rotations and fallowing practices, intercropping, and growing mixed crops or varieties on the farm.

Achieving a sustainable agricultural sector in Kenya will require Kenyan farmers, fishing and pastoral communities innovating to manage lands and soils, and safeguard ecosystem health, and produce food in the face of a changing climate. It also requires expanding access to investment to support the uptake and scaling of organic and resilient agricultural technologies and practices. Organic agriculture is a holistic farming system approach that is based upon sustainable ecosystems, safe food, good nutrition, animal welfare and social justice (Biovision, 2019). OA is a low-cost system that can easily be adopted by farmers because it relies on local or on-farm renewable resources, management of ecological and biological processes and minimized use of inorganic inputs.

Disadvantages of organic farming

- Production cost is high since a lot of labor and time are involved
- High costs of organic inputs as compared to the inorganic ones e.g. fertilizers and pesticides
- Maybe unsuitable for large scale production
- Requires extensive knowledge of local environmental and climatic conditions
- Potential loss of crops to pest and diseases that cannot be dealt with by organic methods.
- Organic crops generally spoil faster after harvest.
- High variance in yield and product quality (Durán-Lara et al. 2020; Selim, 2019; Seufet, 2019; Muscănescu, 2013)

Despite of increasing public interest and recognition of organic agriculture, especially for urban markets and export, there are no official national policies for organic agriculture or ecological agriculture in Kenya.

However, several public policies and strategies mention or allude to supporting and promoting elements of organic agriculture in Kenya (See Appendix I). The devolved system of governance in Kenya provides an opportunity for County Governments to draft their own policies based on the prevailing circumstances. Kiambu County has already adopted a law on agroecology and it the first one among the 47 counties. This will definitely influence other Counties to develop agroecology or organic agriculture policy.

1.5 Embeddedness of Organic Agriculture Principles in Kenya's Policies and Strategies

For small-holder farmers in Kenya, the greatest impact on productivity can be achieved through agricultural approaches that combine improved traditional varieties, soil and water management technologies, crop-livestock integration, and mechanical technologies to exploit their synergistic effects (Chesterman and Neely, 2015). Review of the policies indicate that despite not directly mentioning the word "organic', there is significant contribution of organic or ecological agriculture practices in increasing agricultural productivity and building resilience. Existing agriculture and/or climate change policies or strategies mention or infer to organic agriculture practices and principles. For example, Kenya's NDCs emphasis on increasing resilience of systems and enhancing adaptive capacity through enhanced coordination of climate change action, public participation and inclusiveness. To build resilience, it will be done through improving efficiency in the use of resource in all agricultural production systems (including supporting sectors such as water and energy) and in implementation of polices that will lower cost of production and hence increase productivity. Agroforestry is one of the agroecological practices highlighted and seen as having the potential to provide this synergy and to offer resilience benefits and reduce emissions in agricultural systems (GoK, 2018).

ASDS recognizes Kenya's agro-ecological diversity and aims to improve diversity of food to meet dietary and nutritional requirements, increase agro-biodiversity to include traditional sources of food and support use of organic methods for sustainable food production systems.

The Kenya CSA strategy and framework selectively incorporated some organic/ecological practices and combined them with adaptive, traditional and environmentally sustainable technologies such as provision of weather and agro-advisory information along value chains for decision-making and insurance, efficient water use including irrigation and, conservation and propagation of adaptive crop and livestock germplasm. Some of the CSA and organic practices that overlap include; integrated pest management that minimize the use of pesticides on emerging pests and pathogens brought by temperature rises; agroforestry to bridge agricultural development and forest protection; integrated soil fertility management.

1.6 The Problem

Kenya's agricultural sector experiences low food production and productivity, soil degradation, biodiversity loss and the effects of climate change. This has created yield gaps in Kenya that are driven by productivity challenges on small- and large-scale farming enterprises. First and foremost, despite Kenya's commitment to the Malabo Declaration of investing at least 10% of public expenditure to agriculture, the country continues to have low public expenditure on agriculture at both National and County levels (World Bank, 2018; Ayenew and Arquitt, 2018). Subsequently, Kenya spends about US$ 89 million annually on input subsidies schemes, that are are regressive and distortionary, and disproportionately benefits large-scale farmers (Jayne et al. 2018; Mason et al. 2017; Goyal and Nash, 2017), This has led to a huge yield gap, especially amongst small-scale farmers (Appendix II). Calls for increasing public expenditures on agriculture is not only about quantity of financing but ensuring that the efficiency and effectiveness of the expenditures. According to Goyal and Nash (2017), Africa invests a lot of public investments on agriculture activities

which "*generate low returns, and that improving the quality of public spending would strengthen the case for increasing its quantity*".

Population increases with associated land pressures and falling average farm sizes is leading to significant constraints on production, particularly for smallholders (Muyanga and Jayne, 2014). The pressure of land is also causing declining soil fertility levels and degradations of land (Jayne et al. 2016 and 2018; Bryan et al. 2011). A study by Mulinge et al. (2016) estimated the annual costs of land degradation in Kenya between 2001 and 2009 at US$ 1.3 billion.

Adoption of sustainable land management practices is low, and the changing climate (temperate changes and variability of rainfall) are likely to have significant effects on agricultural production in Kenya (Ochieng et al., 2016; D'Alessandro et al., 2016). Issues like delayed access to high-quality seeds, poor farming practices such as improper use of fertilizers, poor agro-advisory services, increased post-harvest losses (post-harvest losses are between 20-25% driven by gaps in harvesting and drying) and falling government expenditure on agricultural research and development, and agricultural extension are all contributing to the yield gaps (ASTGS, 2019). In particular, government spending on agricultural research and development, and agricultural extension as a proportion of GDP is low and in 2016, it was about 0.48% (Beintema et al., 2018). This is well below the African Union target of 1% (Beintema et al., 2018).

Farmers in Kenya also face limited access to safe and sustainable inputs such as seeds, sustainable soil ameliorates and sustainable pest and disease management agents. Many farmers cannot find inputs in the nearby shopping centers, especially for organic inputs such as resource-responsive and resistant seeds, biological agents and raw material for organic fertilizers. Additionally, the low literacy levels and lack of knowledge on how to effectively use and apply organic soil inputs is a hindrance to millions of small-scale farmers.

Due to the above issues, compounded with the increasing cost of inorganic fertilizer and the associated negative impacts on the environment and human health, and the changing climate, Kenya will be expected to promote a paradigm shift towards low cost, climate-resilient and sustainable and low-emission pathways in agriculture sector. Through its developmental agenda, Kenya will need to design, finance and implement innovative organic and sustainable agricultural initiatives that can be replicated, scaled up and sustained to achieve transformational change.

The above challenges facing the agriculture sector can be turned into potential opportunities. Based on the benefits of OA and the comparative advantages over use of inorganic fertilizers in improving the soil quality, enhancing ecosystem services, improved human health and contribution to low-carbon development, OA promises to be an approach that the Government of Kenya can push forward. Therefore, Kenya requires transformational policy and planning in agriculture sector to support implementation and wide scale adoption of OA. Additionally, Kenya needs to catalyze OA innovation by identifying and testing ecologically sound and organically driven technologies, include the outcomes of organic and ecological research into agricultural policies, mobilize public finance for OA to ensure financial sustainability; and leveraging partnerships and knowledge to scale up and replicate successful OA practices. Currently, the government does not directly allocate finances specifically for OA in its annual budget. Due to the benefits accrued from the use of OA, a policy is thus needed that will support public financing for implementation of organic agriculture, as well as for expansion and replication of OA knowledge across the country.

Ecological Organic Agriculture aims at:

- Working with nature to create a healthy balance between naturally available resources and farming while increasing the resilience of food systems.
- Not using chemical-synthetic pesticides and fertilizers.
- Renouncing livestock feed additives and minimizes synthetic animal drugs.
- Excluding genetically modified organisms including seeds, plants, or animals.
- Making best use of both traditional and new scientific knowledge to come up with the best farming practices that are adaptable to the local conditions and opportunities.
- Relying on ecologically sustainable practices such as feeding the soil with organic material to improve and maintain its productivity, maximal possible disease prevention using tolerant cultivars and appropriate system design and enhancement of beneficial insects to control pests.
- Establishing integrated market chains from field to fork that guarantee a fair share of the benefits of organic products to all partners in the food chain.

(Source: Kilcher et al. 2011)

It is important to outline the challenges facing the organic agriculture sub-sector which include inadequate research and development; weak research-extension-farmer linkages, and low production levels due to the small parcels of land where organic farming is being practiced. The market and infrastructure is poorly developed and does not give clear distinction between conventional and organically produced products. Value addition and processing are poorly developed, consisting mainly of transport and handling as opposed to change of form. The existing legal and regulatory framework is not conducive for the growth and development of organic agriculture due to poor enforcement of produce and product standards. These shortcomings have resulted in poor performance of the organic agriculture sub-sector.

1.7 Purpose and Objectives of the Study

The purpose of this study is to provide evidence on the importance of increased investment on OA in Kenya and the information generated will be used to provide greater buy-in by Kenyan policymakers and support advancement of the implementation of the African Union (AU) Council's Decision on Organic Farming passed during the Eighteenth Ordinary Session, 24-28 January 2011, EX.CL/Dec.621 (XVIII) through the development of a policy brief for effective advocacy and lobby.

Accompanying this report is a policy brief that will be an important advocacy tool in influencing a positive policy change for a conducive policy environment towards securing county policy and budget shifting/allocation in support for ecological and organic agriculture. The policy brief is expected to sensitize policy decision-makers and other actors on the rationale and urgency of critical county and national ecological/agroecological development issues. The objective of this study was to provide a review of public sector investments in the agricultural sector in general and organic agriculture in particular in Kenya and modelled returns on the investments in the last ten years. Specifically, the study aimed to;

a) Undertake a rapid review of public sector investments to the agricultural sector in general and organic agriculture in particular in Kenya and modelled returns on the investments and implications on health on human, animal and the environment in the last five years.
b) Provide recommendations for building and sustaining modelling capacity in the agricultural sector and use of modelling results to inform policy development and implementation.

2 Methodology

Review of public sector investment to the agricultural Sector in general was done at two levels of government, that is the National and County levels. This is because agriculture is a devolved ministry, with the aim of enhancing agricultural production at the 47 Counties in Kenya. For the national level, public investment data was available from 2010 while the data from Counties was available from 2014. A mixed method approach was engaged to evaluate public sector investments for the past five years (2015-2020). That is document search, key informant interviews and a participatory process using the KESHO tool.

2.1 Document Search

A scoping review methodology was employed using methods developed by Arksey and O'Malley (2005). The main aim of a scoping review is to provide an overview of published literature, and in this case in order to identify data on public investments for the past ten years. Key terms and concepts (agreed upon by the BvAT EOA Team) were used by the consultancy team to identify documents and group them into policy, programs, and projects (Table 1). Once a document has been identified to have an organic farming practice or principle, amount of funding was identified. Analysis of trends in public sector investments was done for the years from 2010 to 2020 in agricultural sector at national and county levels.

Table 1: Organic agriculture related search terms

Organic agriculture terms	Agro-ecology terms
• Crop rotation • Crop residues • Organic manure (green, compost and Farmyard manure) • Waste • Biofertilizers • Bio-pesticides • Vermicompost • Agroforestry • Aquaculture	• Diversity • Co-creation and sharing of knowledge • Synergies • Efficiency Human and social values • Cultures and food traditions • Responsible governance • Circular and solidarity economy

Trends in the amount of investment for agriculture in general and with a special focus on organic agriculture was done at the national and county levels. The documents reviewed included government of Kenya annual budgets, strategies and plans, projects, and programs.

2.2 Key Informant Interviews

Interviews were conducted with key stakeholders who had expertise on principles and practices of organic agriculture at National and County levels of government to collect information on public investment in agriculture and organic agriculture. Expert stakeholders were critical because they usually have insights and specific knowledge and are often technical personnel in charge of planning and budgeting.

2.3 Financial Investment Modeling

After data collection was done, a financial modelling was done to assess the economic returns for investments in agriculture and organic agriculture at both national and county levels. This study used the Internal Rates of Return (IRR), which is a very common metric in equity asset investment. It is the discount rate that makes the net present value (NPV) of all cash flows from the investment, across time periods, equal to zero (Cruz and Singerman, 2017; Evison, 2008; Harvest Returns, 2021; Seaver, 1989). The IRR is a robust tool for analysis in agriculture since it does not focus on a single moment in time, but rather factors in the continuous cash-flow in future periods (Cruz and Singerman, 2017; Harvest Returns, 2021). In other words, is the expected compound annual rate of return that will be earned on a project or investment IRR analysis is also helpful in allowing investors to consider changing operating over time (Harvest Returns, 2021; Cruz and Singerman, 2017; Seaver, 1989).

One of the advantages of IRR is that it uses cash flow and takes into consideration time value of money when evaluating an investment. IRR takes into consideration the interest rate at which the present value of future cash flow equals the present the required capital investment. The timing of cash flow in all future year metrics is considered and each cash flow is given equal weight by using the time value of money. IRR is used to determine which investment will be beneficial for an organisation to venture into. Investors or business leaders need to evaluate the reasonable projected returns on an investment before making a financial decision. The internal rate of return is one of the methods that offers a comparison the profitability on the returns.

For the financial decision, IRR and Net Present Value (NPV) were used to determine the right investment opportunity. The two methods are similar but use different variables. NPV assumes a particular discount rate and calculates the investment present value, whereas IRR, it calculates the actual yields provided by the projected cash flow and compare the yield returns. if the IRR is higher, then the investment is worth investing in. There are also other factors and financial evaluation that may be taken into consideration while evaluating the investment such as return on investment and/or risks.

Kenya interest rate was variable throughout the study period, that is 2010-2020. For each year, the interest rate for that year was used in the calculation. The IRR was calculated as follows:

$$NPV = \sum_{(n=0)}^{N} (Cn /(1+r)^n) = 0$$

Where:

N: The total number of years
Cn: The cash flow in the current period
n: The current period at that step in the formula
r: The internal rate of return

Four scenarios were explored, that is County Organic agriculture expenditure, County annual agriculture (minus OA), National Organic agriculture expenditure and National annual agriculture (minus OA).

2.4 Participatory Scenario Forecasting – KESHO Tool

Using the KESHO (a Kiswahili word that means tomorrow) tool a participatory and consultative process that entailed soliciting views from stakeholders (national governments, NGOs, CBOs, Academia), a forecasting of prospects of investing in organic agriculture was conducted. The KESHO tool enables stakeholders to combine possible futures thinking and strategic foresight and visioning to tackle key development challenges (Capitani et al., 2016). For this research, the KESHO tool was used to engage stakeholders in future thinking for importance of investing financing in organic agriculture in Kenya as well as exploring the implications of OA on soils, ecosystems/environment, and human and animal health. The KESHO tool permitted the stakeholders to consider the 'what if' scenarios on public investments, soils, ecosystems/environment, and people and animals. Using the KESHO tool with various stakeholders also increased scenario plausibility and legitimacy via a sense of process ownership by the stakeholders, as well as capturing perspectives from different scales grassroot, sub-national to national (CARE, 2018; McBride et al. 2017).

Participants who were involved in the Participator Scenario Forecasting (PSF) using the KESHO tool included scientists, agricultural advisors, advocates of OA and government policy makers. These participants were selected for their abilities to provide insight and perspective on the possible future of organic agriculture in Kenya. The participants were also purposively selected because of their knowledge of current trends and key elements defining the organic agriculture environment in Kenya. Through a participatory and interactive process, a description of ideal future for food production in Kenya was done and what needs to achieve that future as well. The description of ideal future involved looking at various actors on the food value chain, reflecting on what is currently known and what is expected by 2030.

2.5 Study Limitations

Access to detailed organic agriculture expenditure data was problematic especially at both the national and county government levels. Additionally, data on budget allocations is more readily available than information on actual expenditure and there are frequently large discrepancies between the two. During discussions with key informants, there was a problem on how organic agriculture is defined. In terms of the organic agriculture practices, the study faced a challenge of what should be included and what should be eliminated. According to the key informants, public expenditure on both general agriculture and organic agriculture should be broad enough to encompass, the agriculture initiatives contained within the vision 2030 pillars. For instance, establishment of disease-free zones under the Economic and Macro pillar of Vision 2030, the key informants would not know how much of the public investment has gone into constructing leather infrastructure that supports cattle that are reared organically or spending on rural infrastructure including roads.

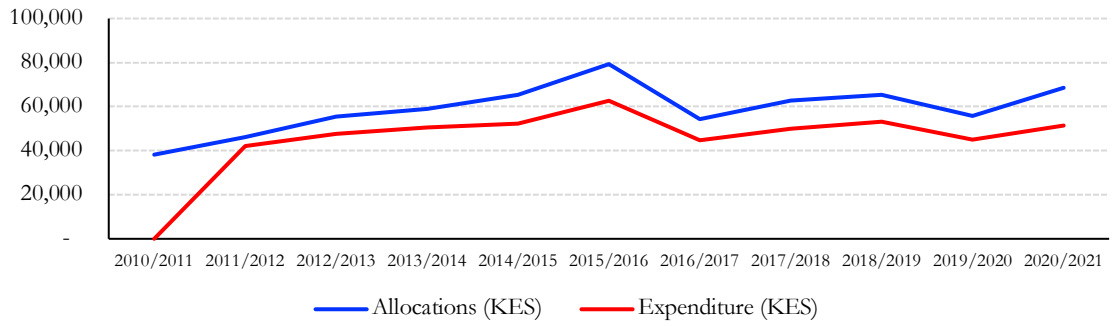
The IRR was calculated by using the budget allocations (investment) and expenditure (assumption) costs only and not full as data on the return of investment was not available. Using the budget allocations and expenditure from each year, the NPV and IRR were estimated. The study also considered an average interest rate of 8% for the 10 years (2011 – 2020) as Kenya has variable interest rate for those years.

3 Public Investments for overall Agriculture and Organic Agriculture

3.1 Public Investments for Agriculture at National Level

The exchequer issue to the agricultural sector in 2010 was KES. 38.2 billion. Between the years of 2011 and 2013, the lowest amount of funding was allocated to agriculture. However from 2014, there was an upward trend with 2015 having the highest issue of KES 54.5 billion (Figure 4). However the government spending on agriculture sector has remained very low and has not met the commitment under Maputo Declaration of 2003 where African governments consented to committing at least 10% (to accelerate the 6% agricultural growth rate) of the annual budgets in agriculture (AU, 2003). For the ten-year period (2010-2020), the average public spending on agriculture sector as percentage of the national budget ranged from 2.7-5.0% with an average of 3.8%. The highest at 5.0% was reported in the 2014/2015 and the lowest in the year 2010/2011. The amount of public investments into agriculture is almost equivalent to the cost in each year. However, in 2017-2019, the cost is quite low compared and at the end of the year, the funds were returned to the National Treasury (Figure 4).

Figure 4: Allocations and expenditure for Agriculture at National level 2010-2020
(Millions of Kenya Shillings)

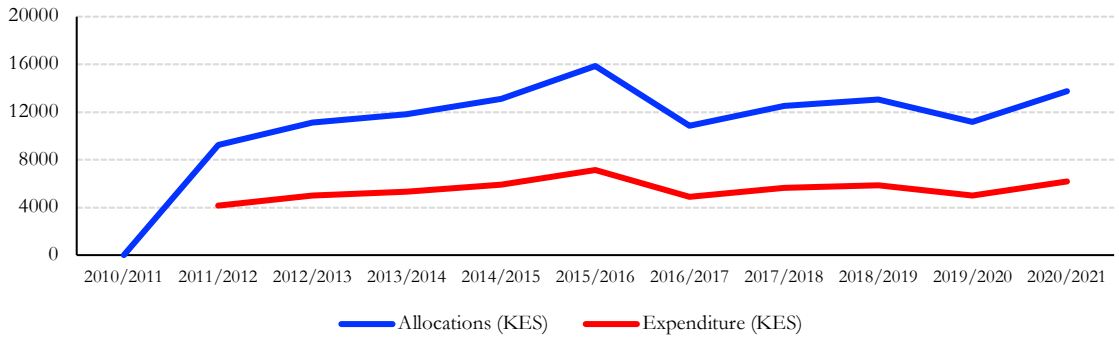


3.2 Public Investments for Organic Agriculture at National Level

In Kenya, the ecological organic agriculture sub-sector is gaining importance in its contribution to increased food security and nutrition, resilience, women empowerment, access to new markets opportunities and income. Due to its diverse benefits, the increased demand for organic agriculture produce is creating a niche for small holder farmers. However, government investment in organic agriculture is low. In fact, there was no clear-cut budgetary allocation to organic agriculture sub-sector. The organic sub-sector is fast growing, mainly led by Civil Society Organisations (CSOs) and private sector (companies growing organic produce for export and domestic).

Discussions with key informants at all the state departments of the Ministry of Agriculture, Livestock, Fisheries and Cooperatives reported that they allocate an average of 3% of the total public annual agriculture budget to organic initiatives such as training farmers on the use of using compost, animal manure, agroforestry, minimal tillage especially for indigenous vegetables, cover cropping and use of local herbs as pesticides. Using the estimated 3% annual public budget allocation to organic agriculture, and the cost of production of organic agriculture (average 45% less of non-organic agriculture) (Edwards and Stevenson, 2015), is much less than the amount of funds allocated in each year (Figure 5).

Figure 5: Estimated allocations and expenditure for organic agriculture at National level 2010-2020 (Millions of Kenya Shillings)

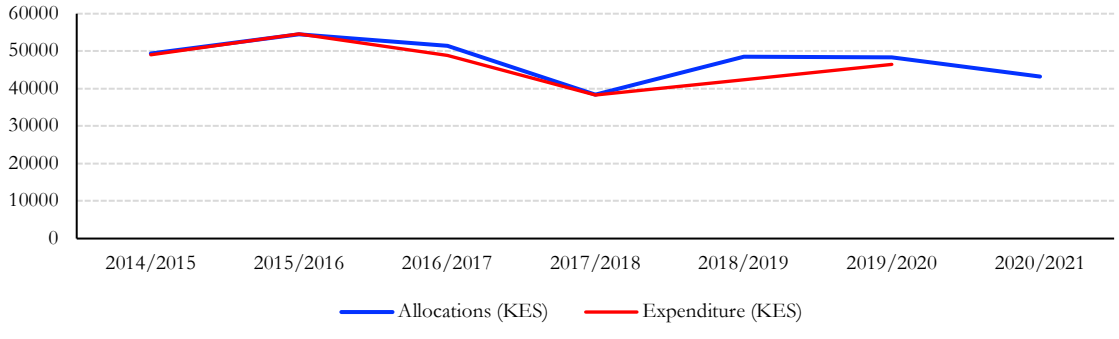


3.3 Public Investments for Organic Agriculture at County Level

The Constitution of Kenya promulgated in 2010 provides for the establishment of a two-tiered government in a devolved system of governance. The devolution created County Governments that were established in 2013 with distinct functions and responsibilities. Agriculture is one of the devolved functions. The first budget implementation report covers the period, March- June 2013. In our analysis, the financial year 2012/2013 is excluded from the data set because only the 4th Quarter March –June 2013- (quarterly report was available). In addition during the stated period, most County Governments and their associated County Assemblies prioritized refurbishment of offices and purchase of Hansard equipment and not implementation of development initiatives. On the other hand the financial year 2013/2014 was also excluded in the analysis because in the annual report available the budgets have not been disaggregated per sector making it difficult to pull out specifics.

The average amount of funding for total agriculture for 2014-2020 amounts to over one billion Kenya Shilling (1, 159,363,636) (USD 99,125,591) (Figure 6). Budgetary allocations to agriculture vary significantly at the county level with an average of 6%. However, some counties, e.g., Uasin Gishu, allocated over 10% of their total budget to agriculture.

Figure 6: Amount of funding for Agriculture at County level 2014-2020 (Millions of Kenya Shillings)



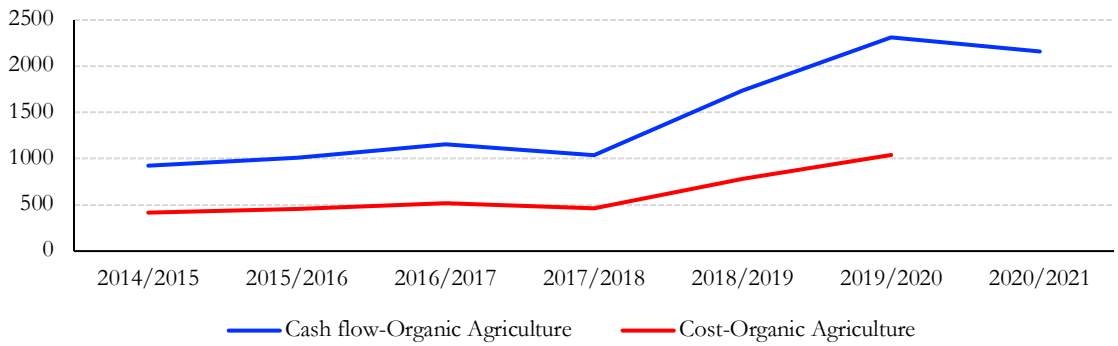
Notably, the budgetary allocation to agriculture sector by counties has been increasing each year (Figure 6 above). This could be attributed to the fact that the county governments attach great importance to the revitalizing agricultural sector.

3.4 Investments for Organic Agriculture at County Level

Agriculture being a devolved function, each county develops its own plans in the County through the County Integrated Development Plan (CIDP) aligned to National plan and policies[3]. There is no disaggregated data that shows allocation to organic agriculture both at the county and national levels. Discussion with key informants at the County level reported that about 5% of the agriculture budget is allocated for organic farming project activities.

Additionally, key informants mentioned that the Kenya Climate Smart Agriculture Project (KCSAP) and The National Agricultural and Rural Inclusive Growth Project (NARIGP) are considered as "organic agriculture budgetary allocations". KCSAP is implemented in 24 counties while NARIGP is in 21 counties. Using the 5% budget allocation for organic agriculture, Figure 7 below shows that the cost of implementing organic agriculture is usually lower than what was budgeted. Since 2014 when the County governments started operating, the amount of funds allocated for organic agriculture has increased through the years. Focusing on the budgetary allocation to organic agriculture at the two levels of government it is clear that organic agriculture receives between 3-5% of the agriculture budgetary allocation.

Figure 7: Amount of funding for organic agriculture at County level 2014-2020
(Millions of Kenya Shillings)



[3] CIDP is the core five-year development plan that integrates the long-term spatial, sector and urban plans with inputs from the Governor's manifesto, national government plans and programs, past county development performance and the views and expectations of other development actors and the public at large. The CIDP sets the priorities and guides all county government spending until the next elections.

4 Internal Rate of Returns on Organic Agriculture in Kenya

In 2019 agriculture sector was the second largest sector in terms of its share in GDP and employment in Kenya contributing 34.15% while Service and Industry each contributeing43.22% and 16.15%, respectively (Statista, 2020). It follows that in Kenya, spending to agriculture should be one of the most important government instruments for promoting economic growth, alleviating poverty and sustainable development. There have been many studies of the relationship between government expenditure and economic growth that show positive growth and poverty reduction effects from public spending in agriculture (Molonko, 2017; Abdinasir, 2013; Maingi, 2010).Yet, public expenditure to agriculture has stagnanted or is declining over the years. This follows that public investment in organic agriculture in the country is also low at National level. However, at the County level, investment in Organic agriculture has been on the increase between 2013-2020, with a dramatic increase in the fiscal year of 2018/2019.

For the period of 2010 to 2020, the Government of Kenya has invested over 425,100,000,000 Kenya shillings (USD 3,634,605,000[4]) into Agriculture. of these, 12,753,000,000 (USD 109,038,150) was allocated to organic agriculture. At the County level, a total of Kenya shillings 206,686,976,706 (USD 1,767,173,651) and 10,334,348,835 (USD 88,358,683) were allocated to agriculture and organic agriculture, respectively. While devolution provides greater freedom for County government to increase spending to general agriculture and organic agriculture, the extent to which this occurs depends upon the priority given to agriculture in each County Integrated Development Plans. Currently there is no evidence that local governments are increasing the relative share of funds allocated to agriculture.

All the four scenarios shows that there is negative IRR (Table 2). Despite the negative IRR for Organic agriculture at both County and National level (that is, negative 7.02 and negative 7.25, respectively), it was better than IRR for agriculture that reported a -8.67 and -23.10, for county and national investments, respectively. Organic agriculture therefore demonstrates that it is the best investment at both levels of governments. It is critical to note that the results are showing a negative IRR, as data on the returns on investment are not available. Data collected from the National Treasury only shows the amounts of funds allocated and the expenditure but there is no data on profits. If data on profits were available, the results would significantly show the actual IRR.

Table 2: IRR of four agriculture investments in Kenya

	Interest Rate	IRR
County Level		
County Organic agriculture	Variable	- 7.02
County annual agriculture (minus OA)	Variable	- 8.67
National Level		
National Organic agriculture	Variable	- 7.25
National annual agriculture (minus OA)	Variable	- 23.10

Disclaimer: IRR calculation is not full as data on the return of investment is not available

[4] USD was calculated for the using an average for the year 2020 from Oanda Currency Exchange. https://www.oanda.com/bvi-en/

5 Participatory Scenario Forecasting for Organic Agriculture

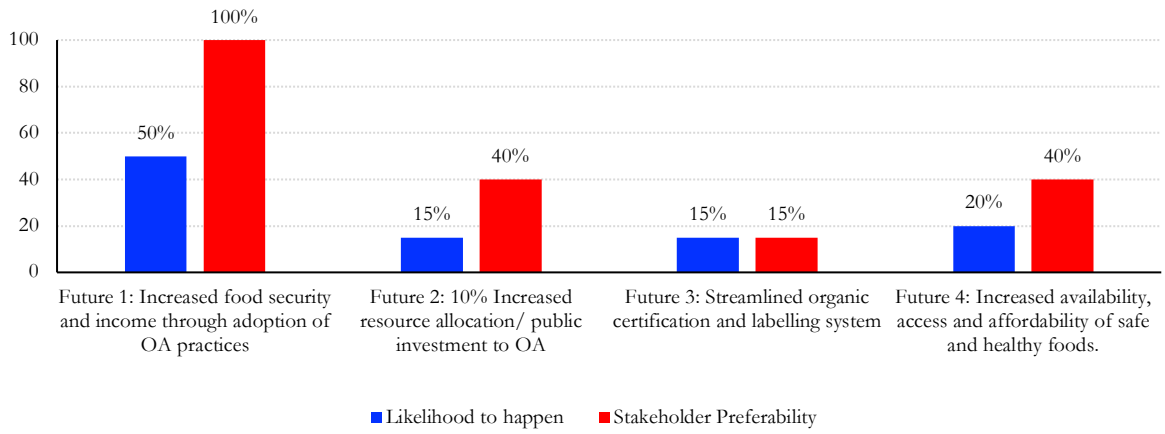
Kenya can be at crossroads on whether to transition into organic farming or have a blend of both inorganic and organic farming to increase food production and achieve food security. For proponents of organic agriculture, they consider it a profitable and climate resilient option for smallholder farmers in Kenya because it offers a unique combination of low inputs, environmental conservation, and contributes to adaptation and low carbon emission. Additionally, there will be increased incomes for farmers due to an increase in organic grocery stores as well as organic sections in major supermarkets in urban centers in Kenya. Therefore, the key questions that needs to be addressed are a) What is the ideal future that stakeholders envision for food production in Kenya? b) What is needed to achieve the OA futures that stakeholders desire? c) How much public investment is needed to achieve the desired OA future? and d) What are the implications of organic agriculture on soils, ecosystems/environment, and human and animal health in Kenya?

5.1 The Ideal Future that Stakeholders Envision for Food Production in Kenya

Launched in 2008, Kenya's Vision 2030 aims to '*transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment*'. Agriculture/livestock is one of the six priority sectors of the Vision that is expected to raise the GDP growth rate by 10 per cent by 2030. However, with an increasing annual population growth of about 4.4% and the negative impacts of climate change, the government is struggling to feed the population. Agriculture is still practiced by smallholder farmers who combine both inorganic and organic farming practices. Space for large-scale farming on arable lands is not possible increase in real estate projects. Therefore, to achieve food security under low carbon development, farming will have to be done in arid and semi-arid areas through irrigation and greenhouses to create concentrated, ecological, and sustainable farming that has proven to yield more and feed more as well as increase family income. Furthermore, with the unpredictable weather patterns, farmers and other actors on food value chain will need to receive timely weather and agro-advisory services to enable them to make informed farming decisions.

During the participatory scenario forecasting for organic agriculture, the stakeholders dialogued on possible idea futures that they envision for Kenya (Figure 8 and Table 3). The most important future that they envision is a situation where there is increased food and income through organic agriculture. The stakeholder predicted that the likelihood of this happening by 2030 (in line with vision 2030) is about 50% (Figure 8). This implies that about 3-4 million of Kenya will not be food secure by 2030 (von Grebmer et al. 2021). The stakeholders preferred that by 2030, Kenya should have achieved 100% food security. The same trend is observed for three other possible futures that were identified by the stakeholders as shown in Figure 8 (Future 2, 3, and 4). The findings show that the difference between the likelihood of a future being achieved and the stakeholders preferability is huge. For instance, for Future 1, stakeholders prefer to achieve 100% but they predict that the likelihood of this future being achieved by 2030 is only 50% (Figure 8). This reinforces the pessimism of stakeholders that Kenya will not achieve food security by 2030. Future 2 and Future 4 follow similar trends where stakeholders' preferences are higher than the likelihood of the desired futures being achieved.

Figure 8: Likelihood and stakeholder preferability of futures in Kenya



5.2 What is Needed to Achieve the OA Futures that Stakeholders Desire?

The public health issues triggered by the use of inorganic fertilizers, pesticides and and its multi-faceted impact on the health of soils, animals, water and the ecosystems will take heavy toll on biodiversity including people especially in high potential arable lands of Kenya. Bold investments that can facilitate and sustain adoption of OA and achieve Vision 2030 are imperative. This calls for fiscal, technological and policy support that will ensure that safe and healthy food production is increased, while at the same time protecting the ecosystem. The workshop stakeholders identified various activities that are to ensure that Kenya becomes a food secure country by 2030 (Table 3). Some of the activities mentioned include development and implementation of an organic policy and strategy that can provide an enabling environment for all stakeholders (farmers, consumers, private sector, and extensions), increased adoption of organic practices by producers and demand by consumers and safe organic products with traceability mechanisms.

Across Kenya, the impact of producing food is under increasing scrutiny by various stakeholders along the value chains. There are emerging food value chain actors that are concerned with better health and nutrition, more diverse diets, or advocates for differing ethical opinions. The actors are also becoming aware of the negative impacts of climate change on agriculture and food producers. Using the PSF tool, stakeholders were asked to describe the kind of ideal future they desire for various actors along food value chains. The stakeholders described the ideal future where agriculture can use less fertilizers, pesticides, herbicides, and more of organically grown foods (Table 4). The likelihood of the ideal future happening by 2030 (to concur with Kenya's Vision 2030) was very high for food producers and input supplies. Stakeholders estimated 85% and 80% likelihood for food producers and input supplies, respectively to attain the ideal future in Kenya. Th least was academia/education actors whose likelihood to have standalone organic agriculture program at different education levels was estimated to be 10%. This is because education curriculum is not under the docket of agriculture and therefore, the influence of it is very low.

Table 3: Possible organic food production and security futures desired in Kenya by 2030	
Possible desired futures	What is needed to achieve this desired future?
Future 1: Increased food security and income through adoption of OA practices	•Development and implementation of an organic policy and strategy for providing an enabling environment •Improved market infrastructure for organic products •Increased political support for OA •Increased public awareness of benefits of OA •Subsidized organic inputs •Increased funding for organic agriculture •Efficient and renewable irrigation systems •Access to weather and agro-advisory services •Adoption of integrated pest & disease management (IPDM) for emerging crop and livestock pest and diseases
Future 2: 10% Increased resource allocation/ public investment to OA	•Development and implementation of an organic Policy/Strategy for providing an enabling environment •Framework for certification of organic products
Future 3: Streamlined organic certification and labelling system	•Consumer education and awareness to stimulate demand for organic products •Safe organic product with traceability mechanism •OA curriculum from primary to tertiary institutions developed and implemented
Future 4: Increased availability, access, and affordability of safe and healthy foods.	•Increased adoption of organic technologies and practices by producers •Wide variety of organic products that are locally produced •Digital platforms to boost OA •Support stronger OA farmer organizations

**Stakeholders used the range of 0-100% as likelihoods and their preference of achieving the desired future*

Table 4: Ideal future desired by different stakeholders in the food production chain in Kenya		
Stakeholders	Ideal future	Likelihood of this happening by 2030?*
Input suppliers	• Increased demand for organic inputs (manure, slurry and green compost, bio-pesticides) • Increased varieties of organic inputs	80%
Producers (farmers)	• Reliable, affordable, available, accessible and quality organic inputs (seeds, fertilizers, pesticides e.t.c) • Government to increase subsidies and develop favorable policies for OA • Sustained market for organic produce and good prices • Low cost and sustainable production technologies • Increased and sustained food production • Increased household incomes • Improved soil health • Reduction in post-harvest losses • Increased adoption of organic agriculture practices • Increased farmers knowledge on organic agriculture from outreach and exchange activities • Increased access and utilization of technology from research • Re-orientation of organic agriculture from subsistence to commercial • Farmers investing in value addition for diversified products • Increased number of farmers producing organic products for the local and international markets • Farmers understand importance of certification schemes and labelling • Strong farmers' organizations that will ensure secure food security	85%
Processors	• Increased supply of organically produced raw materials • Sustained market for the organic product • Efficient, affordable and low carbon technologies for processing organic products • Friendly and harmonized regulatory framework that supports manufacturing of organic products • Enhanced linkages to the markets, and Business Development Support Services (BDSS)	65%
Distributors/ marketing/ traders	• Sustained supply • Friendly and harmonized regulatory framework that supports organic products • Improved infrastructures	30%
Consumers	• Sustained and reliable supply of organic products that is available in diversified markets • Affordable products • Wide variety of locally sourced organic products • Improved packaging that is biodegradable • Safe organic food • Access to affordable and healthy diets and improved quality of life • Increased awareness of safe foods • Well streamlined organic certification systems/ and access to certified organic products.	45%
CSO/CBO	• Policies that are friendly to organic value chain and take care of the environment and health • Increased funding allocation for organic agriculture • Enhanced access to information and capacity building activities on organic agriculture	55%

	• Ability to facilitate certification of organic products • Enhanced Advocacy promoting organic products • Sustained and increased funds in OA	
Government (Regulator)	• Organic Agriculture Policy, Strategy and Regulation developed and implemented • Achieve safe and nutritious food security for all Kenyans as per Big 4 Agenda • Safe organic food • Improved food traceability • Increased funding for organic agriculture • Reduced cases of non-communicable diseases and thus reduced pressure on the healthcare bill • Adequate government allocation of funds into organic agriculture at the national and county government (at least 10%)	50%
National Research Institutions	• Increased innovations on organic agriculture • Adoption of appropriate organic agriculture technologies • Increased funding for organic agriculture • Scaling up best practices of OA	45%
Education/ Academia	• Organic agriculture program curriculum developed for primary to university level institutions (The curriculum has to include organic, sustainable and regenerative agricultural practices, focused on replicating natural processes, through to technology-driven precision farming, digital agriculture, resilient to climate change, using locally sourced inputs in circular farming systems, entrepreneurship, agribusiness and market prospecting) • Integration of OA curriculum at agriculture training institutions	10%
Extension/ advisory	• Strengthened and structured farmer to farmer extension services to support OA • Capacity building of extension providers on OA • Digitalizing of extension services	35%

**Stakeholders used the range of 0-100% as likelihoods of achieving the desired future*

5.3 Stakeholders' Perceptions of Implications of Organic Agriculture on Soils, Ecosystems/Environment, Human and Animal Health in Kenya

If Kenya can advocate for organic agriculture, increasing food production while reducing use of inorganic fertilizers and pesticides will require profound changes in agricultural systems. But is organic agriculture the solution? This question was addressed through focus group discussions that were held for various stakeholders and key informants on the implications of OA on soil, ecosystems/environment, and human and animal health in Kenya. To elucidate the positive and negative implications of organic farming on soil health, ecosystems/environment, and human and animal health in Kenya, stakeholders and key informants identified several indicators as shown by Figure 9.

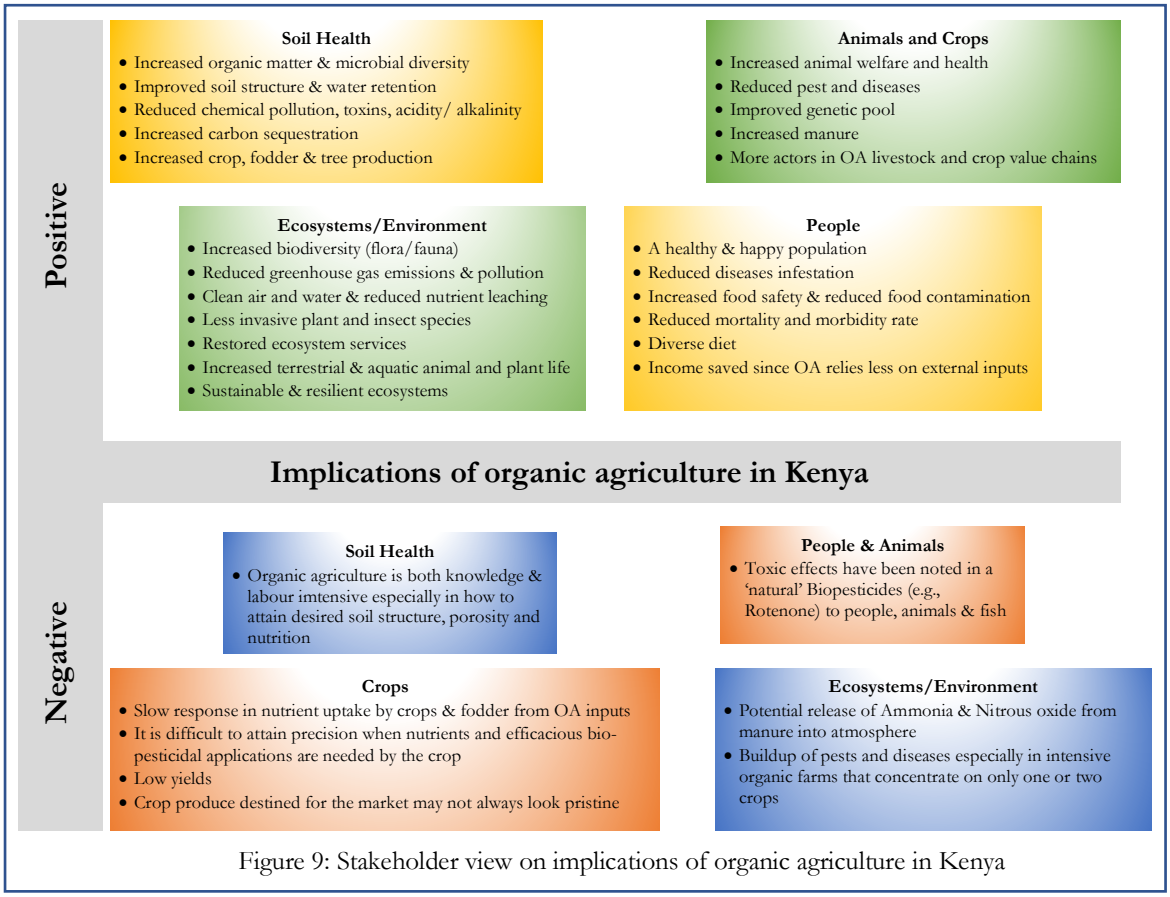


Figure 9: Stakeholder view on implications of organic agriculture in Kenya

Soil health will always be the sturdy base of every organic farming. The stakeholders identified several positive impacts including higher organic matter that can hold more air and water and produce higher yields than soils low in organic matter. Soils with higher organic matter also supply a steady release of nutrients to crops, inhibit erosion, host a robust population of beneficial microorganisms, and sequester carbon. These indicators have been reported in several studies in Kenya (Anyango et al. 2020; Nyagumbo et al. 2015).

Very few studies have directly addressed the effect of organic food on human health. Studies that have addressed the effect of organically grown foods on human health found that the results were inconclusive and non-committal (Mie et al. 2017; Crystal et al. 2012; Jensen et al. 2012). The studies also found that it was difficult to isolate effects of organic food from other lifestyle factors (Johansson et al. 2014; Huber et al. 2011; FAO, 2012). Despite that, stakeholders and key informants were able to list positive impacts of OA on human health from personal experiences and from literature. In particular, stakeholders shared experiences they had consuming foods and fruits sprayed with pesticides. Some of the stakeholders and key informants mentioned that they experienced stomach illness after eating fruits sprayed with pesticides while organically grown fruits did not have any effect on their health.

6 Conclusion and Recommendations

The objectives of this study were a) undertake a rapid review of public sector investments to the agricultural sector in general and organic agriculture in particular in Kenya and modelled returns on the investments and implications on health on human, animal and the environment in the last five years and b) provide recommendations for building and sustaining modelling capacity in the agricultural sector and use of modelling results to inform policy development and implementation.

Findings form the study shows that for the ten-year period (2010-2020), the average public spending on agriculture sector as percentage of the national budget ranged from 2.7-5.0% with an average of 3.8% at the national level. The highest at 5.0% was reported in the 2014/2015 and the lowest in the year 2010/2011. Out of this, key informants reported that an average of 3% was allocated to organic agriculture related such as training farmers on the use of using compost, animal manure, agroforestry, minimal tillage especially for indigenous vegetables, cover cropping and use of local herbs as pesticides. At the county level the average amount of funding for total agriculture for 2014-2020 amounts to over One billion Kenya Shilling (1,159,363,636 an equivalent of about USD 99,125,591). Key informants estimated that about 5% of the County agriculture budget is allocated for organic farming project activities.

IRR calculations for investments in general agriculture and organic agriculture shows a negative IRR. Despite the negative IRR for Organic agriculture at both County and National level (that is, negative 7.02 and negative 7.25, respectively), it was better than IRR for agriculture that reported a -8.67 and -23.10, for county and national investments, respectively. Using the KESHO tool, stakeholders identified four possible futures for organic agriculture, and these were: Future 1: Increased food security and income through adoption of OA practices; Future 2: 10% Increased resource allocation/ public investment to OA; Future 3: Streamlined organic certification and labelling system; and Future 4: Increased availability, access, and affordability of safe and healthy foods. Participants also identified factors that are needed to achieve the desired futures and some of them were a) development and implementation of an organic policy and strategy for providing an enabling environment; b) increased public awareness of benefits of OA and c) consumer education and awareness to stimulate demand for organic products among others.

Finally, the stakeholders identified several positive impacts of organic agriculture on soil health, animals and crops, ecosystem/environment, and people. Some of the benefits identified were a) higher organic matter that can hold more air and water and produce higher yields than soils low in organic matter, b) robust population of beneficial microorganisms, c) increased food safety and d) increased biodiversity among others.

Some recommendations include

- On the policy side, OA does not have an explicit structure/framework and this limits practice as well as budgettary allocation. Government ministres need to coordinate policies related to OA to avoid inconsistencies and clarify responsilities to enhance enforcement.
- Agriculture being a devolved function, county governments need to prioritize and invest in OA by making provisions for OA policy, regulatory and institutional frameworks. The Kiambu County has shown the way and this can be emulated in the other counties.
- The government at all levels needs to embrace the initiatives by NGOs and CBOs in various parts of the country to support advancement of OA and provide for enabling environment for practice.

- Given that OA responsibilities are often spread over a number of ministries without clear responsibilities and enforcement, it makes it difficult to track and or report the gains by the sector.
- There is a general consensus that promotion of OA mitigates the risks associated to health and environmental degradation while combating the impacts of climate change, but the translation to responsive interventions is lacking. Policymakers and other actors need to be sensitized on the benefits of OA to allow for conducive environment for adoption of OA combined with adequate control and enforcement.
- Capacity building programs including vocational trainings, exposure/exchange visits for farmers and extension service providers, lead/model farm approach will be of great importance (seeing is believing)
- Investments need to be made in more research programs to demonstrate suitability and benefits of OA in various regions in the country.
- Finally, there is need to improve OA market infrastructure to stimulate demand and enhance consumer education. On the flipside, incentivizing organic input suppliers by providing for a harmonized regulatory framework will fast track development of the sector. This will increase availability and accessability of reliable, affordable high organic inputs by farmers.

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8 Appendices

Appendix I: Kenya policies that mention elements of organic agriculture

- Constitution of Kenya 2010
- Kenya Vision 2030
- The Kenya National Biodiversity Strategy and Action Plan 2000
- National Environment Policy, 2013
- National Policy for the Sustainable Development of Northern Kenya and other Arid Lands
- Agriculture Sector Development Strategy (ASDS) 2010-2020
- Water Master Plan Towards 2030
- National Oceans and Fisheries Policy (2008)
- National Land Policy
- National Climate Change Response Strategy (2010)
- National Climate Change Action Plan 2013-2017
- Kenya National Adaptation Plan 2015-2030
- Green Economy Strategy and Implementation Plan
- National Climate Change Framework Policy
- Kenya Climate Smart Agriculture Strategy
- Kenya Climate Smart Agriculture Implementation Framework (KCSAIF 2018-2027)
- Medium Term Plan 2018-2022
- County Integrated Development Plans (CIDP) 2013 – 2017
- Agriculture and Livestock Sector Plan of Medium-Term Plan III 2018- 2022
- Agriculture Sector Transformation and Growth Strategy (ASTGS)
- National Livestock Policy, 2008:
- National Agriculture Service Extension Policy (NASEP) of 2011
- National Aquaculture Policy (2011)
- National Food and Nutrition Security Policy (NFNSP)
- National Agricultural Research System Policy (NARS) 2012
- National Agricultural Mechanization Policy (NAMP)

Appendix II: The yield gap of key crops in Kenya