

**ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN/NYANZA, CENTRAL/EASTERN, COASTAL, NORTH EASTERN AND  
RIFT VALLEY REGIONS OF KENYA**



**PROJECT PROPONENT**

BAYER EAST AFRICA LIMITED | P. O. BOX 47686 - 00100 NAIROBI  
TEL: (+254) 758 537 658/0730 705000

**CONSULTING FIRM**

BAYPAL CONSULTANCY FIRM | NEMA REGISTRATION NO. 7496  
JOMO KENYATTA GROUNDS | ROOM 08  
TEL: (+254) 724 242 338/0737 046 895

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## CERTIFICATION

This Environmental & Social Impact Assessment Study Report (ESIA) for the proposed **Bt. Cotton Commercialization Project in Western/Nyanza, Rift Valley, Coastal, North Eastern and Central/Eastern Regions of Kenya** has been prepared in accordance with the Environmental Management and Coordination (Amendment) Act (EMCA) 2015 and the Environmental (Impact Assessment and Audit) (Amendment) regulations 2019 for submission to the National Environment Management Authority (NEMA).

### CONSULTANTS

 JOMO KENYATTA GROUNDS    ROOM 08, P.O.BOX 7937 – 40100, KISUMU TEL: (+254) 724 242 338/0737 046 895 <a href="http://www.baypalconsultancy.com">www.baypalconsultancy.com</a>		<b>NEMA REGISTRATION NO. 7496</b>
<b>NAME OF EXPERT</b>	<b>DESIGNATION</b>	<b>SIGNATURE / DATE</b>
<b>Mr. Paul Nicholas Otieno</b>	<b>Lead Expert</b> <b>NEMA Reg. No 2921</b>	
<b>Dr. John Muriuki</b>	<b>Lead Expert</b> <b>NEMA Reg. No 0050</b>	

### SIGNED BY AND ON BEHALF OF THE PROPONENT:

	<b>BAYER EAST AFRICA LIMITED,</b> <b>P. O. BOX 47686 – 00100,</b> <b>NAIROBI, KENYA.</b>
<b>Name .....</b>	<b>Designation .....</b>
<b>Signature:.....</b>	<b>Date/ Stamp .....</b>

### Disclaimer

*The Information contained in this report is true and correct to the best knowledge of the experts at the time of the assessment and based on the information provided by the proponent. Changes in conditions after the time of publication of the report may impact on the accuracy of this information and the ESIA experts therefore give no assurance of any information or advice contained. It is however, subject to conditions spelt out in the Environmental Management and Coordination (Amendment) Act, 2015 and the Environmental (Impact Assessment and Audit) (Amendment) regulations 2019.*

## PLANNING AND PARTICIPATING CONSULTANTS

The ESIA team for this study was composed of:

*Table 1: ESIA study team*

	<b>Name</b>	<b>Profession</b>
1	Paul Nicholas Otieno	Environmentalism & Lead expert ( <b>NEMA Reg. No. 2921</b> )
2	Dr. John Muriuki	Environmentalism Lead Expert ( <b>NEMA Reg. No. 050</b> )
3	Dr. Charles Waturu Nderito	Agriculturalist (Crop Protection Specialist) & Project M&E
4	Aron Kecha	Spatial Planner / Policy Expert & ESIA Lead Expert ( <b>NEMA Reg. No. 8763</b> )
5	Apiyo Christine Awuor	Sociologist
6	Jane Otadoh	Biotechnologist
7	Caleb Obonyo	Environmentalism (Associate Expert <b>NEMA reg. No. 6162</b> )
8	John Wycliffe	Biotechnologist
9	Tonny Agutu	Environmentalism
10	Rebecca Otieno	Administrator

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1. National Biosafety Authority
2. Alupe University
3. Lake Basin Development Authority
4. Kerio Valley Development Authority
5. Kenya Plant Health Inspectorate Service
6. Rivatex E.A Ltd
7. Ministry of Interior and Coordination of Government
8. Agriculture & Food Authority –Directorate of Fiber Crop
9. Kenya Agricultural Livestock Research Organization
10. Various County Departments of Agriculture, Environment
11. Cotton Farmers Cooperative Societies in Various Counties

We highly appreciate the cooperation accorded us by other stakeholders/ opinion leaders and the general public. The information they availed to us contributed enormously towards the success of this exercise.

The final report is the result of a collaborative process which drew on the effort, knowledge, expertise and patience of the ESIA Study team. To all the others that have not been mentioned here, we earnestly recognize their efforts.

Thank you all

**Paul Nicholas - Lead Consultant**



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**LIST OF ACRONYMS**

AFA	-	Agriculture & Food Authority
BOD	-	Biological Oxygen Demand
CO	-	Carbon Monoxide
CO <sub>2</sub>	-	Carbon Dioxide.
COD	-	Chemical Oxygen Demand
DOSHSS	-	Directorate of Occupational Safety and Health Services
EHS	-	Environmental, Health and Safety
EMCA	-	Environmental Management & Coordination Act
ESIA	-	Environmental & Social Impact Assessment
GMO		Genetically Modified Organisms
GoK	-	Government of Kenya
ISO	-	International Standard Organization
IUCN	-	International Union for Conservation of Nature
KALRO	-	Kenya Agriculture and Livestock Research Organization
KEBS	-	Kenya Bureau of Standard
KEPHIS	-	Kenya Plants, Health Inspectorate Service
KWS	-	Kenya Wildlife Service
MAHYCO	-	Maharashtoa Hybrid Seed Company
Masl	-	Meters above Sea Level
MOH	-	Ministry of Health
NBA	-	National Biosafety Authority
NEMA	-	National Environmental Management Authority
NGOs	-	Non-Governmental Organization
NO <sub>x</sub>	-	Nitrogen Oxide
PPEs	-	Personal Protective Equipment
RFCS	-	Respective farmer Cooperative Societies
SERC	-	Standards and Enforcement Review Committee
VOC	-	Volatile Organic Compounds
WRA	-	Water Resources Authority
MoALF&C	-	Ministry of Agriculture Livestock, Fisheries & Cooperatives
STIs	-	Sexually Transmitted Infections
AIDS	-	Acquired Immuno Deficiency Syndrome
KALRO		Kenya Agricultural and Livestock Research Organization

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## EXECUTIVE SUMMARY

### Background information

Cotton is one of the most important natural sources for fiber, oil, and seeds for livestock feeding. All the cotton produced in the world is obtained from four domesticated species of the *Gossypium* genus of the Malvaceae family. In most parts of the world where it is grown, cultivation of cotton has been characterized by application of large quantities of chemical insecticides. These chemical insecticides are applied from the plant emergence to harvest, since cotton plants must be protected from insect attack when the plant emerges, until the profitable bolls opens in a period that lasts about 5 months or more.

Cotton is largely drought tolerant and in Kenya it can potentially be grown in 24 counties which fall under arid and semi-arid areas. In the 1970's, Kenya was a major East African producer of seed-cotton for both local consumption and export. However, over the year's production levels fell drastically due to a number of factors, key among the high production costs and the resultant low returns or earning. The current situation is such that while the annual domestic market demand is 140,000 bales with a potential to grow to 260,000, the industry is only producing a meager 10,000 bales or in 2018 or less to date. Furthermore, only about 13,000 ha of land is was utilized under cotton compared to the potential of 400,000 ha. The current yield for the local varieties HART 89M and KSA 81M is about 572 kg/ha against a potential of 2500 kg/ha with only about 20,000 farmers engaging with cotton production even when the industry can be able to support over 200,000 growers. The combined outcome is that Kenya has become an importer of cotton rather than being an exporter. The bulk of cotton and cotton products imported include Bt-Cotton, which Kenya can easily grow, creating incomes for our local farmers, create more employment in the cotton industry value chain, and safe and additionally generate more foreign exchange.

It is in this context that Kenya has taken bold steps to address the problem of low yields from the local varieties caused by the African bollworm, which a key demotivating factor in cotton growing in Kenya, and join other global countries in the introduction of Bt-Cotton on farms. A good example of on the potentiality of Bt-Cotton in re-igniting cotton growing in Kenya can be taken from Mexico (In 1996, the introduction of Bt-Cotton Mexico made it possible to reactivate this crop, which in previous years was greatly reduced due to pest problems, and production costs, to a level where today Mexico is a major global cotton producer). A similar scenario is envisaged for Kenya, where farmers are usually devoted to crops that will always bring meaningful returns. Bt-Cotton is widely accepted globally by both consumers and producers. To the producers it has proven to be very efficient in the control of lepidopteran pests, leading to very high productions. In efforts by Kenya towards commercialization of Bt-Cotton, the necessary protocols including local research alongside international research have been undertaken over time both in the laboratory and field.

The natural environment and socio-economic growth are inter-related. An Environmental and Social Impact Assessment (ESIA) is an assessment of the possible positive or negative impacts that a proposed project may have on the environment, which broadly consist of biological, physical, and social (including economic and cultural) aspects. The ESIA tool aims at enhancing the integration of environment into development planning. The project covers wide areas of Kenya namely, Western, Coastal, North Eastern, Eastern and Rift Valley Regions, hereinafter referred to as the "Project Areas",

for the project proponent BAYER EAST AFRICA LTD. This report documents ESIA procedures undertaken and findings for the proposed BT cotton commercialization in the regions mentioned above. The Ministry of Agriculture, Livestock, and Fisheries and development agencies identified cotton as a strategic crop that can enhance economies of resource-poor communities in marginal areas that have a low potential for arable

Environmental Impact Assessment and Audit regulations (Amendment 2019), provides categories of projects that must undergo ESIA study. The proposed project is listed as one requiring such study. The purpose is to predict all possible positive and negative impacts that the project may have on human, natural and social environment and suggest mitigation measures for the significant negative impacts before the project is implemented.

The main objective of the ESIA is to provide information on the nature and extent of potential environmental impacts arising from the proposed Bt. Cotton commercialization and related activities and to contribute to decisions on the overall environmental acceptability of the Project after the implementation of environmental mitigation measures.

### **Project Description**

The project involves commercialization of Bt-Cotton in five regions identified by the Ministry of Agriculture (Table 2). BT Cotton is a variety of cotton that has been genetically engineered to provide resistance to selected insect pests (Lepidoptera) specifically the African bollworm. The commercialization will entail the following:

- Land preparation
- Seed distribution
- Cotton seed planting,
- Farm maintenance,
- Cotton Harvesting and
- Processing of the produce

The farm inputs will be bought from the locals and beyond as will be necessary. Currently, Bt. Cotton seeds for the demonstration fields is sourced and distributed by MAHYCO.

### **Justification of the proposed project**

Cotton farming in Kenya has been experiencing difficult times with almost all the ginneries and textile industries collapsing due to low cotton production among others (Gitonga et al.,). The government in a bid to improve cotton yield, is proposing to introduce high-yielding quality cotton seeds that are resistant to pests. Bt-Cotton has been proven to provide resistance to Bollworm which is the major contributor to low yields of cotton. Bt-Cotton is grown in across the globe including African countries. The results have shown that the variety is efficient in the controlling lepidopteran pests leading to very high cotton production. The Kenya Agricultural and Livestock Research Organization (KALRO) has piloted Bt-Cotton and confirmed its efficacy on target cotton pests and its safety on the Kenyan environment. Bt-Cotton yields about two to three times more than current conventional varieties thus is expected to play a critical role in reviving the cotton sub-sector upon commercialization. This is expected to result in manifold benefits to the country and beyond.

### **Scope of the project**

The Bt-Cotton Commercialization project will be implemented in five cluster areas (see Table 2) and

will involve the distribution of the Bt-Cotton seeds to the farmers, land preparation, planting maintenance harvesting and processing of the produce.

**Objective of the proposed project**

The objective of this project is to ensure increased and sustained cotton production in the country through an environment friendly means so as to support the government's Big Four Agenda plan. This is expected to create massive job opportunities and enhanced earnings from apparel export.

**Scope of ESIA**

- Description of Project Objectives
- Complete description of the existing site conditions
- Significant environmental issues of concern through the presentation of baseline data, which should include social, cultural considerations
- Assessment of public perception of the proposed development.
- Policies, Legislation and Regulations relevant to the project
- Likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and their relative importance to the design of the development's facilities
- Mitigation actions to be taken to minimize predicted adverse impacts if necessary and quantify associated costs.
- Monitoring Plan that would ensure that the mitigation plan is adhered to
- Alternatives to the project that could be considered at those sites or at any other location including no action alternative.
- Conclusion and recommendations

**Objectives of ESIA**

- To identify potential environmental impacts of proposed project;
- To assess the significance of these impacts to the environment and other stakeholders
- To assess the relative importance of the impacts of alternative plans to the proposed project
- To propose mitigation measures for the significant negative impacts of the proposed project on the environment and all involved stakeholders
- To propose measures that will enhance the positive impacts of the proposed project to the environment and all involved stakeholders
- To generate baseline data for monitoring and evaluation of how well the mitigation measures are being implemented during the proposed project cycle;
- To present information on the impact of alternatives;
- Prepare an Environmental and Social Impact Assessment Report with the Environmental Management Plan as per Environmental Management Coordination (Amendment) Act, 2015

**The Terms of Reference were:**

- Identify and assess the anticipated environmental and social impacts of the proposed commercialization of Bt-Cotton
- Identify and analyze alternatives to the proposed Commercialization project
- Propose mitigation measures for negative impacts and enhancement measures for positive



impacts to undertake during and after the implementation of the proposed project

- Verify compliance with national environmental regulations and policies and industry best practices and standards at local, national and international level
- Determine current environmental impact status as experienced by the sector
- Sustainability roll-out plans for recommendations from the study including possible collaborative areas and capacity building initiatives for key sector players on identified environmental risks.
- Gather more in-depth information about the diverse climatic features of the various ecological zones in the target counties (such as drought, erratic rainfall)
- Assess the current livelihood conditions of poor and marginal farmers in the proposed areas
- Generate baseline data for monitoring and evaluation of how well the mitigation measures will be implemented during the project life cycle.
- Recommend cost effective measures to be used to mitigate against the anticipated negative impacts.
- Seek the views of the affected persons in consultation with the Client, relevant stakeholders and the National Environmental Management Authority (NEMA)
- Prepare an Environmental and Social Impact Assessment Report with the Environmental Management Plan as per Environmental Management Coordination (Amendment) Act, 2015

### Methodology

This report was produced after the experts held several consultative meetings with key stakeholders and general public in the already identified and known counties for the rollout of Bt-Cotton Commercialization project. In summary, the methodology used purposive identification of counties that grow cotton or have high potential to grow it. For the purpose of data collection these areas were divided into two clusters; the first one in which data was collected through field visits and cluster two where data was collected virtually. Cluster one concentrated in counties in Western Kenya, Nyanza and parts of Riftvalley namely; Kisumu; Homa Bay; Bungoma; Busia; Elgeyo marakwet and Baringo.

In cluster two, virtual techniques were used to collect data, and this was important due to corona virus pandemic and rampant spread in the Central and Coastal regions of the County. Counties in this cluster included: Kwale; Kilifi; Tana River; Lamu; Makueni; Machakoes; Kitui; Kirinyaga; Embu; Tharaka Nithi; Meru and Elgeyo Marakwet. Data in this study was obtained through literature review, interviews using questionnaires, discussions with farmers and key informants in addition to observations. Both physical field visits and virtual means of collecting data applied. The methodology of the process which culminated to the assessment and the subsequent ESIA project report included the following: -

- **Preliminary assessment** of the sites; where the experts visited the identified counties using a multi stage purposive sampling focusing on areas in the counties already identified by the ministry of agriculture and having favourable conditions for growing cotton-

- **Screening and scoping:** To determine and identify the significant impacts to focus on in the ESIA, on a number of factors which include but not limited to the sensitivity of the area likely to be affected; possibility of uncertain, unique or unknown effects of the project.
- **Collection of Data:** Data collection involved activities such as;
  - ✓ Desktop study and discussion with the key project affected parties and relevant stakeholders. virtual technique was also adopted due to the corona virus pandemic
  - ✓ Observation
  - ✓ Detailed physical inspection of the proposed cotton growing regions/counties and the surrounding areas to determine the present and anticipated impacts of the proposed project

The data obtained was used to assess potential impacts on health, safety, physical, social and economic environments. From the obtained data, environmental, health, safety and social concerns were identified in relation to the proposed Bt. commercialization and mitigation measures proposed for the negative impacts. Enhancement measures were also proposed for the positive impact.

- **Data Analysis and Evaluation of Alternatives:** Use of checklists, observation, photography and the threshold limits were used in data analysis; potential environmental impacts, capital and operating costs, suitability under local conditions, and institutional, training, and monitoring requirements were considered in the evaluation of alternatives.
- **Consultation and Public Participation:** Here, stakeholders, that included National government ministries especially that of agriculture and agencies in the Cotton value chain, County Government Ministries, Academia, Civil Society, farmer groups and media, local administration among others were interviewed, in order to get their views, expectations, projected economic and social effects regarding the proposed Bt-Cotton Commercialization project activities and locations. These findings were then analyzed and incorporated in this study report.
- **Preparation of the Project Report:** This Environmental and Social Impact Assessment project report was then prepared by NEMA-registered ESIA experts.

#### **Possible Positive impacts of the proposed project**

- Will put in to beneficial use the lands that cannot support other crops
- Reduce cotton production cost and Increase cotton production: Bt-Cotton will provide inherent resistance to the devastating African Bollworms that contribute to about 60% of the crop loss to pests thereby reducing the dependency on the expensive agro-chemical (reduction in the quantity of the pesticide use); this is projected to boost the country's cotton production from the current low of 25,000 bales annually to 200,000 bales per year. Thus bridging the wide supply-demand gap currently in experienced Kenya.
- Reduction in the number of pesticides spray regimes in cotton fields- this will improve on the farmers' health and reduce exposure to health and environmental risks associated with multiple sprays of agro-chemicals used in the farms.
- Employment opportunities: Increased cotton production will see the revitalization of the textile and apparel industry, and other auxiliary industries will also be boosted. This will ensure better

income for families and create both direct and indirect employment in the whole value cotton value chain especially youths and women and contribute to poverty reduction especially among the farmers in arid and semi-arid areas.

- Increased revenue: The project will translate into increased revenue to both the county and the national governments in terms of tax and other charges in the cotton value chain.
- Bt-Cotton commercialization will strengthen the local cotton farmers' cooperatives and empower ginners to increase capacity and new cotton facilities.
- Investment: Bt-Cotton commercialization will attract other investments such as those that utilize the by-products from cotton processing eg production of oil, animal feed etc from the cotton seeds.
- Improved living standards: farmers and employees in the cotton value chain will have increase income and use it to improve their living standards.
- High quality cotton which competes well in the international market thus improved economy

#### **Issues of environmental concern associated with the proposed project and mitigation measures;**

<b>TYPE OF IMPACT (S)</b>	<b>PROPOSED MITIGATION MEASURES</b>
<b><i>Threat to food security</i></b>	<ul style="list-style-type: none"> <li>• <i>Sensitize farmers on the need to grow food crops alongside cotton</i></li> <li>• <i>Sensitize farmers to Practice crop rotation (cotton with food crops)</i></li> <li>• <i>Practice farm planning</i></li> </ul>
<b><i>Sustainability concerns of Bt-Cotton farming</i></b>	<ul style="list-style-type: none"> <li>• <i>Government to strengthen the capacity of local research institutions to produce seeds locally and provide to farmers at a subsidized cost</i></li> <li>• <i>Revitalize the ginneries and textile industries to provide ready market for the produced cotton</i></li> <li>• <i>Provision of loans to farmers Bt-Cotton farmers accessible so that farmers can obtain machinery and seeds</i></li> <li>• <i>Rigorous marketing to ensure ready market for the cotton produced</i></li> <li>• <i>Improvement of cotton prices encourage farmers</i></li> </ul>
<b><i>Increased surface run off, soil erosion and destruction of soil properties</i></b>	<ul style="list-style-type: none"> <li>• <i>Practice Contour ploughing to control soil erosion</i></li> <li>• <i>Practice conservation agriculture</i></li> <li>• <i>Avoid clearing areas susceptible to soil erosion</i></li> <li>• <i>A storm water management plan that minimizes impervious areas</i></li> <li>• <i>Provide soil erosion control structures to help in management of surface run-offs during planting and operational phases.</i></li> <li>• <i>Planting trees especially along the edges</i></li> <li>• <i>Proper planning of planting activities to ensure the project affects only designated sections</i></li> <li>• <i>A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.</i></li> <li>• <i>where supplemental irrigation will be carried out appropriate irrigation structure will be erected to minimize sediment loads</i></li> </ul>

<b>Pollution of soil, potable, surface or ground water</b>	<ul style="list-style-type: none"> <li>▪ A vegetated buffer zone between the water bodies and the Bt-Cotton farms shall be provided with suitable plants to absorb nutrients</li> <li>▪ Proper soil erosion measures to be put in place to prevent sedimentation</li> <li>▪ Farms to be located at least 30m from the surface water bodies</li> <li>▪ Sensitize the farmers to report any incident of poisoning suspected to be from water contamination</li> <li>▪ Recommended agronomic and soil fertility maintenance measures will be applied</li> <li>▪ Annual Environmental Audits and Impact evaluation be done to assess the impacts of Bt-Cotton adoption</li> <li>▪ Develop protocols for monitoring changes in soil particle aggregation and water-holding capacity which are likely to be consequences of changes in the soil management practices as result of Transgenic plant material, transgene products and metabolites</li> <li>▪ Put in distinctive protocol for classification and segregation waste related to Bt- Cotton planting activities</li> </ul>
<b>Threat to biodiversity and gene flow</b>	<ul style="list-style-type: none"> <li>• Use certified pesticides that do not harm non-target organisms</li> <li>• Ensure proper disposal of plant materials at the end of the project</li> <li>• a buffer zone shall be provided between the Bt- Cotton farms and other cotton fields, if any</li> <li>• Time and or distance isolation from other crops shall be maintained to restrict genetic escape</li> </ul>
<b>Emergence of new pests</b>	<ul style="list-style-type: none"> <li>• Regular monitoring to detect the pests early by extension officers</li> <li>• Employ integrated pest control at early stage before pests get out of hand</li> </ul>
<b>Potential adverse consequences of resistance</b>	<ul style="list-style-type: none"> <li>▪ Develop distinctive protocol to define resistance operationally, so that cases of resistance as a result of Bt.-Cotton commercialization can be looked at in advance</li> </ul>
<b>Increased vehicular traffic and nuisance</b>	<ul style="list-style-type: none"> <li>▪ Supply of Bt-Cotton seeds and farm inputs to be done during off peak time and on demand only to stores</li> <li>▪ Truck drivers collecting the cotton product from farmers to the ginnery to be instructed to avoid recklessness and observe convectional traffic rules</li> <li>▪ Vehicles supplying the farm inputs and collecting cotton from the farms shall not idle on site longer than expected</li> </ul>
<b>Solid Wastes generation</b>	<ul style="list-style-type: none"> <li>• Ensure that all the solid waste management systems during farming, harvesting activities of Bt-Cotton and processing phases do comply with the Environmental Management and Coordination (Waste management) regulations of 2019 (Amendment)</li> <li>• Use of an integrated solid waste management system i.e. through a hierarchy of options: reduction, sorting, re-use, recycling (where</li> </ul>



		<p><i>applicable) and proper disposal</i></p> <ul style="list-style-type: none"> <li><i>Incorporate suitable facilities for collection, segregation and safe disposal of solid wastes.</i></li> <li><i>Ensure a continuous review of waste management procedures with changing technology and regulatory changes.</i></li> <li><i>Creation of awareness on proper solid waste disposal methods among the farmers and staff in the cotton value chain industries.</i></li> </ul>
<b>Air pollution</b>		<ul style="list-style-type: none"> <li><i>Workers on cotton farms, ginneries, textile and cotton auxiliary industries to use nose-muffs during cotton spraying and processing</i></li> <li><i>Ploughing will be done when the soil is reasonably wet to quell dust generation and enable ploughing-water may be sprinkled on the farms during dry seasons</i></li> <li><i>Strict adherence to Air Quality regulations, 2014</i></li> </ul>
<b>Occupational and Safety risks</b>	<b>Health</b>	<ul style="list-style-type: none"> <li><i>Use appropriate PPEs</i></li> <li><i>Sensitize workers on the negative health impacts of overworking</i></li> <li><i>Farmers to be sensitized to go for medical checkups regularly and seek medical attention immediately in case of health issue</i></li> <li><i>The chemicals used to be stored away from human habitation, flood prone areas, in non-corrodable containers</i></li> <li><i>Strict adherence to the instructions for handling the seeds, fertilizers and pesticides</i></li> <li><i>Danger and warning signs to be mounted on the hazardous chemicals and their storages</i></li> <li><i>Standards and legal requirements should be adhered to. These include: Occupational Safety &amp; Health Act, the Public Health Act, as well as other recognized best practices and procedures.</i></li> <li><i>Regular inspection and servicing of the equipment must be undertaken by a reputable service provider and records of such inspections maintained</i></li> </ul>
<b>Socio-Economic Impacts</b>		<ul style="list-style-type: none"> <li><i>Rigorous sensitization of the community members in the cotton farming regions and farmers on social norms and values to avoid family breakups</i></li> <li><i>Farmers and unions to make alternative arrangements with an existing suitable and equipped health facility for the screening, diagnosis and counseling on STI and HIV/AIDS cases</i></li> <li><i>The cotton cooperative societies and unions shall comply with the HIV/AIDS Prevention and Control Act (2006) which prohibits discrimination of persons living with HIV and AIDS.</i></li> <li><i>Ensure that the operations of the cotton farming activities does not result in interference with the community's cultural practices</i></li> <li><i>Adhere to the Government directives on containment and control of</i></li> </ul>

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**COVID-19**

- *promotion of awareness to the employees and the neighbouring communities on the risks and prevention of STIs, HIV/AIDS and Covid – 19*
- *Encourage employees to go for the voluntary scanning & testing*

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**Human- wildlife conflict**

- *Use human security to keep off the wild animals*
- *Fence off the farms to keep off the wild animals away from the farms*
- *Avoid farming migratory routes of the wild animals*
- *Engage KWS to manage the wild animals*
- *Formation of grievances redress committee*

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**Decommissioning of the project**

- *Elaborate ESIA to be carried out for the decommissioning activities of Bt-Cotton commercialization so as to effectively address the negative impacts that may result from the same.*
- *Assisting those who will still be employed and will be affected in the cotton value chain to search for alternative employment elsewhere*
- *Ensuring that any hazardous wastes are carefully removed, and properly disposed of*
- *Elaborate soil tests must be carried out to identify any impact of the Bt. Cotton in the farms*
- *Sensitization of the workers on the health impacts of wastes*
- *Have PPEs while collecting potentially hazardous wastes*

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**Conclusion**

The report concludes that if all the suggested mitigation measures and the above recommendations are implemented and if the proposed ESMP is followed, the proposed project will not adversely impact on the environment. Further, the proposed project has actively involved the key stakeholders who did not object the development. It is therefore the recommendation of the experts' that the project be approved.

## **TABLE OF CONTENT**

<b>CERTIFICATION .....</b>	<b>i</b>
<b>PLANNING AND PARTICIPATING CONSULTANTS .....</b>	<b>ii</b>
<b>ACKNOWLEDGEMENT .....</b>	<b>iii</b>
<b>LIST OF ACRONYMS .....</b>	<b>iv</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>v</b>
<b>TABLE OF CONTENT .....</b>	<b>xiv</b>
<b>CHAPTER ONE.....</b>	<b>1</b>
<b>1. INTRODUCTION.....</b>	<b>1</b>
1.1 Project Background .....	1
1.2 Project Description .....	2
1.3 Bt-Cotton Commercialization Progress .....	3
1.4 Background and Rationale of the ESIA.....	4
1.5 Principles of Environmental Impact Assessment Considered .....	4
1.6 Project Objectives.....	5
1.7 Scope of the project .....	5
1.8 Objectives of this ESIA .....	5
1.8.1 Specific Objectives of the ESIA .....	5
1.9 Scope of ESIA .....	6
1.10 Terms of Reference .....	7
1.11 Methodology .....	7
1.12 Proposed Project Justification .....	10
<b>CHAPTER TWO.....</b>	<b>12</b>
<b>2.0 PROJECT LOCATION AND DESCRIPTION .....</b>	<b>12</b>
2.1 Project location .....	12
2.1.1 Western Region .....	12
2.1.2 Nyanza region.....	13
2.1.3 Rift Valley region .....	14
2.1.4 Central/Eastern .....	15
2.1.5 North Eastern Region .....	17
2.1.6 Coastal Region .....	17
2.2 Project description .....	17

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<b>CHAPTER THREE:</b>	<b>19</b>
3.0 BASELINE INFORMATION	19
3.1 Introduction	19
3.2 Western region	19
3.2.1 Busia County	19
3.2 Physiographic and natural conditions	20
3.2.2 Bungoma County	25
3.3 Nyanza Region	27
3.3.1 Homa Bay County	27
3.3.2 Kisumu County	31
3.3.3 Siaya County	33
3.4 Rift Valley Region	36
3.4.1 Baringo County	36
3.4.2 Elgeyo Marakwet County	37
3.5 Central/Eastern	38
3.5.1 Kirinyaga County	38
3.5.2 Meru county	40
3.5.3 Embu County	43
3.5.4 Tharaka Nithi	45
3.5.5 Machakos County	47
3.5.6 Kitui County	50
3.5.7 Makueni County	52
<b>3.6 North Eastern region</b>	<b>54</b>
3.6.1 Tana River County	54
3.7 Coastal Region	56
3.7.1 Lamu County	56
3.7.2 Kilifi County	59
3.7.3 Kwale County	59
<b>CHAPTER FOUR</b>	<b>62</b>
4.0 LEGISLATION, POLICY AND INSTITUTIONAL FRAMEWORK	62
4.1 Introduction	62

---



---

4.2 Policy framework.....	62
4.2.1 National environment policy.....	62
4.2.2 National Land Policy, 2009 .....	62
4.2.3 National Wildlife Conservation and Management Policy, 2017 .....	62
4.2.4 National Forest Policy, 2014.....	62
4.2.5 National Climate Change Framework Policy .....	63
4.3 Legal framework.....	63
4.3.1 The constitution of Kenya, 2010 .....	63
4.3.2 Environmental Management and Coordination Act, EMCA (1999)-amended in 2015 .....	63
4.3.3 Sessional Paper No. 6 (1999).....	63
4.3.4 Environmental Impact Assessment and Audit Regulations 2003 (Legal Notice No.101) and (Amendment) 2009 .....	64
4.3.5 Environmental Management and Coordination (Air Quality) Regulations, 2014.....	65
4.3.6 National Environmental Action Plan (NEAP) 1994 .....	65
4.3.7 Biosafety Act 2009.....	65
4.3.8 Public Health Act (Cap 242).....	66
4.3.9 Waste Management Regulations, 2006 (Legal Notice No.121) .....	67
4.3.10 The Wildlife (Conservation and Management) Act.....	67
4.3.11 Water Act, 2016.....	67
4.3.12 Water Quality Regulations, 2006, (Legal Notice No.121) .....	68
4.3.13 Seeds and plant varieties (plant breeder's rights) (scheme) regulations, 2001 .....	68
4.4 Relevant Multilateral Environmental Agreements (MEAs).....	69
4.4.1 Introduction.....	69
4.4.2 Cartagena Protocol on Biosafety.....	69
4.4.3 Convention on Biological Diversity (CBD-1992) .....	70
4.4.4 The International Union for the Protection of New Varieties of Plants (UPOV).....	70
4.5. Institutional Framework .....	71
4.5.1 Introduction.....	71
4.5.2 The National Environmental Council (NEC).....	71
4.5.3 The National Environmental Management Authority (NEMA) .....	72
4.5.4 The Kenya Plant Health Inspectorate Service (KEPHIS).....	72

---

4.5.5 Department of Veterinary Services (DVS) .....	72
4.5.6 The Kenya Bureau of Standards (KEBS) .....	72
4.5.7 The National Commission for Science Technology and Innovation .....	73
4.5.8 National Biosafety Authority .....	73
4.5.9 Agriculture and Food Authority (AFA) .....	74
4.5.10 National Taskforce for Commercialization of Bt-Cotton .....	75
4.5.11 National Irrigation Board .....	75
4.5.12 Kenya Agricultural and Livestock Research Organization .....	76
4.5.13 BAYER East Africa Limited .....	77
4.5.14 MAHYCO .....	77
<b>CHAPTER FIVE .....</b>	<b>78</b>
5.0 PUBLIC PARTICIPATION .....	78
5.1 Introduction .....	78
5.2 Methodology .....	78
5.2.1 Key Informant Interviews: .....	79
5.3 Views from public consultation and participation .....	79
<b>CHAPTER SIX .....</b>	<b>81</b>
6.0 ANALYSIS OF PROJECT ALTERNATIVES .....	81
6.1 Introduction .....	81
6.2 Relocation Option .....	81
6.3 The 'proposed project' alternative .....	81
6.4 The 'no action' Alternative .....	82
6.5 Alternative bollworm control methods .....	82
6.6 Alternative land uses (using the proposed site for other projects other than Bt-Cotton production) .....	82
6.7 Waste Management Alternatives .....	83
6.7.1 Solid waste management alternatives .....	83
<b>CHAPTER SEVEN .....</b>	<b>84</b>
7.0 POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES .....	84
7.1 Introduction .....	84
7.2 Potential adverse impacts during Bt. Commercialization phase .....	84
7.2.1 Impacts on other species in the ecosystem .....	84

7.2.2	Potential adverse consequences of resistance .....	86
7.2.3	Impacts on vegetation, water and soil .....	86
7.3	Impacts cutting across phases.....	88
7.3.1	Pollution: Noise, Dust and Air quality concerns .....	88
7.3.2	Generation of wastes (Solid and liquid wastes) .....	89
7.3.6	Transmission of HIV/AIDS and other communicable disease .....	90
7.3.6	Food insecurity .....	91
7.3.7	Sustainability problems of Bt-Cotton farming .....	91
7.3.8	Water pollution .....	91
7.3.9	Occupational Safety and Health and community health impacts.....	92
7.3.10	Human-wildlife conflict .....	92
7.3.11	Moral decadence:.....	92
7.3.12	Child labour and school drop outs .....	93
7.3.13	Fire hazards at cotton storage sites and ginneries- cotton can easily catch fire .....	93
7.3.14	Grievances among the community members, community and other cotton stakeholders ....	93
7.4.15	Malaria and other waterborne diseases .....	94
7.5	Potential beneficial impacts .....	94
<b>CHAPTER EIGHT</b>	.....	<b>96</b>
8.0	ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN.....	96
8.1	Planning .....	96
8.2	Implementation and operations.....	96
8.3	Strategies for ESMP implementation .....	96
8.4	Set up phase ESMP .....	97
8.5	Operation phase ESMP .....	100
8.6	Decommissioning phase ESMP.....	108
<b>CHAPTER NINE</b>	.....	<b>110</b>
9.0	ENVIRONMENTAL MONITORING PLANS .....	110
9.1	Invasion and biodiversity monitoring plan.....	110
9.2	Water quality monitoring plan .....	110
9.3	Soil quality monitoring plan .....	110
9.4	Air quality monitoring .....	110

---

9.5 Grievances redress mechanism.....	111
9.5.1 Introduction.....	111
9.5.2 Grievances prevention .....	111
<b>CHAPTER TEN .....</b>	<b>112</b>
10.0 CONCLUSION AND RECOMMENDATIONS .....	112
<b>REFERENCES .....</b>	<b>113</b>
<b>Annex 5: Experts' licenses.....</b>	<b>126</b>



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List of Tables

Table 1: ESIA study team .....	ii
Table 2: Cluster areas for the project implementation.....	2
Table 3: Cotton growing areas studied .....	9
Table 4: List of targeted Counties for ESIA study .....	12
Table 5: population of the sub counties in Busia County.....	19
Table 6: Sub Counties and wards of Bungoma County .....	25
Table 7: Agro-ecological zones of Machakos County.....	47
Table 8: Taskforce Membership.....	75
Table 9: ESMP for Start-up phase.....	98
Table 10: EMP for the operation phase .....	100
Table 11: ESMP for the Decommissioning phase.....	108
Table 12: possible pollutants from the proposed project and the EMC (Air Quality) Limits.....	111

List of Figures

Figure 1: rainfall pattern in Homa Bay County .....28

Figure 2: temperature range in Homa Bay County .....28

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## CHAPTER ONE

### 1. INTRODUCTION

#### 1.1 Project Background

Cotton is one of the most important natural sources for fiber, oil, and seeds for livestock feeding. All the cotton produced in the world is obtained from four domesticated species of the *Gossypium* genus of the Malvaceae family. In most parts of the world where it is grown, cultivation of cotton has been characterized by application of large quantities of chemical insecticides. These chemical insecticides are applied from the plant emergence to harvest, since cotton plants must be protected from insect attack when the plant emerges, until the profitable bolls opens in a period that lasts about 5 months or more.

Cotton is largely drought tolerant and in Kenya it can potentially be grown in 24 counties which fall under arid and semi-arid areas. In the 1970's, Kenya was a major East African producer of seed-cotton for both local consumption and export. However, over the year's production levels fell drastically due to a number of factors, key among the high production costs and the resultant low returns or earning. The current situation is such that while the annual domestic market demand is 140,000 bales with a potential to grow to 260,000, the industry is only producing a meagre 10,000 bales or in 2018 or less to date. Furthermore, only about 13,000 ha of land was utilized under cotton compared to the potential of 400,000 ha. The current yield for the local varieties HART 89M and KSA 81M is about 572 kg/ha against a potential of 2500 kg/ha with only about 20,000 farmers engaging with cotton production even when the industry can be able to support over 200,000 growers. The combined outcome is that Kenya have become an importer of cotton rather than being an exporter. The bulk of cotton and cotton products imported include Bt cotton, which Kenya can easily grow, creating incomes for our local farmers, create more employment in the cotton industry value chain, and safe and additionally generate more foreign exchange.

It is in this context that Kenya has taken bold steps to address the problem of low yields from the local varieties caused by the African bollworm, which a key demotivating factor in cotton growing in Kenya, and join other global countries in the introduction of Bt-Cotton on farms. A good example of on the potentiality of Bt-Cotton in re-igniting cotton growing in Kenya can be taken from Mexico (In 1996, the introduction of Bt-Cotton Mexico made it possible to reactivate this crop, which in previous years was greatly reduced due to pest problems, and production costs, to a level where today Mexico is a major global cotton producer). A similar scenario is envisaged for Kenya, where farmers are usually devoted to crops that will always bring meaningful returns. Bt-Cotton is widely accepted globally by both consumers and producers. To the producers it has proven to be very efficient in the control of lepidopteran pests, leading to very high productions. In efforts by Kenya towards commercialization of Bt-

Cotton, the necessary protocols including local research alongside international research have been undertaken over time both in the laboratory and field.

The natural environment and socio-economic growth are inter-related. An Environmental and Social Impact Assessment (ESIA) is an assessment of the possible positive or negative impacts that a proposed project may have on the environment, which broadly consist of biological, physical, and social (including economic and cultural) aspects. The ESIA tool aims at enhancing the integration of environment into development planning. The project covers wide areas of Kenya namely, Western, Coastal, North Eastern, Eastern and Rift Valley Regions, hereinafter referred to as the “Project Areas”, for the project proponent BAYER EAST AFRICA LTD. This report documents ESIA procedures undertaken and findings for the proposed BT cotton commercialization in the regions mentioned above. The Ministry of Agriculture, Livestock, and Fisheries and development agencies identified cotton as a strategic crop that can enhance economies of resource-poor communities in marginal areas that have a low potential for arable Environmental Impact Assessment and Audit regulations (Amendment 2019), provides categories of projects that must undergo ESIA study. The proposed project is listed as one requiring such study. The purpose is to predict all possible positive and negative impacts that the project may have on human, natural and social environment and suggest mitigation measures for the significant negative impacts before the project is implemented.

The main objective of the ESIA is to provide information on the nature and extent of potential environmental impacts arising from the proposed Bt-Cotton commercialization and related activities and to contribute to decisions on the overall environmental acceptability of the Project after the implementation of environmental mitigation measures.

## 1.2 Project Description

The project involves commercialization of Bt-Cotton in five regions identified by the Ministry of Agriculture (as shown in Table 2).

*Table 2: Cluster areas for the project implementation*

Cluster	Western/Nyanza	Eastern/Central	North Eastern	Rift Valley	Coastal
<b>Targeted Counties</b>	Kisumu Busia Migori Siaya Homa Bay Bungoma	-Kirinyaga -Murang’a -Tharaka Nithi -Meru -Embu -Makueni -Machakos -Kitui	-Isiolo -Garrisa -Tana River	Baringo Elgeyo Marakwet	Taita Taveta Kwale Kilifi Lamu

Bt-Cotton is a variety of cotton that has been genetically engineered to provide resistance to selected insect pests (Lepidoptera) specifically the African bollworm. The commercialization will entail:

- Land preparation
- Seed distribution
- Cotton seed planting,
- Farm maintenance,
- Cotton Harvesting and
- Processing of the produce

The farm inputs will be bought from the locals and beyond as will be necessary. Currently, Bt-Cotton seeds for the demonstration fields is sourced and distributed by MAHYCO.

### **1.3 Bt-Cotton Commercialization Progress**

- 2001 - 2004 when application process by KARI through National Biosafety Committee to introduce Bt – Cotton in Kenya was made,
- In 2004 – 2010 research on Bt-Cotton was carried out both in screen houses and confined trials at KARI Mwea,
- 2011 – 2016 -application process for environmental release and placing on the market of Bt-Cotton and varietal derivatives and
- In 2016 the National Biosafety Authority gave conditional approval for environmental release subject to conduct of Environmental Impact Assessment.
- June 2018 and September 2019- Bt-Cotton National Performance Trials were conducted and the results indicated that Bt-cotton is superior to Kenyan local varieties in terms of resistance to African Bollworm, yield, and fiber qualities. The Bt-cotton hybrids NPTs findings were seamlessly recommended and released by the NPTC and NVRC on 5<sup>th</sup> and 6<sup>th</sup> December 2019 respectively.

The cabinet in a declaration of 19<sup>th</sup> December 2019 approved open release and placing on the market of the Bt-cotton modified or transformed using modern biotechnology with the requirements of the Environmental Management and Coordination Act (EMCA) and laws of Kenya that require an Environmental and Social Impact Assessment (ESIA) to be conducted before, and/or during the testing and introduction into the environment. In addition, the legal notice 150 of 19<sup>th</sup> August 2016 lists major developments in Biotechnology including the introduction and testing of Genetically Modified Organisms (GMOs) as high-risk projects.

The cabinet in a declaration of 19<sup>th</sup> Dec 2019 approved open release and placing on the market of the Bt-Cotton hybrids and their derivatives. The National Biosafety Authority is thus expected

to give full approval for commercialization and placing on market of Bt-cotton subject to clearance by National Environment Management Authority.

#### **1.4 Background and Rationale of the ESIA**

The National Environmental Management Authority requires that new plant varieties (modified or transformed using biotechnology or imported) must comply with the requirement of Environmental Management and Coordination (Amendment -2015) Act (EMCA) of Laws of Kenya that require an Environmental and Social Impact Assessment (ESIA) to be conducted before and/or during the testing and introduction into the Environment. Under the legal notice 150 of 19th August 2016 list major development in Biotechnology including the introduction of GMOs as high risks projects, consequently requires for a full study. However, EMCA section 43(a), provides that NEMA may direct that the proponent foregoes the submission of the Environmental Impact Assessment Study report and allows the Director General NEMA to exempt the BT-cotton from conducting full study but prepare an ESIA project report for submission to the National Environment Management Authority (NEMA). In Pursuit to the legal requirements as envisaged in the Act and based on the level, magnitude and the potential impacts that are likely to arise from the Bt-Cotton.

The main purpose of an ESIA is therefore to assist the Proponent, NEMA and all other stakeholders in understanding the potential environmental consequences of the project and thus provide a basis for making informed decisions on the project.

#### **1.5 Principles of Environmental Impact Assessment Considered**

The key principles of ESIA are that every person is entitled to a clean and healthy environment and has a duty to enhance and safeguard the environment. It is in view of these that this report is compiled for submission to NEMA.

Apart from the key principles highlighted above, other principles of ESIA considered in the development of this report include:

- ☐ Accounting for all environmental concerns in the proposed Bt-Cotton Commercialization projects activities
- ☐ Performance Assessment of the proposed project; this will involve:
  - a. Meeting or exceeding all applicable standards and regulations for the proposed project.
  - b. Measuring and reviewing environmental performance by conducting regular audits during the implementation phase.
- ☐ Conducting public participation to get the relevant information from the involved stakeholders regarding the proposed Bt-Cotton commercialization activities
- ☐ Recognition of social and cultural principles traditionally used in the management of the environment and natural resources



- Considerations on the emergency/contingency
- The precautionary principle in which, there is a requirement that action should be taken to prevent serious and irreversible damage.

It is on the basis of the aforementioned principles that an Environmental Impact Assessment is considered both as a planning tool and as a decision-making tool.

### **1.6 Project Objectives**

The objective Bt-Cotton commercialization is to ensure increased and sustained cotton production in the country through an environment friendly means so as to support the government's Big Four Agenda plan. This is expected to create massive job opportunities and enhanced earnings from apparel export. This is expected to create massive job opportunities and enhanced earnings from apparel export.

### **1.7 Scope of the project**

The Bt-Cotton Commercialization project will be implemented in five cluster areas (see Table 2) and will involve the distribution of the Bt-Cotton seeds to the farmers, land preparation, planting maintenance harvesting and processing of the produce.

### **1.8 Objectives of this ESIA**

The objective of this assessment is to enhance integration of projects into their environmental and social setting; reduce environmental damage; and a positively contribute to achieving sustainability.

The broad expectations include;

- i. Identify and analyze the social and environmental impacts of agricultural practices along the target value chains during and after the project closure in the target countries
- ii. Recommend measures and strategies to address and mitigate adverse social and environmental impacts in different ecological zones
- iii. Develop an Environmental Management Plan (EMP) which describes how the identified impacts are dealt with and parameters to be monitored

#### ***1.8.1 Specific Objectives of the ESIA***

- Identify and assess the anticipated environmental and social impacts of the proposed commercialization of Bt-Cotton
- Identify and analyze alternatives to the proposed Commercialization project
- Propose mitigation measures for negative impacts and enhancement measures for positive impacts to undertake during and after the implementation of the proposed project

- 
- Verify compliance with national environmental regulations and policies and industry best practices and standards at local, national and international level
  - Determine current environmental impact status as experienced by the sector, sense check for compliance and non-compliance in regards to the study findings and how they affect BT- Cotton production
  - Sustainability roll-out plans for recommendations from the study including possible collaborative areas and capacity building initiatives for key sector players on identified environmental risks.
  - Gather more in-depth information about the diverse climatic features of the various ecological zones in the target counties (such as drought, erratic rainfall)
  - Assess the current livelihood conditions of poor and marginal farmers in the proposed areas
  - Generate baseline data for monitoring and evaluation of how well the mitigation measures will be implemented during the project life cycle.
  - Recommend cost effective measures to be used to mitigate against the anticipated negative impacts.
  - Seek the views of the affected persons in consultation with the Client, relevant stakeholders and the National Environmental Management Authority (NEMA)
  - Prepare an Environmental and Social Impact Assessment Report with the Environmental Management Plan as per Environmental Management Coordination (Amendment) Act, 2015

### **1.9 Scope of ESIA**

- Description of Project Objectives
- Complete description of the existing site conditions
- Significant environmental issues of concern through the presentation of baseline data, which should include social, cultural considerations
- Assessment of public perception of the proposed development.
- Policies, Legislation and Regulations relevant to the project
- Likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and their relative importance to the design of the development's facilities
- Mitigation actions to be taken to minimize predicted adverse impacts if necessary and quantify associated costs.
- Monitoring Plan that would ensure that the mitigation plan is adhered to
- Alternatives to the project that could be considered at those sites or at any other location including no action alternative.

- Conclusion and recommendations

### **1.10 Terms of Reference**

- ✓ Description, evaluation and analysis of the foreseeable potential environmental effects of the project broadly classified into physical, ecological/biological and socio-economic aspects (direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated)
- ✓ Evaluation of wastes to be generated by the project.
- ✓ To propose/recommend a specific environmentally sound and affordable waste management system.
- ✓ Assessment of the proposed location/ regions of the Bt-Cotton commercialization project.
- ✓ A concise description of the baseline information, national environmental legislative and regulatory framework, and any other relevant information related to the project.
- ✓ Evaluation of the technology, procedures and processes to be used, in the implementation of the project.
- ✓ Evaluation of materials to be used in the implementation of the Bt-Cotton commercialization project and their extended sources.
- ✓ Evaluation and analysis of alternatives including the proposed project, no project alternative, project site, design and technologies.
- ✓ An environmental management plan (EMP), proposing the measures for eliminating/minimizing or mitigating adverse impacts on the environment and social setup,
- ✓ Propose measures to prevent health and safety hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies. This encompasses prevention and management of the foreseeable accidents and hazards during all phases of the project implementation.
- ✓ Such other matters as NEMA may require.

### **1.11 Methodology**

The methodology used purposive identification of counties that grow cotton or have high potential to grow it. For the purpose of data collection these areas were divided into two clusters; the first one in which data was collected through field visits and cluster two where data was collected virtually. Cluster one concentrated in counties in Western Kenya , Nyanza and parts of Rift valley namely; Kisumu; Homa Bay; Bungoma; Busia; Elgeyo Marakwet and

Baringo. In cluster two, virtual techniques were used to collect data, and this was important due to corona virus pandemic and rampant spread in the Central and Coastal regions of the County. Counties in this cluster included: Kwale; Kilifi; Tana River; Lamu; Makueni; Machakoes; Kitui; Kirinyaga; Embu; Tharaka Nithi and Meru. Data in this study was obtained through literature review, interviews using questionnaires, discussions with farmers and key informants in addition to observations. Both physical field visits and virtual means of collecting data applied,

The methodology of the process which culminated to the assessment and the subsequent ESIA study report included the following: -

- **Preliminary assessment** of the sites; where the experts visited the identified counties using a multi stage purposive sampling focusing on areas in the counties already identified by the ministry of agriculture as having favourable conditions for growing cotton
- **Screening:** To determine and identify the significant impacts to focus on in the ESIA, on a number of factors which include but not limited to the sensitivity of the area likely to be affected; possibility of uncertain, unique or unknown effects of the project. Determination in the proposed project depended on but not limited to the following aspects:
  - The sensitivity of the area likely to be affected;
  - Public health and safety;
  - The possibility of uncertain, unique or unknown risks;
  - The possibility of having individually insignificant but cumulatively significant impacts;
  - Whether the proposed activity affects protected areas, endangered or threatened species and habitats;

From the above, the Bt. Commercialization project was seen to require an Environmental Impact Assessment study since it involves planting of plant varieties that are modified by use of modern biotechnology and as such, are expected to result in negative effects to the environment and ultimately contribute to increased environmental concerns in all the phases of the project phases. This stage also involved activities such as:

- a. Getting a comprehensive site description that includes: Location of the proposed project, the soils and geology of the proposed site, water resources available on site, drainage system evident on site, climatic conditions of the proposed location and its vicinity, vegetation on site, land use systems on site and its vicinity, infrastructure at the site and justification for selection of the site
- b. Getting detailed information on: The nature of the proposed Bt-Cotton

commercialization activities,

### **Cotton growing areas**

A total of 24 counties are earmarked for Bt-Cotton commercialization. Of these, ESIA was carried out in 18 counties. The selection was based on the of previous history of cotton growing, availability resources and time limitations..

Key informants were purposively chosen based on the expertise and knowledge on cotton growing and Bt-Cotton.

*Table 3: Cotton growing areas studied*

	<b>Counties</b>	<b>Cotton growing areas</b>
1.	Busia	Matayos, Teso North, Nambale
2.	Kisumu	Nyando, Muhoroni, Kisumu East
3.	Homa Bay	Rachuonyo North, Homa Bay
4.	Siaya	Bondo, Rarieda
5.	Bungoma	Bumula, Bungoma West
6.	Makueni County	Kibwezi East, Kibwezi West, Makueni, Mbooni
7.	Kitui	Mwingi North, Mwingi Central, Mwingi West, Kitui East, Kitui Rural, Kitui South
8.	Machakos	Masinga, Mwala, Wote
9.	Tana River	Specific areas: Tana Delta, Bura and Hola irrigation schemes
10.	Kwale	Lungalunga, Matuga, and Msambweni
11.	Kilifi	Magarini, Malindi
12.	Lamu	Lamu East and Lamu West
13.	Kirinyaga	Mwea east and Mwea West
14.	Embu	Mbeere North and South
15.	Tharaka Nithi	Tharaka North, Tharaka Central, Tharaka South, Maara
16.	Meru	Igembe North, Igembe Cntral, Igembe South, Tigania East, Tigania West, Mbuure, Imenti Central, Imenti South and Imenti North
17.	Baringo	Baringo North, Baringo Central and Marigat
18.	Elgeyo Marakwet	Kerio Valley

**Data collection procedure:** data collection areas were divided into two clusters. In cluster one, data was collected through field visits. This was done in Western/Nyanza and Rift valley regions. Cluster two entailed virtual data collection. This was due to the high prevalence of corona virus cases in and around the coastal and Central regions of the country. Counties in this cluster included all the remaining regions (see Table

3Table 1).

- **Collection of Baseline Data:** Data collection involved activities such as desktop study and discussion with the stakeholders, observation, detailed physical inspection of the proposed regions and the surrounding areas to determine the present and anticipated impacts of the proposed Bt-Cotton Commercialization project,
- **Data Analysis and Evaluation of Alternatives:** Use of checklists, observation, photography and the threshold limits were used in data analysis; potential environmental impacts, capital and operating costs, suitability under local conditions, and institutional, training, and monitoring requirements were considered in the evaluation of alternatives.
- **Consultation and Public Participation:** Here, stakeholders, that included National government ministries especially that of agriculture and agencies in the Cotton value chain, County government ministries, academia, civil society, farmer groups and media, local administration among others were interviewed, in order to get their views, expectations, projected economic and social effects regarding the proposed Bt-Cotton Commercialization project activities and locations. These findings were then analyzed and incorporated in this project report.
- **Preparation of the Project Report:** This Environmental and Social Impact Assessment project report was then prepared by NEMA-registered ESIA experts, who are familiar with the provisions of the Environmental Management and Coordination Act (EMCA), (Amendment) 2015 and other relevant regulations and laws of Kenya as indicated in the Legal framework
- **Submission of the Project Report:** This report will then be submitted to National Environment Management Authority (NEMA), in copies of ten and a soft copy for review.

### 1.12 Proposed Project Justification

Cotton farming in Kenya has been experiencing difficult times with almost all the ginneries and textile industries collapsing due to low cotton production among others (Gitonga et al.,). The government in a bid to improve cotton yield, is proposing to introduce high-yielding quality cotton seeds that are resistant to pests. Bt-Cotton has been proven to provide resistance to Bollworm which is the major contributor to low yields of cotton. Bt-Cotton is grown across the globe including African countries such as Malawi, Nigeria, South Sudan, South Africa among others. The results have shown that the variety is efficient in the controlling lepidopteran pests leading to very high cotton production. The Kenya Agricultural and Livestock Research Organization (KALRO) has piloted Bt-Cotton and confirmed its efficacy on target cotton pests and its safety on the Kenyan environment. BT- Cotton yields about two to three times more

than current conventional varieties thus is expected to play a critical role in reviving the cotton sub-sector upon commercialization. This is expected to result in manifold benefits to the country and beyond. These include: strengthening the local cotton farmers' cooperatives and empower ginners to increase capacity, increased cotton production will see the revitalization of the textile and apparel industry, and other auxiliary industries like oil production will also be boosted, better income for families and creation of both direct and indirect employment in the whole value cotton value chain especially for youths and women thus contributing to poverty reduction especially farmers in arid and semi-arid areas among other benefits. It is against this background that the project will be implemented.



## CHAPTER TWO

### 2.0 PROJECT LOCATION AND DESCRIPTION

#### 2.1 Project location

The proposed cotton commercialization will be implemented in five regions of the Country namely, Nyanza/Western, Eastern/Central, North Eastern, Rift Valley and Coastal regions. ESIA study focused on the specific counties in the targeted regions as listed in the Table 4 below

*Table 4: List of targeted Counties for ESIA study*

Cluster	Western/Nyanza	Eastern/Central	North Eastern	Rift Valley	Coastal
Targeted Counties	Kisumu	-Kirinyaga	-Tana River	Baringo	Kwale
	Busia	-Tharaka Nithi		Elgeyo	Kilifi
	Bungoma	-Meru		Marakwet	Lamu
	Siaya	-Makueni			
	Homa Bay	-Machakos -Kitui			

The selected areas have had history of cotton growing. The variety grown is the low-yielding conventional cotton. In all the areas, it will be upon the farmer to choose to plant Bt-Cotton and so it is expected that there will be patches of farms with other crops other than cotton.

The project locations are described as below:

#### 2.1.1 Western Region

##### 2.1.1.1 Busia County

In Busia County, seven sub counties have been earmarked for the commercialization. They include:

- Samia,
- Nambale,
- Teso North
- Matayos
- Teso South,
- Budalangi,
- Butula

As at the time of the assessment, some 3,500 acres of land were under Cotton-both Conventional and non-BT Hybrid (AFA, Busia County). According to AFA, the acreage under cotton is expected to grow to about 10,000 with the introduction of Bt-Cotton. The areas that are not currently under cotton are occupied by other crops and shrubs.

Bt-Cotton had been planted at demonstration plots and were at various stages. However, there is no functional ginnery in the county.

#### *2.1.1.2 Bungoma County*

Cotton is currently grown in two sub counties in Bungoma County; it's in these sub counties that Bt-Cotton will be grown. The sub counties are:

- Butula
- Bungoma West

As at the time of the assessment, the area under cotton (Conventional and Non-hybrid BT) is about 500 Acres. This is expected to be increased to about 2,000 acres (AFA Busia County). The areas not under cotton currently are occupied by food crops and some are fallow.

There is no functional ginnery in the county.

### **2.1.2 Nyanza region**

In the region, the counties where the project will be implemented include Kisumu, Homa Bay, Siaya and Migori.

#### *2.1.2.1 Kisumu County*

Cotton is grown in the following sub counties;

- Kisumu East
- Kisumu west
- Nyando
- Seme
- Muhoroni
- Nyakach

In the year 2019, the county produced about 56tons of cotton. With the increased acreage and better yielding cotton varieties, the production is projected to be about 600tons from about 2000 acres (AFA, Kisumu County).

The county has 2 Cooperative Unions and 8 farmer cooperative societies. There is no functional ginnery in the county.

Bt-Cotton had been planted on demonstration plots in the county.

### *2.1.2.2 Homa Bay County*

Proposed areas for cotton growing are:

- Rachuonya North Sub County
- Homa Bay Sub County
- Suba North sub county
- Suba south sub County
- Rangwe sub county

The cotton farmers are organized into one Cooperative union and 7 cooperative societies.

The area under cotton as at the time of the assessment was about 3,500 acres producing about 149 metric tons of cotton (as of 2019). The acreage is projected to increase to about 5000 with a projected cotton yield of 200 metric tons (AFA, Homa Bay County). There is no functional ginnery in the county. No Bt-Cotton had been planted in the county

*Source: Homa-Bay County Integrated Development Plan (2013-2017)*

### *2.1.2.3 Siaya County*

Cotton is grown in all the Sub Counties of Siaya County. The Sub Counties are:

- Rarieda
- Bondo
- Alego usonga
- Ugenya
- Gem

As of the time of assessment about 4500 acres were under cotton and the production for the year 2019 was about 180 metric tons. The county has one mini ginnery at Madiany that is not operational due to lack of maintenance (AFA, Siaya County). No Bt-Cotton had been planted at the county.

## *2.1.3 Rift Valley region*

### *2.1.3.1 Baringo County*

Baringo County is situated in the Rift Valley Region and shares borders with 8 counties namely, West Pokot to the North West, Turkana to the North, Samburu to the North East, Laikipia to the East, Nakuru to the South, Kericho and Uasin-Gishu Counties to the South West, and Elgeyo-Marakwet to the West. The County is divided into 6 Sub-Counties, namely Baringo South, Mogotio, Eldama Ravine, Baringo Central, Baringo North and Tiaty.

Cotton farming is mainly practiced in Baringo North, Baringo Central and parts Mogotio Sub-counties.

### *2.1.3.2 Elgeyo Marakwet County*

Elgeyo Marakwet County borders West Pokot to the North, Baringo to the east, Trans-Nzoia to the northwest, and Uasin Gishu to the west. Agriculture is the main economic activity in the County, contributing 66 percent to household income and absorbing 53 percent of the labor force. The main industrial crops produced, namely tea, pyrethrum, and Cotton in the Kerio valley. The proposed Bt-Cotton farming will mainly be practiced in the Kerio Valley areas

## *2.1.4 Central/Eastern*

### *2.1.4.1 Kirinyaga County*

Kirinyaga County is located between latitudes 001' and 00 40' South and longitudes 370 and 380 East. The county borders Nyeri County to the North West, Murang'a County to the West and Embu County to the East and South and also boarder small part of Machakos County. It covers an area of 1,478.1 square kilometres

The county is divided into five districts currently sub-counties namely; Kirinyaga East, Kirinyaga West, Mwea East, Mwea West and Kirinyaga Central. The county has four constituencies namely Mwea, Ndia, Kirinyaga Central and Gichugu. Mwea Constituency comprises of two sub counties namely Mwea East and Mwea West Sub Counties.

In the county, cotton is grown in Mwea East and Mwea West Sub Counties.

### *2.1.4.2 Meru County*

Meru County is one of the Forty-Seven (47) counties of Kenya strategically located east of Mt. Kenya, whose peak cuts through the outskirt of its southern boundary. The county has a total area of 6,936.2Km<sup>2</sup> out of which 972.3Km<sup>2</sup> is gazetted forest. The county borders five counties; to the North it borders Isiolo County, to the East Tharaka/Nithi County, to the South West Nyeri County and to the West Laikipia County. It spans the equator lying 0°6' North and 0°1' South and between latitudes 37° West and 38° East.

The county has 9 sub-counties that include: Imenti South, Meru Central, Imenti North, Buuri, Tigania East, Tigania West, Igembe Central Igembe South and Igembe North.

Currently Cotton is grown in all the sub counties of the county.

### *2.1.4.3 Embu County*

Embu County is located approximately between latitude 0° 8' and 0° 50' South and longitude 37o 3' and 37o 9' East. It borders Kirinyaga County to the West, Kitui County to the East, Machakos County to the South, Murang'a County to the South West, Tharaka Nithi County to the North and Meru to the North West. The county is divided into four constituencies, namely; Runyenjes, Manyatta, Mbeere South and Mbeere North. Cotton is grown in Mbeere North and South sub Counties.

#### 2.1.4.4 Tharaka Nithi

Tharaka Nithi County borders the counties of Embu to the South and South West, Meru to the North and North East, Kitui to the East and South East while sharing Mount Kenya with Kirinyiga and Nyeri to the West. The county lies between latitude  $00^{\circ} 07'$  and  $00^{\circ} 26'$  South and between longitudes  $370^{\circ} 19'$  and  $370^{\circ} 46'$  East. The total area of the County is 2,662.1 Km<sup>2</sup>; including 360Km<sup>2</sup> of Mt Kenya forest in the county

The County is divided into five (5) administrative sub-counties namely Tharaka North, Tharaka South, Chuka, Igambango'mbe and Maara. Tharaka North Sub-county is the largest covering an area of 803.4 Km<sup>2</sup>, followed by Tharaka South with 746.1 Km<sup>2</sup>; Maara is third in size with an area of 465.3Km<sup>2</sup> and Chuka fourth is with 316Km<sup>2</sup> and Igambangombe is the smallest covering an area of 308 Km<sup>2</sup>.

Cotton farming is being practiced in Tharaka North, Tharaka Central, Tharaka South, Maara sub Counties.

#### 2.1.4.5 Machakos County

The County borders eight counties: Nairobi and Kiambu counties to the West; Embu to the North; Kitui to the East; Makueni to the South; Kajiado to the South West and Muranga and Kirinyaga to the North West. It lies between latitudes  $0^{\circ}45'$  South and  $1^{\circ}31'$  South and longitudes  $36^{\circ}45'$  East and  $37^{\circ}45'$  East. It covers a total area of 6208.2 km<sup>2</sup>. Administratively, the County is sub-divided into eight sub-counties/constituencies, namely Mavoko, Kathiani, Machakos, Matungulu, Yatta, Masinga, Mwala, and Kangundo. In the county Cotton is grown in Masinga, Mwala and Wote sub counties.

#### 2.1.4.6 Kitui County

Kitui County is about 160 kilometres from Nairobi City on the eastern part of Kenya. The county is the sixth largest County in Kenya by land area covering an area of approximately 30,496.4 KM<sup>2</sup>. It shares its borders with seven other counties, namely, Machakos and Makueni counties to the west, Tana River County to the east and south-east, Taita Taveta County to the south, Embu to the north-west, and Tharaka-Nithi and Meru counties to the north. It is located between latitudes  $0^{\circ}10'$  South and  $3^{\circ}0'$  South and longitudes  $37^{\circ}50'$  East and  $39^{\circ}0'$  East.

#### 2.1.4.7 Makueni

Makueni County is one of the forty-seven counties in Kenya. It is situated in the South Eastern part of the country and borders the following counties: Machakos to the North, Kitui to the East, Taita Taveta to the South and Kajiado to the West. Makueni lies between Latitude  $1^{\circ} 35'$  and  $3^{\circ} 00'$  South and Longitude  $37^{\circ}10'$  and  $38^{\circ} 30'$  east and covers an area of 8,008.7 Km<sup>2</sup>. Areas cotton is grown in the county: Kibwezi East, Kibwezi West, Makueni, Mbooni sub counties

### **2.1.5 North Eastern Region**

#### **2.1.5.1 Tana River County**

Tana River County is located in the coastal region of Kenya. The county borders Kitui County to the West, Garissa County to the North East, Isiolo County to the North, Lamu County to the South East and Kilifi County and Indian Ocean to the South. The county straddles between latitudes 0°0'53" and 2°0'41" South and longitudes 38° 30' and 40°15' East and has a total area of 38,862.20 Km<sup>2</sup>. The county has a coastal strip of only 76 Km. cotton growing areas are: Tana Delta, Bura and Hola irrigation schemes.

### **2.1.6 Coastal Region**

#### **2.1.6.1 Lamu County**

Lamu County is composed of two constituencies comprising Lamu East and Lamu West. The county is also made of seven divisions, 23 locations and 39 sub locations. Cotton is grown in Lamu East and Lamu West sub Counties.

#### **2.1.6.2 Kilifi County**

The county has seven sub counties namely: Kilifi North, Kilifi South, Ganze, Malindi, Magarini, Rabai and Kaloleni. It has 35 wards, 54 locations, and 165 sub locations as shown in the Table 1.1. Magarini sub-county is the largest while Rabai is the smallest sub county in terms of area. In the county cotton is grown in Magarini and Malindi sub Counties.

#### **2.1.6.3 Kwale County**

The county is divided into four sub-counties namely; Kinango, Matuga, Msambweni and Lunga-Lunga. The sub counties are further divided into wards. The cotton growing areas of the county are: Lungalunga, Matuga, and Msambweni sub Counties.

## **2.2 Project description**

The proposed Bt-Cotton commercialization project will involve distribution of transgenic cotton seeds to the farmers in the cluster regions listed in Table 2, Land preparation, cotton seed planting, farm maintenance, Cotton Harvesting and processing of the produce. Bt-Cotton is a variety of cotton that has been genetically engineered to provide resistance to selected insect pests (Lepidoptera) specifically the African bollworm. Insect resistance is accomplished by the insertion of two genes from naturally occurring bacteria called *Bacillus thuringiensis* which encode for the production of toxins crystals in the Cry group of endotoxin targeting only the Lepidoptera larva but having no adverse effect to mammals, birds, fish and beneficial insects. When insects attack and eat the cotton plant, the Cry toxins or crystal protein are dissolved due to the high pH level of the insect's stomach, leading to their death. The Bt-Cotton was produced by two subsequent

transformations of cotton tissue. Firstly, cotton tissue was genetically modified via *Agrobacterium tumefaciens* mediated transformation, generating MON 531 (BollGard I) with Cry1Ac gene. The transformation of MON 531, using the particle acceleration transformation system, introduced a second genetic modification Cry2Ab2 gene, which is referred to as MON 15947. The final cotton plant, containing both genetic modifications MON 531 and MON 15947, is named MON 15985 commonly referred as BollGard II. MON 15985 Bt-Cotton is therefore a second-generation stack event developed to produce both Cry1Ac and Cry2Ab2 proteins that confer enhanced protection from certain lepidopteran insect pests in cotton (NBA, 2016).

The farm inputs will be bought from the locals and beyond as will be necessary. Currently, Bt-Cotton seeds for the demonstration fields is sourced and distributed by MAHYCO.

The proposed Bt-Cotton commercialization will incorporate environmental guidelines as well as health and safety measures.



## CHAPTER THREE:

### 3.0 BASELINE INFORMATION

#### 3.1 Introduction

The proposed commercialization will be implemented in western region (Busia, Bungoma Counties), Nyanza region (Homabay, Siaya and Kisumu Counties), Rift Valley (Baringo, Elgeyo Marakwet counties), Coast, Eastern/ Central and North Eastern regions. The background information of the counties is presented as below.

#### 3.2 Western region

##### 3.2.1 Busia County

The County is situated at the extreme Western region of Kenya and borders Bungoma to the North, Kakamega to the East and Siaya to the South East, Lake Victoria to the South West and the Republic of Uganda to the West. It lies between latitude 0° and 0° 45 North and longitude 34° 25 East. The County can be accessed through Kisumu International Airport which is 112 Km away, Kisumu Busia Road, Nairobi –malaba highway. The county is home to the gateway to Kenya's regional neighbors; Uganda, Rwanda, Burundi, DRC Congo and Southern Sudan, with two border crossing points at Busia and Malaba Towns.

#### Administrative

Busia County is divided into seven administrative sub - Counties namely Samia, Bunyala, Butula, Matayos, Nambale, Teso North and Teso South. These sub - Counties are further divided into 10 divisions, 60 locations, 181 sub-locations and 120 villages under the Ministry of Interior and Coordination of National Government. The county has seven (7) constituencies namely: Teso North, Teso South, Funyula, Nambale, Matayos, Budalang'i and Butula and 35 electoral wards as shown below:

Table 5: population of the sub counties in Busia County

Constituency	County Wards
<b>Teso North</b>	Malaba Central, Malaba North, Angurai South, Angurai North, Angurai East, Malaba South
<b>Teso South</b>	Amukura West, Ang'orom, Chakol South, Amukura Central, Chakol North, Amukura East
<b>Matayos</b>	Bukhayo West, Mayenye, Matayos, Busibwabo, Bukhayo West
<b>Nambale</b>	Nambale Township, Bukhayo North/Waltsi, Bukhayo East, Bukhayo Central
<b>Butula</b>	Marachi Central, Marachi East, Marachi North, Elugulu, Marachi West, Kingandole
<b>Funyula</b>	Ageng'a Nanguba, Nangina, Bwiri, Namboboto Nambuku
<b>Budalang'i</b>	Bunyala Central, Bunyala North, Bunyala West, Bunyala South

Source: IEBC Electoral Boundaries, 2013

### **3.2 Physiographic and natural conditions**

#### **Climate**

Busia County receives annual rainfall of between 760 millimeters (mm) and 2000 mm. 50% of the rainfall falls in the long rain season which is at its peak between late March and late May, while 25% falls during the short rains between August and October. The dry season with scattered rains falls from December to February. The temperatures for the whole county are more or less homogeneous. The annual mean maximum temperatures range between 26°Celsius and 30°Celsius while the mean minimum temperature range between 14°Celsius and 22 °Celsius

The rainfall is moderate throughout the year allowing the County to experience conducive conditions for crop agriculture. Cassava, millet, ground nuts, sweet potatoes, cotton, sugar cane, beans, and maize are grown though in small scale. The produce from the county is reasonably priced food and crop items and is sold in various markets within Kenya and beyond. The county experiences an average temperature of 22°C.

#### **Topography**

Busia County falls within the Lake Victoria Basin. The altitude varies from 1,130m above sea level on the shores of Lake Victoria to about 1,500m above sea level in the central part in Teso North and Samia. Butula and Nambale Divisions occupy a plain characterized by low flat divides. These are often capped by late rites and shallow incised swampy systems. The peneplain has fertile soils suitable for growing maize, coffee and sugar cane. The southern part, which covers parts of Matayos Division, Funyula Division and the northern part of Budalangi Division is covered by range of hills comprising the Samia Hills, which run from northeast to southwest culminating at Port Victoria. In the extreme south of the district is found the Yala Swamp. The area forms a colony of papyrus growth broken by irregular water channels and occasional small lakes with grassy islands.

The central part of the county, especially Butula and Nambale Sub - Counties, are occupied by a peneplain marked by low flat divides of approximately uniform height, often capped by lateritic and a shallowly incised swampy drainage system. Due to the flat terrain and the soil type of the low lying areas of Busia County especially Budalang'i, there are frequent floods.

**Hydrology and water resources**

The County has numerous sources of water. There are two main rivers which drain into Lake Victoria- River Nzoia and River Sio. Part of Lake Victoria is in the county. There are numerous streams, springs and dams. The potential for ground water is good in Nambale and Matayos Divisions and moderate in Butula Division. There are a wide variety of sources of water for domestic, livestock and industrial use in the County, especially in Nambale, Butula and Matayos Divisions.

The Rivers serve the community for various purposes including domestic and agricultural uses. There are springs and shallow wells too. Few boreholes have been developed in the cotton growing areas mainly at institutional levels. These water resources require conservation

**Soils and geology**

Most of the soils in Busia County are moderately deep, generally rocky and stony consisting of well drained red clays which have a low natural fertility. Most of these are sandy loam soils, dark clay soils (cover the Northern and Central parts of the county). Other soil types are sandy clays and clays. The extreme Northern part of the county has land formation and structure that makes it suitable for both food and cash crops farming like tobacco and cotton. The lower Northern part covering parts of Nambale, Butula and Amukura in Teso South are suitable for maize, robusta coffee and sugar cane cultivation. The Central and Southern parts of the county are suitable for maize, cotton and horticultural crops. The lower parts of Samia and Bunyala Sub - Counties require irrigation while large areas of Bunyala Sub - County towards the lower reaches of Rivers Nzoia and Yala require drainage.

The Samia Hills represent the basement complex and consist of acid and sub-acid lavas, tuffs, and agglomerates, banded quartzite and iron stones. The Kavirondo series rocks are developed around Busia, Nambale and Butula while the granites dominate the Northern parts of the county. The Northern part of the central region features granitic outcrops, which are essentially part of the peneplain and is characterized by the presence of large granitic hills and tors such as Amukura and Chelelemuk. The Southern part is covered by a range of hills comprising the Samia and Funyula Hills which run from the North East to the South West culminating at Port Victoria, forming a very conspicuous topographic feature. The Southernmost part of the county is covered by the Yala Swamp which is a down warped area associated with the formation of Lake Victoria. The area forms

a colony of papyrus growth and is broken by irregular water channels and occasional small dams with grassy islands. This area is covered with lacustrine and alluvial deposits of recent and Pleistocene times.

### **Biological conditions**

#### *Flora*

The Flora in the cotton growing areas comprise *thevetia peruviana*, *Spathodea* spp, *Eucalyptus* spp, *markhamia lutea*, *podocarpus* spp, cypress spp, *gravillea* spp, *casuarina equisetifolia*, *Artocarpus heterophyllus* (jack tree/ jackfruit) locally called Fenesi ,shrubs and grasses among others. The shores of the River Sio are rich in hydrophytes too. The locals depend on the mentioned flora for different purposes. There will be need for clearance of flora to give way for the expansion of cotton growing, I case this will be necessary.

The County has two gazetted forests located in Budalangi Sub - County totaling to only 328.8ha. There are also forestry resources on the farms through agro-forestry practices and preservation of individual woodlots. These provide the bulk of the forest product for domestic use in the County. The proposed commercialization will be implemented in areas that are currently used as cotton growing farms.

#### *Fauna*

Fauna in the proposed project sites included avifauna, small mammals, fish in the rivers, reptiles and different aquatic microphages. The project area is well endowed with fisheries resources both aquaculture and capture. Fishing is mainly undertaken in Lake Victoria, River Nzoia, Sio and other areas. Fish farming is practiced in Nambale, Butula and Funyula Divisions, while capture fisheries is concentrated in Budalang'I and Funyula Divisions. Some of the major fish caught include nile perch, tilapia, omena etc.

The wild animals in Busia county include: hares, dik diks and hyenas. Hippopotamuses, wild pigs and velvet monkeys are found in pockets mainly around the shores of Lake Victoria. They are under threat due to human encroachment in their habitations. There are no game reserves in the county.

### **Agro-ecological zones**

Busia County is in the Low Midland (LM) zone. It is divided into four agro-ecological zones LM1, LM2, LM3 and LM4. LM1 is the sugarcane zone and covers the largest part of Butula, Matayos, Nambale and Township Divisions. LM2 is the marginal sugarcane zone and is found in parts of Butula, Nambale and Funyula Divisions. LM3 is the cotton zone and covers the largest part of Funyula Division and parts of Nambale and Budalangi Divisions. LM4, the marginal cotton zone covers parts of Funyula and Budalangi Divisions that adjoin Lake Victoria from Sio Port to Osieko

## **Socio-economic setting**

### *Population and settlement patterns*

The county has a total population of 893,681 according to the population census of 2019.

The Settlement pattern of the people in the district is largely evenly distributed within the divisions with minor concentration in the main urban areas of Busia, Port Victoria, Bumala, Nambale and Funyula. The hilly areas in Funyula and Budalang'i Divisions and the wetland areas especially in the southern part of Budalang'i have low concentration of people. The major influences to the settlement pattern are the potential of the land for agricultural production and ease of accessibility by road. Consequently, in-migration is higher to the rural areas of Nambale, Matayos and Butula Divisions, which have a higher potential, and a better road network.

### *Economic activities*

The county is the main point of entry between Kenya and Uganda accounting for the bulk of trade between the two countries. The presence of Lake Victoria has allowed the residents of this region to practice fishing one of the major economic activities in the county. The large population in the County has endowed it with a large labour force which if exploited well would allow the county to be a major contributor to Kenya's economy. The county has also seen a boon in the financial and services sector owing the large population. The major economic activities include: fishing, crop farming, and trade.

### *Land use*

The county has mixed land uses most of which are: farming, trade, commercial and industrial uses

### *Education*

The County has 638 primary schools and 162 secondary schools with a population of over 252,057 pupils and 52,488 students respectively, 25 Vocational Training Centres and 3 university constituent colleges located in Amagoro, Nambale Market and Alupe Sub - County Hospital.

### *Sensitive ecosystems, places of cultural importance*

Kakapel National Monument, a UNESCO World Heritage Site, is located on a huge rock site in the Chelelemuk Hills – a few kilometers from the Kenya -Uganda border, is one of the top attractions of Busia County. The site that was gazetted as a National Monument in 2004 comprises spectacular rock art that is believed to have been crafted by a group of hunters about 4,000 years ago. The site is administered by the Trust for Africa Rock Art (TARA) and the National Museums of Kenya.

## **Infrastructure**

### *Transport: Road, Rail Network, Ports, Airstrips*

The total road network in the county is approximately 1,600 kilometres (km). This consists of 169.64 km of tarmacked roads; 591.91 km are of gravel surface and 838.55 km earth surface. Some of the roads are however impassable during rainy seasons because they lack appropriate drainage.

The County is traversed by only 11 km of railway and served by one railway station in Malaba Town crossing into the Republic of Uganda. The Government of Kenya has identified two corridors for the development of modern, high capacity Standard Gauge Railway (SGR) transport system for both freight and passengers. The County has no functional airport or airstrip and has two ports at the Lake Victoria shores. The Sio Port in Samia Sub - County and Port Victoria in Bunyala Sub - County which mainly serve as fish landing ports.

#### *Communication*

The county is mostly covered by cellular phone network provided by Safaricom, Airtel and Telkom. There are over seventy licensed cyber cafes most of which are located in urban centers.

#### *Irrigation*

The county has several irrigation schemes. National irrigation schemes have a total of 8000 Ha. Majorly, the crops under irrigation include; vegetables, melons, tomatoes, maize, sorghum and rice.

#### *Water supply*

There are two main existing water supply schemes in Busia County. The Sio River Water Supply that serves Busia Town and its environs and the Bunyala Supply Scheme that serves Port Victoria Town.

### **Environmental Challenges**

#### *Land, catchment and wetland degradation*

This entails increased siltation in rivers and dams due to poor land use practices such as poor farming methods, use of pesticides and inorganic fertilizers, clearance catchment and wetland vegetation for agricultural farms among others especially along the rivers.

#### *Pollution*

There is poor disposal of solid and liquid waste especially in urban environments. This is evidenced by the fact that there is indiscriminate littering and poorly planned construction of pit latrines and malfunctioning sewerage systems. Besides, the unplanned hawking and trading along the tarmac highway has led to highway littering. The rural areas are hardly reached by the county government as regards waste collection.

#### *Flooding*

The county is one of the worst affected by the perennial floods especially the areas that border river Nzoia and the shores of Lake Victoria. These have brought destruction of properties, lives and degradation of environment.



### 3.2.2 Bungoma County

Bungoma County is found in the former western province. The County lies between latitude 00 28' and latitude 10 30' North of the Equator, and longitude 340 20' East and 350 15' East of the Greenwich Meridian. The County covers an area of 3032.4 Km<sup>2</sup>. It borders the republic of Uganda to the North west, Trans-Nzoia County to the North-East, Kakamega County to the East and South East, and Busia County to the West and South West.

#### Administrative units

Bungoma County is divided into 12 Sub-Counties, 45 Wards and 236 Village Units

Table 6: Sub Counties and wards of Bungoma County

Constituency	County Assembly Wards	No. of County Assembly Wards
Kanduyi	Bukembe West, Bukembe East, Township, Khalaba, Musikoma, East Sang'alo, West Sang'alo, Tuuti/ Marakaru	8
Bumula	South Bukusu, Bumula, Khasoko, Kabula, Kimaeti, West Bukusu, Siboti	7
Webuye East	Mihuu, Ndivisi, Maraka	3
Webuye West	Sitikho, Matulo, Bokoli, Misikhu	4
Kabuchai	Kabuchai/Chwele, West Nalondo, Bwake/Luuya, Mukuyuni	4
Sirisia	Namwela, Malakisi/South Kulisiru, Lwandanyi	3
Tongaren	Mbakalo, Naitiri/Kabuyefwe, Milima, Ndalua, Tongaren, Soysambu/Mituwa	6
Kimilili	Kibingei, Kimilili, Maeni, Kamukuywa	4
Mt Elgon	Cheptais, Chesikaki, Chepyuk, Kapkateny, Kaptama, Elgon	6
Total		45

Source: Bungoma CDIP (2018-2022)

#### Physiographic and Natural Conditions

##### Physical and Topographic features

The major physical features in the county include Mt. Elgon, several hills (Chetambe, Sang'alo and Kabuchai), rivers (Nzoia, Kuywa, Sosio, Kibisi and Sio-Malaba/Malakisi), waterfalls such as Nabuyole and Teremi. The altitude of the County ranges from over 4,321m (Mt. Elgon) to 1200m above sea level. The County has only one gazetted forest, the Mt. Elgon forest reserve, which measures 618.2Km<sup>2</sup>, and one National park, which measures 50.683 Km<sup>2</sup>.

##### Climatic conditions

The County experiences two rainy seasons, the long rains of March to July and short rains



- August to October. The annual rainfall in the County ranges from 400mm (lowest) to 1,800mm (highest). The annual temperature in the County is in the range of 0°C and 32°C due to different levels of altitude, with the highest peak of Mt. Elgon recording slightly less than 0°C. February is the warmest month of the year and the lowest average temperatures in the year occur in July. However, there increasing variability in rainfall and temperature patterns that have influenced changes in agricultural seasons.

#### *Soil and geology*

The county have good physical and varying soil types properties, with inherently fertile deep rich Andosols and Nitisols towards the slopes of Mt. Elgon. The western part of the County has Acrisols, while the centre of the county is predominantly Feralsols. The eastern part of the county comprises Acrisols and Feralsols. The soils have been mined of their nutrients due to continuous cropping with little addition of quality inputs. The availability of major nutrients N, and P is low in the districts.

#### *Ecological conditions*

The county has varied ecological conditions. These experience negative impacts due from anthropogenic activities leading to variation of nutrients and accumulation of toxins that have affected the ability of the environment to support life systems. Mt. Elgon forest ecosystem supports diverse life systems contributing immense goods (fruits, tubers, medicinal herbs, game meat, timber, logs, poles, firewood, fodder etc) and services (shed, pollination, decomposition, evaporation, absorption of CO<sub>2</sub>, nutrient formation, recreation, spiritual and cultural values etc). The county is high in biodiversity; some of the tree species in the area include *Makhamia lutea*, *Croton* spp. Animal species include wild animals in the protected areas and other non-protected forested areas.

#### *Socio economic conditions*

Majority of the residents of the county are Bukusu. The concentration of the population in the county is mainly in the town centres and factory areas- Webuye (Pan Paper Mills), Nzoia Sugar Company, Bungoma Town, Kimilili, Sirisia, Malakisi, among others.

#### *Agriculture*

Subsistence agriculture is the major economic activity in the county with Maize, Sunflower, Sugarcane, Coffee, Tobacco, Potatoes, Beans and cotton being the main crops

The Agro-Ecological Zones in the county include; Sugarcane Zones to Cotton Zone and Coffee/Tea/Dairy Zone to Maize-Sunflower Zones. The potential for sugarcane production covers more than half the agricultural land area measuring the agro-ecological zones. Livestock production is also common in the county though in small scale. The animals kept include cows, goats, and sheep

## **Environmental Challenges**

### *Deforestation*

The expanding County population accompanied by increasing agricultural activities have reduced spaces for fauna and flora.

### *Land degradation*

Excessive use of artificial fertilizers for instance has affected soil nutrients, insects and certain bacteria niches thereby affecting nitrogen conversion for plants, leading to variability in yields, increased soil erosion, and other land degradation aspects are common due to poor farming practices.

### *Pollution*

This is experienced in areas of the county with factories, where sugarcane is burnt in the farms. These contribute to air pollution from the fumes/ smoke. Pollution from solid waste and liquid wastes are also a challenge. The county government waste collection does not cover a great part of the county even in some urban centers.

## **3.3 Nyanza Region**

### **3.3.1 Homa Bay County**

#### *3.3.1.1 Geographical location*

Homa Bay County covers 3,183 km<sup>2</sup>. It is located in South Western Kenya along Lake Victoria where it borders Kisumu and Siaya Counties to the North, Kisii and Nyamira Counties to the East, Migori County to the South and Lake Victoria and the Republic of Uganda to the West. (Homa Bay County Development Profile, 2013).

#### *3.3.1.2 Physical and climatic Conditions*

### **Rainfall**

Homa Bay County has an inland equatorial type of climate. The climate is however modified by the effects of altitude and nearness to the lake which makes temperatures lower than in equatorial climate. There are two rainy seasons namely the long rainy season from March to June and the short rainy season from August to November. The rainfall received in the long rainy season is 60 per cent reliable and the average rainfall is 1226mm.

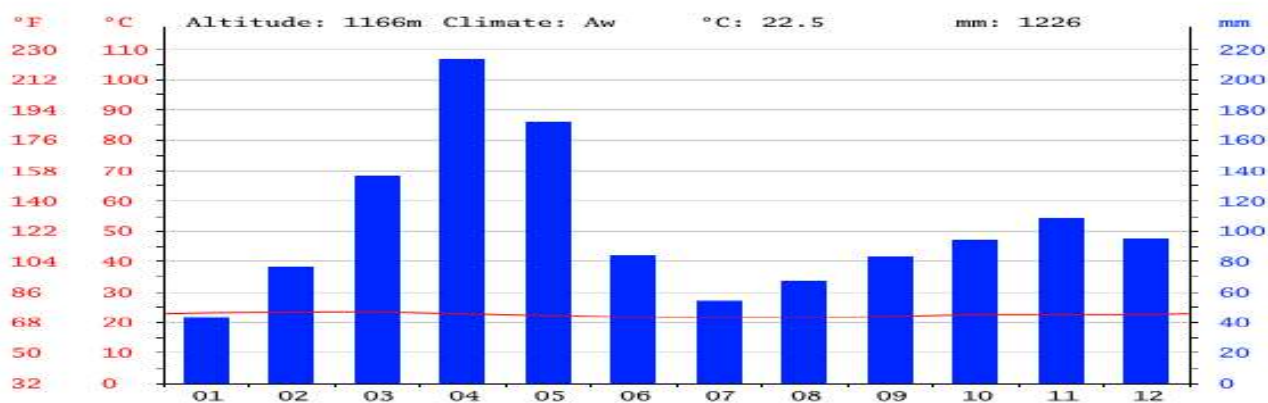


Figure 1: rainfall pattern in Homa Bay County

Source: (Climate-data.org)

The driest month is January, with 43 mm of rain. In April, the precipitation reaches its peak, with an average of 213 mm.

### Temperatures

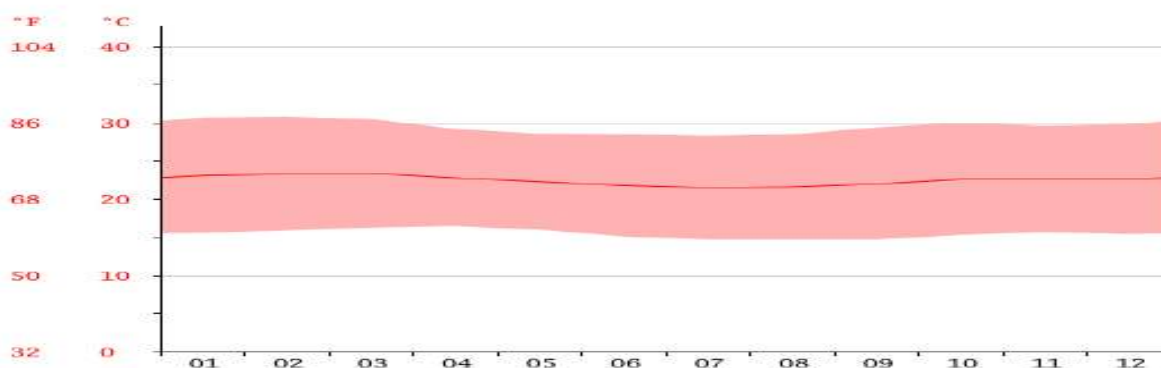


Figure 2: temperature range in Homa Bay County

Source: Climate-data.org

March is the warmest month of the year. The temperature in March averages 23.4 °C. At 21.5 °C on average, July is the coldest month of the year.

### Ambient Air Quality

There are minimal air quality issues in the areas where Bt-Cotton will be grown. The county has Sukari Sugar Factory in Dhiwa which may be the major source of air pollution. The other likely sources of air pollution in the area are the numerous murram roads and the loose soil surfaces especially during drought and while ploughing farms. These however do not have serious effects on the environment in the county.

### Wind

Generalized wind speeds average about 4 m/sec and have certain regularity due to the convection effect of the large water body of the lake that borders the often hot dry land.

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## Topography and Drainage

The county is divided into two main relief regions namely the lakeshore lowlands and the upland plateau. The lakeshore lowlands lie between 1,163 – 1,219 m above the sea level and comprise a narrow stretch bordering the Lake Victoria especially in the northern parts of the county. The upland plateau starts at 1,219 m above the sea level and has an undulating surface which has resulted from erosion of an ancient plain. It is characterized by residual highlands such as Gwasssi and Ngorome hills in Suba, Gembe and Ruri Hills in Mbita, Wire Hills in Kasipul as well as Homa hills in Karachuonyo. Koderia forest in Kasipul and the Kanyamwa escarpment that runs along the borders of Ndhiwa and Mbita also form part of the upland plateau. To the west of the county lies the Lambwe Valley where Ruma National park is located.

The project sites are generally located on relatively lower and flat grounds.

### 3.3.1.3 Geology and Soils

#### **Rocks**

The proposed areas are underlain by various rock types, namely, agglomerates, conglomerates, tuff sandstone, granite and other deposits. The cotton growing areas generally have black cotton soils.

#### **Soil**

The county has varied soil types; The lake shore lowland is dominated by alluvial soils, mainly the sandy loam type which is well drained and suitable for cotton, sunflower, maize, beans, cow peas and vegetable production; there are also sandy soil in the gendia, kendu bay, and kanyaluo areas- these areas do not retain water thus not very suitable for agriculture. Other crops with potential are sugar cane and potatoes especially on the upland areas.

### 3.3.1.4 Hydrology

The county is dissected by a number of rivers namely Awach Kibuon, Awach Tende, Maugo, Kuja, Rangwe and Riana rivers, most of which originates from Kisii and Nyamira counties. There are also several seasonal rivers and streams which originate from highlands within the county. The county has 16 islands, some with unique fauna and flora and an impressive array of physiographic features with great aesthetic value as well as breath-taking scenery and forested landscape particularly those around the islands and the coast of Lake Victoria and a peninsula like Sikri of Mbita sub-county.

### 3.3.1.5 Biodiversity

#### **Flora**

The cotton growing areas of the county have variety of plants. Since the areas are mainly semi arid, the plants mostly xerophytes such as *Balanites aegyptiaca*, *Cactus* spps, *Euphorbia tirucalii*, and other succulent plants. The other plants found in the areas are: *Terminalia brownii*, Umbrella tree, star grass, *Makhamia lutea*, *Psidium guajava*, sisal, *Lantana camara*, poo, Obino, *Zea mays*,

*Lucaena calothyrsis*, and ground nuts among others. The exotic species include mostly *Grevillea robusta* and *Eucalyptus* spp. A lot of trees are grown within the urban and peri-urban areas for the conservation of the environment. Of the invasive plant species in the area is the *Eichhornia crassipes* (water hyacinth) which covers the surface of the lake when blown by the wind to Kendu Bay side of the lake.

### **Fauna**

Fauna of the area comprise many varieties of domesticated animals like cattle, sheep, goats, birds, cat, and dogs among others. Wild fauna include insects, birds, snakes, and rodents. However, at most of the farm areas and the surrounding areas there were limited number of fauna due to the presence of humans and human activities- thus impact to fauna is expected to be insignificant.

#### *3.3.1.6 Sensitive ecosystems or places of cultural importance*

The county has several sensitive ecosystems including wetlands-around lakes and along rivers, Ruma National Park, Lake Simbi and cultural sites. Some of these sites fall in the cotton growing areas.

#### *3.3.1.7 Socio-economic environment*

### **Land use and Economic Activities**

The land use in the proposed commercialization areas is mixed but mostly agricultural. others are residential, commercial and natural. Generally, the residents earn their living from fishing, crop farming and other small commercial activities. Food insecurity in the area is common due to poor climate conditions and soils that cannot support food crop farming, low purchasing power and lack of significant economic activities. Homa Bay County ranks as one of the poorest regions in Kenya with over 70% of its population categorized as living below the poverty line. The urban and rural areas have poverty rates of 73% and 71%, respectively (FAO, 2003; WFP, 2003).

### **Agro ecological zones**

The county can be divided into seven agro-ecological zones namely:

- i) Upper Midland (UM1), coffee-tea-zone which occupies southern parts of Kasipul and Kabondo Kasipul sub-counties where tea and coffee are grown.
- ii) Upper Midland (UM3), Marginal coffee zone covers Gwassi hills of Suba sub-county. Maize, millet, pineapples, sorghum, sunflower and tomatoes grow well here.
- iii) Upper Midland (UM4), sunflower-maize zone covers areas surrounding Gwassi hills of Suba as well as Ndhiwa and Nyarongi areas of Ndhiwa sub-county. It supports maize, soya beans and pineapples.
- iv) Lower Midland (LM2), marginal sugar zone occupies parts of Ndhiwa, Homa Bay Town, Rangwe, Kasipul and the north of Kabondo Kasipul sub-counties. This zone supports green

grams, millet, sorghum, tobacco, sunflower, sugarcane, beans, pineapples, sisal and groundnuts.

- v) Lower midland (LM3), cotton zone occupies parts of Homa Bay Town and Rangwe sub-counties. It is suitable for growing maize, sorghum, cow peas, ground nuts, beans, soya, sweet potatoes, sunflower, *simsim*, green grams, rice and vegetables.
- vi) Lower Midland (LM4), marginal cotton zone occupies a strip along west of Karachuonyo, central Mbita and Gwassu areas of Suba sub-county. It supports the growth of cotton.
- vii) Lower Midland (LM5), livestock-millet zone occupies S.W. Suba, Rusinga and Mfangano islands, Lambwe Valley and Gembe and Kasungu areas of Mbita sub-county. It supports livestock rearing and millet growing.

(Homa Bay County Integrated Development Plan, 2018 – 2022)

### **Community and social amenities**

The social amenities in the areas include homesteads, secondary and primary schools, technical training institutes, among others. There is a wide range of denominations within the Christian community embracing Catholics, Apostolic Church, African Inland Church with the Seventh Day Adventists being the dominant denomination.

### **3.3.2 Kisumu County**

Kisumu County is part of the former Nyanza province. The county neighbours Siaya County to the West, Vihiga County to the North, Nandi County to the North East, Kericho County to the East, Nyamira County to the South and Homa Bay County to the South West. The county has a shoreline on Lake Victoria, occupying northern, western and a part of the southern shores of the Winam Gulf. It has a population of 1,155,574 (according to the 2019 National Census). The land area of Kisumu County totals 2085.9 km<sup>2</sup>.

#### **3.4.1.1 Physical and Climatic Conditions**

##### **Rainfall**

The county receives annual average precipitation of about 1200mm in a bimodal pattern of short and long rains seasons occurring between March-June and August-November respectively. Rainfall is the main mode of ground water recharge by way of lateral infiltration through the vadose zones and subsequent percolation into the zones of saturation. Rainfall is also depended upon to a large extent for the for the agricultural activities.

##### **Ambient Air Quality**

The air quality in the county is generally good. Air quality deterioration can be experienced in Kisumu Town due to the presence of many vehicles and industries. The rural areas are generally of

good air quality.

### **Temperatures**

Hot daily temperatures with high humidity characterize the daily weather of the area. The temperature ranges from 19.3<sup>0</sup>C -21.7<sup>0</sup>C in highland (Nyabondo Plateau) but in lower parts division the temperature may go up to or beyond 28<sup>0</sup>C.

The rainfall is controlled by the movement of the ITCZ (Inter Tropical Convergence Zone). There are considerable spatial variations in rainfall in the area, mainly due to the location of the highlands and nearness to Lake Victoria.

### **Hydrology and topography**

The surface water bodies in the county include L. Victoria, rivers Nyando, Sondu-Miriu, Awach-Kano, Oroba/Ombeyi, Kibos, Awach-Seme, Kisian, and Mugru in the catchment of Lake Victoria. These resources provide a big potential for development of blue economy. The seasonal streams in the larger catchment area are the modes of groundwater recharge by either direct or by way of regional replenishment. The low vegetative cover and steep gradients in some of the areas in the county discourage rainfall water infiltration and eventual percolation into the subsurface hence underground water potential is low.

Ndere is land, Kit-Mikayi are among the unique topographical features in the county.

### **Geology and Soil**

The soils in the county are dominated by lake sediments, commonly sand and clay soils. Red loamy soils are found in the Nyabondo plateau and the Maseno midlands. In Kano plains, the soils are predominantly the black cotton soils generally dark brown and grey in colour, poorly drained and quite unstable.

#### *3.4.1.2 Biological setting*

### **Flora**

The county has varied climatic conditions that determine the vegetation that inhabit an area. Thus the highland areas have abundant and more diverse in fauna compared to the lowland semiarid areas. the variety include both indigenous and exotic plants such as: *Terminalia brownie* (Onera), *Makhamia lutea* (Siala), *Lantana camara* (Nyabende), *Croton megalocarpus*, grasses, *Casuarina equisetifolia*, *Macadamia* spps, *Grevillea robusta*, *Psidium guajava*, *Eucalyptus* spps, *Balanites aegyptiacae*, *Thevetia peruviana*, *Euphorbia tirucalii* among others.

### **Fauna**

The proposed sites for the commercialization being existing farms, have few fauna. However there are burrowing animals small insects among others.



#### *3.4.1.3 Sensitive ecosystems or places of cultural importance*

Kisumu County is home to several sensitive ecological sites cultural sites. Some of these are: Impala Park, wetlands around Lake Victoria and along the rivers that traverse the county, Kit Mikai etc these areas must not be farmed so as to keep these areas intact.

#### *3.4.1.4 Land Use*

The county has various land uses- agricultural, residential, commercial, recreational etc. most of the proposed BT commercialization areas are in the rural areas which are dominated by agricultural, residential use.

#### *3.4.1.5 Social and Economic Aspects*

##### **Population and Settlement pattern**

According to the Kenya Population Census 2019, Kisumu County has a population of 1,155,574 of which there are 560,942 males and 594,609 females.

##### **3.4.1.5.2 Economic activities**

The economic activities in the County are Trade, fishing, farming and other commercial activities.

#### *3.4.1.6 Environmental challenges in Kisumu County*

##### **Water hyacinth**

Water hyacinth covers Lake Victoria which is the source of livelihood to many residents of the county. With the hyacinth present, fishing and water transport in the lake is hampered. This also affects the water quality and negatively affects the aquatic life in the lake.

##### **Floods**

Floods in the county is experienced mostly during long rains in the low lying areas of the county especially in Kano Plains and flat sections of Nyakach Sub County. This often results in loss of lives, properties, fertility of agricultural farms.

##### **Waste management**

Solid waste management on Kisumu County is the responsibility of the county government. However, rural areas are not served by this service. Even in towns, solid management is poor especially in the informal settlements. In the county, only Kisumu city has a sewerage system. The rest of the towns use septic tanks, pit latrine and open defecation. With the collapsible soils in some areas especially in most cotton growing areas, this is a serious issue.

#### *3.3.3 Siaya County*

Siaya County is one of the counties in the former Nyanza Province in the southwest part of Kenya. It is bordered by Busia County to the north, Kakamega County and Vihiga County's to the northeast and Kisumu County to the southeast. It shares a water border with Homa Bay County which is

located south of Siaya County. The total area of the county is approximately 2,496.1 km<sup>2</sup>. The county lies between latitude 0° 26' to 0° 18' north and longitude 33° 58' east and 34° 33' west.

#### *3.4.5.1 Physical and Climatic condition*

##### **Rainfall and temperature**

Hot daily temperatures with high humidity characterize the daily weather of the area. An annual precipitation amount of about 1400mm obtains in the area falling in a bimodal pattern of short and long rains seasons occurring between February-June and August-October respectively. Rainfall is the main mode of ground water recharge by way of lateral infiltration through the vadose zones and subsequent percolation into the zones of saturation.

##### **Drainage**

Drainage in most parts of the county area is greatly influenced by the surface water sources. The county is traversed by river Yala and Nzoia as the major rivers. There are several streams that flow to these rivers. The rivers subsequently drain westerly to Lake Victoria, part of which is in Siaya County.

Surface run-off from rainfall does contribute to the area's drainage. The plain terrain facilitates infiltration of the surface run off into the underground formations. Swampy and marshy lands also form part of the drainage system eg Yala swamp.

##### **Physiography**

The county has varied landscapes; plain lands, undulating topography, hilly. Nyatigo hills and Rambugi hills are some of the physiographic units and influence the local catchment. This geographical position bears a positive influence on the local hydrogeology; the hills are high rainfall areas whose surface run off accelerates towards the plains of the surveyed area whereupon infiltration and subsequent percolation into the subsurface is occasioned to recharge the expected aquifers. Yala swamp and other smaller swamps aid in the groundwater flow through seepage into the aquifers.

##### **Geology and Soil**

Rocks in the county range from early Precambrian to Quaternary. The Precambrian rocks are mainly of volcanic series. Rocks in this area can be divided into the following well defined groups based on their relative age and lithology; Precambrian Intrusives, Nyanzian system rocks, Kavirondian system rocks and Pleistocene to Recent formations. The investigated area is underlain by the Kavirondian system rocks as well as the Nyanzian system rocks. The Nyanzian system rocks consist of Rhyolites, Basalts and Andesites while the Kavirondian system rocks comprise of conglomerates, grits and mudstones which are sedimentary derivatives of the Nyanzian system rocks as outliers within the Nyanzian system. The cotton growing areas generally have black cotton soils. Other sections have reddish-brown loam soils which have deep layer profile. The sandy soils characterize the shores of Lake Victoria.

### 3.4.5.2 Flora and Fauna

The county has variety of plants which form part of its ecosystem. There are food crops such as Maize, finger millet, beans grown in the farmlands. Tree species observed at and around the Bt-Cotton proposed commercialization areas include *Euphorbia spp*, *Gravellia spp*, *Mangifera spp*, *Makhamia lutea*, *Psidium guajava*, *Lantana camara*, cactus, *Thevetia Peruviana*, variety of grasses among others. Among the animals are the domesticated and the wild. The wild animals include the birds, insects, monkeys, variety of ants and burrowing animals. Domesticated animals included the dogs, chicken, cattle, among others.

Natural vegetation of the *Euphorbia spp* and grassy fields has been cleared for human economic advancements. Traces of these can however be seen in the farm and homestead hedges. Natural trees also occur for both timber and fruits. This kind of vegetation observably holds the surface run off and consequently increases infiltration into the aquifers.

The vegetation on the in the areas forms a good habitat for avi-fauna. Thus, various birds' species could be observed near the site. Most animal species observed were domesticated ones and insects.

### 3.4.5.3 Social and Economic Aspects

#### **Population and Settlement Pattern**

Siaya County has a population of 993,183 according to 2019 census. Population density is more in the towns as compared to the rural areas.

#### **Population**

The total population of the county is 993,681.

#### **Economic Activities**

The major economic activities in the area are as discussed below:

#### ***Crop and Livestock Production***

The county is an agricultural county; agricultural activities include food and crop farming, livestock farming and fishing. Food crops include maize, ground nuts, sorghum, cassava and millet while livestock in the area include cattle, local breed poultry, goats and sheep. The cotton is the major cash crop.

#### ***Trade***

Buying and selling of goods and services takes place in the major shopping centres; Siaya, Bondo, Lwanda Kotieno, Usenge among others.

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### **3.4 Rift Valley Region**

#### **3.4.1 Baringo County**

Baringo County is situated in the Rift Valley Region and shares borders with 8 counties namely, West Pokot to the North West, Turkana to the North, Samburu to the North East, Laikipia to the East, Nakuru to the South, Kericho and Uasin-Gishu Counties to the South West, and Elgeyo-Marakwet to the West. It is located between longitudes 35 30' and 36 30' East and between latitudes 0 10' South and 1 40'. The Equator cuts across the county at the southern part. Baringo covers an area of 11,015.3 sq km of which 165 sq km is covered by surface water from Lake Baringo, Lake Bogoria, and Lake Kamnarok. The County is divided into 6 Sub-Counties, namely Baringo South, Mogotio, Eldama Ravine, Baringo Central, Baringo North and Tiatiy

#### **Topography**

One of the prominent features is the Kerio Valley, which is situated on the western part of the county. In the eastern part of the county near Lake Baringo and Bogoria is the Lobo Plain covered mainly by the lathstring salt-impregnated silts and deposits. The Tugen Hills form a conspicuous topographic feature in the county. The trend of the hills is north-south and mainly consists of volcanic rocks. The hills have steep slopes with prominent gullies. On the eastern and western parts of the hills are escarpments. Rivers on the hills flow in very deep gorges.

#### **Ecological Conditions**

Exotic forests exist in the county but the known indigenous forests are found in Kabarnet, Kabartonjo, Tenges, Lembus, Saimo, Sacho and Ol' Arabel and Eldama Ravine. The main exotic species are: *Grevillea Rabusta*, *Cuppressus lusitanica* and *Eucalyptus saligna*. *Prosopis juliflora* also exists in Marigat area. Kipng'ochoch forest in Sacho, one of the 10 forest blocks under Tenges forest station, is an example of a well conserved indigenous forest where visitors and nature lovers could view the entire Lake Baringo basin, fluorspar mines, Laikipia ranges, Elgeyo escarpment, Kerio Valley and other touristic attractions that the county offers. The county is classified as arid and semi-arid. Most parts of East Pokot, Baringo Central, Baringo South, Baringo North, Mogotio sub-counties are arid and semi-arid except for Koibatek sub-county, which is in a highland zone. Rainfall ranges between 300 mm and 500 mm, decreasing from south to north.

Climatic conditions The rainfall varies from 1,000mm to 1,500mm in the highlands to 600mm per annum in the lowlands. Due to their varied altitudes, the sub-counties receive different levels of rainfall. Koibatek sub-county receives the highest amount of rainfall. The lowland sub-counties of Mogotio, East Pokot and Baringo North receive relatively low amounts. The temperatures range from a minimum of 10°C to a maximum of 35°C in different parts of the county. Average wind speed is 2m/s and the humidity is low. The climate of Baringo varies from humid highlands to arid lowlands while some regions are between these extremes.

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## Soils

The soils in the site are moderately drained, deep, dark reddish brown, weak structured clay. The soil pH is too alkaline for most crops to grow. Salinity is low in the top soils and can increase with depth to extremely high levels while the sodicity follows the same trends. They have a high bulk density. The soil moisture storage capacity is generally low. These soils are deficient in nitrogen and organic matter. To be able to attain potential yields the fertility status needs to be enhanced.

## Geology and physiography

The area is underlain by sedimentary rocks. The site has one physiographic unit, plains with slopes ranging from 0-1%.

## Climate

The centre lies in Agro ecological Zone IL 5 (Jaetzold, *et al.*, 2009). The average annual rainfall totals 654mm with weak bimodal peaks recorded from March-May and June-August. Annual evapo-transpiration totals 1360 mm and exceeds rainfall in every month of the year by as low as 19 mm in May and as high as 109 mm. in February. This necessitates irrigation throughout the year. This area has low potential for rain fed agriculture.

## Present land use

The crops grown include cotton, maize, horticultural crops such as onions, water melons etc. The natural vegetation is characteristic of agro-ecological zone IL5 with dryland Acacia trees mainly *Acacia tortilis*, *Acacia nubica*, *Boscia abyssinica*, *Balanites aegyptiaca*, and bushes of *Salvadora persica*. The generally bare ground springs up with life of ephemeral herbs when it rains. The vegetation gradually gives way to bushed savanna grassland towards the uplands in the east, west and south while becoming sparse with increasing aridity towards the north from Nginyang (at 914 m. asl) to Kapedo (at 762 m).

## Hydrology

Both the escarpment and the hills are irregularly dissected by seasonal and few permanent rivers running down slopes into the only two surface water masses of Lakes Baringo and Bogoria. River Perkerra with its watershed in southern parts of Tugen hills is a permanent river passing through Marigat town and is depended upon by the centre for irrigation. R. Molo is another major river flowing into Lake Baringo while R. Waseges is the major river feeding L. Bogoria.

### 3.4.2 Elgeyo Marakwet County

The County borders West Pokot County to the North, Baringo County to the East, Trans Nzoia County to the Northwest and Uasin Gishu County to the West. The County covers a total area of 3029.6 km<sup>2</sup> which constitutes 0.4 percent of Kenya's total area. It extends from latitude 0° 20' to 1° 30' to the North and longitude 35° 0' to 35° 45' to the East.

**Topography**

The county has three distinct topographic zones; The Highland, The Escarpment and the Kerio Valley. Each of the three zones has attracted a different settlement pattern. The Highlands, which constitute 49 percent of the county area, is densely populated due to its endowment with fertile soils and reliable rainfall. The Escarpment and the Kerio Valley make up 11 percent and 40 percent respectively. These areas have poor soils, low rainfall and are prone to natural disasters such as drought and landslides. The high-altitude topography caused by the existence of these zones favors athletic sports evidenced by the county being home to world's greatest athletes. This contributed to the county being branded as 'county of champions'.

**Soils**

The most dominant soil type in the area is nitsols. Nitsols are deep, well drained, red-coloured tropical soils. They are soils with high nutrient content and a significant accumulation of clay of about 30%. Nitsols have a strong angular blocky aggregate structure. They are said to have a high content of iron oxides and water.

**Hydrology and Ecological conditions**

The county is home to two forest ecosystems and water towers namely Kaptagat and Cherangany and hosts the second largest forest cover in Kenya of 37.6%. These ecosystems are a source of many rivers that form the main water divide running along the Escarpment. East of the water divide is the Kerio catchment area which drains into Lake Turkana while West of the divide is the Lake Victoria Basin which drains into Lake Victoria. Lake Victoria Basin includes the following rivers: Moiben, Chepkaitit and Sabor. The Kerio catchment area includes River Kerrer and Kerio River. The other major rivers in the county are Torok, Chesegon, Embobut, Embomon, Arror, Mong and Kimwarer

**Population**

According to the 2009 census report, the County had 370,712 people with the males constituting 184,500 (about 50 percent) and the females 186,212 (about 50 percent). The total projected population is 460,092 in 2017, 228,982 being male and 231,108 being female. The population of Elgeyo Marakwet County is majorly rural, at 91 percent (335,835) (KNBS 2009). The County has four sub-Counties namely Keiyo North, Keiyo South, Marakwet East and Marakwet West. The population distribution is across the four sub counties in the ratio of 20, 30, 21, and 29 percent respectively

**3.5 Central/Eastern****3.5.1 Kirinyaga County**

Kirinyaga County is located between latitudes 001' and 00 40' South and longitudes 37<sup>0</sup> and 38<sup>0</sup> East. The county borders Nyeri County to the North West, Murang'a County to the West and Embu

County to the East and South and also boarder small part of Machakos County. It covers an area of 1,478.1 square kilometers

### **Physical and Topographic Features**

The county lies between 1,158 metres and 5,380 metres above sea level in the South and at the Peak of Mt. Kenya respectively. Mt. Kenya which lies on the northern side greatly influences the landscape of the county as well as other topographical features. The mountain area is characterized by prominent features from the peak, hanging and shaped valleys. The snow melting from the mountain forms the water tower for the rivers that drain in the county and other areas that lie south and west of the county. The Snow flows in natural streams that form a radial drainage system and drop to rivers with large water volumes downstream

### **Climatic Conditions**

The county has a tropical climate and an equatorial rainfall pattern. The climatic condition is influenced by the county position along the equator and its position on the windward side of Mt Kenya. The county has two rainy seasons, the long rains which average 2,146 mm and occur between the months of March to May and the short rains which average 1,212 mm and occur between the months of October to November. The amount of rainfall declines from the high-altitude slopes of Mt. Kenya towards the Semi-arid zones in the eastern part of Mwea constituency. The temperature ranges from a mean of 8.10C in the upper zones to 30.30C in the lower zones during the hot season.

### **Ecological Conditions**

The county has three ecological zones; the lowland areas that fall between 1158 metres to 2000 metres above sea level, the midland areas that lie between 2000 metres to 3400 metres above sea level and the highland comprising areas of falling between 3400 metres to 5380 metres above sea level. The lowland area is characterized by gentle rolling plains that cover most of Mwea constituency. The midland area includes Ndia, Gichugu and Kirinyaga Central constituencies. The highland area covers the upper areas of Ndia, Gichugu and Central constituencies and the whole of the mountain area. The county is well endowed with a thick, indigenous forest with unique types of trees covering Mt. Kenya. Mt. Kenya Forest covers 350.7 Km<sup>2</sup> and is inhabited by a variety of wildlife including elephants, buffaloes, monkeys, bushbucks and colourful birds while the lower parts of the forest zone provide grazing land for livestock. The rich flora and fauna within the forest coupled with mountain climbing are great potential for tourist activities.

### **Hydrology**

The county has six major rivers namely; Sagana, Nyamindi, Rupingazi, Thiba, Rwamuthambi and Ragati, all of which drain into the Tana River. These rivers are the principal source of water in the county. The water from these rivers has been harnessed through canals to support irrigation at the

lower zones of the county especially in Mwea sub-county. The rivers are also important sources of domestic water through various water supply schemes. The rapid populating increase is however constraining many of the schemes since the designs were meant to cater for a smaller population. There is therefore a dam being constructed in the county at Gichugu Constituency as well as rehabilitation and expansion of Mwea irrigation scheme which will address some of these problems. The water resources, if optimally harnessed, will boost agricultural production in the county and contribute to sustained economic development and poverty reduction.

### **Geology and Soils**

The geology of the county consists of volcanic rocks, which influence formation of magnificent natural features such as “Ndarasa ya Ngai’ (God’s bridge)” along Nyamindi River, and the seven spectacular water falls within the county. The soils are poorly drained, moderately deep, black, well-structured clay. They are slightly alkaline and have moderately high organic matter content. To be able to attain potential yields the fertility status needs to be enhanced.

### **Administrative and Political Units**

The county is divided into five districts currently sub-counties namely; Kirinyaga East, Kirinyaga West, Mwea East, Mwea West and Kirinyaga Central. The county has four constituencies namely Mwea, Ndia, Kirinyaga Central and Gichugu. Mwea Constituency comprises of two sub counties namely Mwea East and Mwea West Sub Counties.

### **Population and settlement**

From the Kenya Population and Housing Census 2009 report, the population of the county stood at 528,054 persons with an annual growth rate of 1.5 percent. The population is projected to be 613,511 in 2019, 632,195 in 2021 and 651,449 in 2023. Generally, there are two types of settlements in the county namely; clustered settlement and scattered settlement. Clustered settlement patterns are primarily found around towns and irrigation schemes where those who work in the rice fields have settled. Scattered settlement patterns are found mostly in the lower zones of the county where land sizes are large.

### **3.5.2 Meru county**

Meru County is one of the Forty-Seven (47) counties of Kenya strategically located east of Mt. Kenya, whose peak cuts through the outskirt of its southern boundary. The county has a total area of 6,936.2Km<sup>2</sup> out of which 972.3Km<sup>2</sup> is gazetted forest. The county borders five counties; to the North it borders Isiolo County, to the East Tharaka/Nithi County, to the South West Nyeri County and to the West Laikipia County. It spans the equator lying 0°6’ North and 0°1’ South and between latitudes 37° West and 38° East.



**Physical and Topographic Features**

The county's position on the eastern slopes of Mt Kenya and the equator has highly influenced its natural conditions. Altitude ranges from 300m to 5,199m above sea level. This has influenced the atmospheric conditions leading to a wide variety of microclimates and agro-ecological zones.

**Drainage & Hydrology**

The drainage pattern in the county is characterized by rivers and streams originating from catchment areas such as Mt. Kenya and Nyambene ranges in the North of the county. The rivers cut through the hilly terrain on the upper zones to the lower zones and drain into the Tana and Ewaso Nyiro Rivers. The rivers form the main source of water for both domestic and agricultural use.

**Ecological Conditions**

The county has varied ecological zones ranging from upper highlands, lower highlands, upper midlands and lower midlands. This has greatly influenced the major economic activities. The upper highlands zones covers majority of the county's area ranging from Imenti South, Imenti Central, Imenti North, Part of Tigania East, Part of Tigania West, Igembe Central and Igembe South constituencies. The lower midland zones are only found in lower parts of Buuri, Igembe North and Tigania East and West which borders Laikipia and Isiolo Counties.

**Climatic Conditions**

The distribution of rainfall ranges from 300mm per annum in the lower midlands in the North to 2500mm per annum in the South East. Other areas receive on average 1250mm of rainfall annually. There are two seasons with the long rains occurring from mid-March to May and short rains from October to December. Temperatures range from a low of 8oC to a high of 32oC during the cold and hot seasons respectively.

**Population Size and Composition**

The County's population growth rate is estimated at 2.1 per cent per annum. The projected population of the county in 2018 is 1,635,264, consisting of 808,596 males and 826,668 females as shown in table 3 below. The county population is projected to grow to 1,703,945 in 2020 and 1,775,511 in 2022. The growth in population will be a strain on available resources

**Land and Land Use**

Land in Meru County is utilized in diverse ways that include: agricultural, residential, educational, public purpose, public utilities, transportation, industrial, recreation and conservation and commercial. However the major land use in the county is mainly for agricultural activities for both crop farming and livestock-keeping. Agricultural land use is common in all the sub Counties and is particularly intense in the Imenti sub counties and Buuri while livestock is common in the Tigania and North Igembe sub counties. Other uses include cultural and forestry conservation. There are

large scale farming carried out by private companies in Timau, Buuri constituency. Livestock and Miraa farming is also practised in Tigania and Igembe areas. Coffee, Tea and Macadamia are also major crops produced in Imenti Central and Imenti South sub counties respectively. Other crops grown in the county include Bananas, maize, beans, sorghum, millet, green grams, potatoes, cabbages, carrots and kales among others. Urban uses are also rapidly emerging in the County with Meru, Maua, Nkubu, Timau developing as urban nodes. The urban areas are also being complemented by other centres in the Sub Counties and ward level.

### **Administrative Subdivisions (Sub-counties, Wards and Villages)**

The county government administrative structure comprises of nine recognised (9) sub-counties, forty-five (45) wards and three hundred and ninety-two (392) villages. The 9 sub-counties include: Imenti South, Meru Central, Imenti North, Buuri, Tigania East, Tigania West, Igembe Central, Igembe South and Igembe North.

### **Infrastructure Development**

#### **Roads Network**

The county has 5,968 km of road network. This comprises of 582 km bitumen, 581 km gravel and 4,805 km of earth surface roads. This network is maintained by different road agencies such as KeRRA, KURA, KeNHA and County Government. Eighty percent of the earth roads are under the mandate of the county government. However during the rainy seasons, some sections of earth surface roads are impassable.

### **Crop, Livestock, Fish Production and Value addition**

#### **Main Crops**

The economy of Meru is primarily agrarian. The growing of a variety of crops and keeping livestock in some parts of the county form a critical chunk of the economic activities of the people of Meru. The Greater Meru is endowed with soils and climatic conditions that allow for the production of a variety of commodities including wheat, barley, potatoes, millet, sorghum and maize. High grade tea, coffee, bananas and Miraa (Khat) are the key cash crops. The Meru were indeed the first Africans to grow coffee in Kenya in early 1930s upon the implementation of the Devonshire White Paper of 1923. Other crops include groundnuts and a wide range of legumes, vegetables and fruits.

### **Agricultural Extension, Training, Research and Information Services**

The only government training facility in the County is Kaguru Agricultural Training Centre located in Imenti South Sub-County. The institution trains farmers and hosts workshops for staff under various programmes. Agricultural Mechanization Services station (located in Mitunguu) is the other government institution which offers mechanization services to farmers. Every ward has at least two technical officers in the agriculture sector who offer extension services to farmers. This workforce is inadequate.

### **3.5.3 Embu County**

Embu County is located approximately between latitude 0o 8' and 0o 50' South and longitude 37o 3' and 37o 9' East. It borders Kirinyaga County to the West, Kitui County to the East, Machakos County to the South, Murang'a County to the South West, Tharaka Nithi County to the North and Meru to the North West. The county is divided into four constituencies, namely; Runyenjes, Manyatta, Mbeere South and Mbeere North.

#### **Physical and Topographical Features**

Embu County is characterized by highlands and lowlands and slopes from North-West towards East and South-East with a few isolated hills such as Kiambere and Kiang'ombe. It rises from about 515m above sea level at the River Tana Basin in the East to 5,199m at the top of Mt. Kenya in the North West. The southern part of the county is covered by Mwea plains which rise northwards, culminating in hills and valleys to the northern and eastern parts of the county. There are also steep slopes at the foot of Mt. Kenya.

#### **Hydrology**

The County is served by six major rivers which are Thuci, Tana, Kii, Rupingazi, Thiba and Ena. There are also some major dams which generate hydroelectric power for the country that are partly in the county. These include Masinga, Kiambere, Kindaruma and Gitaru dams which are situated along the Tana River. The most conspicuous physical features in the county are Mt. Kenya, Kiang'ombe hills, Kiambere hills, Mwea game reserve, River Tana, Masinga dam, Kamburu dam, Kindaruma dam, Kiambere dam and Gitaru dam.

#### **Ecological Conditions**

Embu County depicts two distinct areas with different agro-climatic and natural characteristics. The County has a typical agro-ecological profile of the windward side of Mt. Kenya, from cold and wet upper zones to hot and dry lower zones in the Tana River Basin. The average annual rainfall reflects this contrast: from more than 2200 mm at 2500 m to less than 600 mm near the Tana River at 700 m (Farm Management Handbook 2006, p.87). The variation is mainly due to the mountain but also to the "water recycling" effect of the forest by evapo-transpiration. Above 2500 m, rainfall decreases due to the lower moisture content of the colder air and the stronger influence of the trade wind system, but nevertheless the area is still very wet.

#### **Climatic Conditions**

The rainfall pattern is bi-modal with two distinct rain seasons. Long rains occur between March and June while the short rains fall between October and December. Rainfall quantity received varies with altitude averaging to about 1,067.5 mm annually and ranging from 640 mm in some areas to as high as 1,495 mm per annum. Temperatures range from a minimum of 12oC in July to a maximum of 30oC in March with a mean average of 21oC.

The extensive altitudinal range of the county influences temperatures that range from 200C to 300C. July is usually the coldest month with an average monthly temperature of 150C while September is the warmest month with an average monthly temperature rising to 27.10C. There is however localised climate in some parts of the county especially the southern region due to their proximity to the Kiambere, Masinga, Kamburu and Kindaruma dams.

**Administrative Units**

The county comprises of four (4) Sub-counties namely; Manyatta, Runyenjes, Mbeere North and Mbeere South.

**Population and Settlement**

The 2009 Population and Housing Census recorded a population of 516,212 persons for Embu County consisting of 254,303 males and 261,909 females. This population was projected to rise to 571,413 in 2018, 582,298 persons in 2020 and 593,651 persons in 2022 at population growth rate of 1.4 percent per annum, which is lower than national growth rate of 2.6 percent

**Land and Land Use**

The County is characterised by a predominantly rural settlement pattern. There is a concentration of people along the major permanent water sources such as rivers and dams where irrigation, farming and fishing are carried out. The settlement pattern is also influenced by social economic activities, rain and soil fertility. Mbeere North and Mbeere South receive less rainfall and have a more scattered settlement pattern compared to Manyatta and Runyenjes sub-counties which receive more rainfall.

The county has three major urban centres, namely Embu, Siakago and Runyenjes towns. There are also major market centres like Ishiara, Karaba, Kiritiri, Gachoka, and Kianjokoma. These areas have relatively better developed infrastructure and therefore have good potential for business enterprises.

**Crop, Livestock, Fish Production and Value addition**

The agriculture sector continues to play a vital role in the rural economy. The sector was one of the first to fully devolve the function of service provision to the county governments underscoring the importance of County Governments' role in ensuring food security. Agriculture is key to Kenya's economy, contributing 26 percent of the Gross Domestic Product (GDP) and another 27 percent of GDP indirectly through linkages with other sectors. The sector employs more than 40 percent of the total population and more than 70.1 percent of Kenya's rural people. Majority of the population in the county derive their livelihood from crop farming

### **3.5.4 Tharaka Nithi**

Tharaka Nithi County borders the counties of Embu to the South and South West, Meru to the North and North East, Kitui to the East and South East while sharing Mount Kenya with Kirinyiga and Nyeri to the West. The county lies between latitude 000 07' and 000 26' South and between longitudes 370 19' and 370 46' East. The total area of the County is 2,662.1 Km<sup>2</sup>; including 360Km<sup>2</sup> of Mt Kenya forest in the county

#### **Climatic Conditions**

Temperatures in the highland areas range between 140C to 300C while those of the lowland area range between 220C to 360C. Tharaka constituency, which lies in the lower side, experiences temperatures of up to 40oC at certain periods. The county has a bi-modal rainfall pattern with the long rains falling during the months of April to June and the short rains in October to December.

The rainfall ranges from 2,200mm in Chogoria forest to 500mm in Tharaka. The high altitude areas experience reliable rainfall while middle areas of the county receive moderate rainfall. The lower regions receive low, unreliable and poorly distributed rainfall. The climate of the county is favourable for cultivation of tea, coffee, maize, cowpeas, pigeon peas, sorghum, millet, green grams, tobacco and a variety of other food crops. However, there are unusual climate variability incidences arising from climatic change.

#### **Physical and Topographic features**

The highest altitude of the county is 5,200m in Chuka/Igambang'ombe and Maara while the lowest is 600m Eastwards in Tharaka. The main physical feature of the county is the 360 Km<sup>2</sup> of Mt. Kenya forest distributed between Maara and Chuka/Igambang'ombe constituencies. The forest serves as a tourist attraction, catchment area for Tana River, a source of fuel wood, fodder and honey for the communities living around it. Major hills found in the county landscape include Kiera, Munuguni and Njuguni in Maara constituency and Kijegge and Ntugi in Tharaka constituency. The hilly terrain of the County leads to soil erosion hence environment degradation. The terrain also makes construction and maintenance of road networks costly

#### **Ecological Conditions**

The County has two main ecological zones. The highlands (upper zone) comprise of Maara and Chuka which receive adequate rainfall for agriculture. The semi-arid (lower zone) covers Tharaka and receives less rainfall suitable for livestock production. Poor methods of farming and soil conservation, charcoal burning and overgrazing have left the earth bare and rocky. The sloping areas have experienced uncontrolled soil erosion, which has resulted in deep gullies across the landscape especially in Tharaka. The drainage pattern consists of rivers and streams that ultimately drain into the Indian Ocean through Tana River.

**Administrative Subdivision**

The County is divided into five (5) administrative sub-counties namely Tharaka North, Tharaka South, Chuka, Igambango'mbe and Maara. Tharaka North Sub-county is the largest covering an area of 803.4 Km<sup>2</sup>, followed by Tharaka South with 746.1 Km<sup>2</sup>; Maara is third in size with an area of 465.3Km<sup>2</sup> and Chuka fourth is with 316Km<sup>2</sup> and Igambangombe is the smallest covering an area of 308 Km<sup>2</sup>

**Population Size and Composition**

The demographic features of a population are used as statistics to determine the pattern of resource allocation and utilization. The county had a total population of 365,330 as per the 2009 population and housing census. This is projected to be 428,959 in 2018 (209,531 males and 219,427 Females), 444,540 in 2020 (217,142 Males and 227,398 Females), and 460,688 by 2022 (225,030 Males and 235,658 Females). The county's annual population growth rate is 1.8%.

**Infrastructures (Roads, Rail Network, Ports and Jetties, Airports and Airstrips)**

Infrastructure plays a major role in development as they open up the area for other activities and links the county with other counties. The county has a total road network of 1670Km of which 630Km is classified network, and 1040 is unclassified network. The county has only 61Km of bitumen road. These include the 32Km of road B6 along Thuchi-Nkubu road from Kathageri-Chuka-Chogoria to Keria, 18 Km along Ishiara-Kathwana-Chiakariga (Mate road), Five (5) Km on E789 (Chiakariga-Marimanti), 4.8Km on D474 (Chogoria-Maara), and 1.2 on D471 (Kibugua). National Government is in process of upgrading Chuka-Kareni Road and Chiakariga-Marimanti-Ura Gate road to bitumen standards

**Main Crops Produced**

The main occupation of the people in the county is agriculture, which include crop and livestock production. The main food crops include; maize, beans, cowpeas, sorghum, green grams, millet, pigeon peas, and bananas. The cash crops include tea and coffee grown mainly in Maara and Chuka/Igambang'ombe constituencies. However, farmers from Tharaka grow green grams and sorghum as a food and cash crop.

**Agricultural extension, training, research and information services**

There is no available training Institution within Tharaka Nithi. The county depends on Kaguru Agricultural Training Centre based at Nkubu, Meru County. There is need to develop one ATC within the County.

### 3.5.5 Machakos County

The County borders eight counties: Nairobi and Kiambu counties to the West; Embu to the North; Kitui to the East; Makueni to the South; Kajiado to the South West and Muranga and Kirinyaga to the North West. It lies between latitudes 0°45' South and 1°31' South and longitudes 36°45' East and 37°45' East. It covers a total area of 6208.2 km<sup>2</sup>.

#### Climatic Conditions

The County receives bimodal rainfall with short rains in October and December while the long rains from March to May. The rainfall range is between 500mm and 1250mm, which is unevenly distributed and unreliable. The altitude mainly influences rainfall distribution in the county. The high areas such as Mua, Iveti and Kangundo receive an average rainfall of 1000mm while the lowland areas receive about 500mm. Temperatures vary between 18°C and 29°C throughout the year. The dry spells mainly occur from January to March and August to October.

#### Physical and Topographic Features

The County has unique physical and topographical features. These include hills rising between 1800 – 2100m above sea level and Yatta plateau, which is elevated to about 1700m above sea level and slopes to the South East. There are isolated hills in the North West. In the plains, the soils are well-drained, shallow, dark and red clay soils. In addition, the vegetation across the entire County varies according to the altitude. The plains receive less rainfall and are characterized by open grassland with scattered trees as compared to high altitude areas, which receive high rainfall and have dense vegetation.

#### Ecological Conditions

The County has several hills namely Iveti, Lukenya, Komarock, Ithanga, Mavoloni, Kangonde, Kamuthamba, Nzii, Ekalakala, Kyanzavi, Mua, Kiima kimwe, among others. In addition, the County is home to Yatta plateau and has two main permanent rivers, that is, Tana and Athi.

#### Major Agro-ecological Zones

The table below represents the major Agro-ecological zones across the County.

Table 7: Agro-ecological zones of Machakos County

Major AEZ	Ward (s)	Precipitation amounts & adequacy	Score
<b>Lower Highlands (LH) 2-3</b>	Upper Kaewa, Kathiani Central, Mua,	Moderate (1000 - 1250mm)	3
<b>Upper midland (UM) 2-3</b>	Machakos Central, Upper Kaewa, Kathiani Central, Kangundo Central, Kangundo East,	Moderate (1000 - 1250mm)	3

	Kangundo West, Kangundo North, Tala, Matungulu East, Mutituni, Mumbuni North		
<b>Upper midland (UM) 4</b>	Kalama, Kola, Muvuti-Kiima kimwe, Lower Kaewa, Mitaboni, Kangundo East, Matungulu West, Matungulu East, Matungulu North, Kyeleni,	Low (500-750mm)	4
<b>Upper midland (UM) 5-6</b>	Athi river North, Kinanie, Muthwani, Syokimau-Mlolongo	Low (500-750mm)	4
<b>Lower Midland (LM) 3</b>	Kangundo East, Masii	Very low (<500mm)	5
<b>Lower Midland (LM) 4</b>	Kangundo East, Masii, Mbiuni, Muthetheni, Mwala-Makutani	Very low (<500mm)	5
<b>Lower midland (LM) 5</b>	Wamunyu, Kibauni, Ikombe, Katangi, Matuu, Ndalani, Kithimani, Kivaa, Ekalakala, Masinga central, Muthesya, Ndithini	Very low (<500mm)	5

### Geology and Soils

The soils in the county are well drained, deep, dark red to yellowish brown, weak structured sandy clay loam. They have moderately low organic matter content. To be able to attain potential yields the fertility status needs to be enhanced

### Population Size and Composition

The total population of the County was 1,098,584 as per the 2009 Kenya Population and Housing Census. The projected population for the year 2018, 2020 and 2022 is 1,426,211, 1,511,377 and 1,601,629 respectively.

### Infrastructure (Roads, Rail Network, Ports and Jetties, Airports and Airstrips)

The County has an averagely good road network. Major roads include the Mombasa Highway, Machakos – Kitui, Machakos – Wote, Garissa and Kangundo roads, among others. The County has successfully constructed the following roads among others, the Mwala – Kithimani road, Kathiani – Kangundo road and Athi river road. It has also upgraded most access roads within the County. There are ongoing road initiatives in the County through partnership with the national government and other development partners. These include dualing of Mombasa road (Namanga road



interchange to Makutano Kyumbi), Koma – Konza, Matuu – Ekalakala, Kenol – Kaseve, Tala – Oldonyo Sabuk roads, among others.

### **Administrative Sub-divisions**

Administratively, the County is sub-divided into eight sub-counties/constituencies, namely Mavoko, Kathiani, Machakos, Matungulu, Yatta, Masinga, Mwala, and Kangundo. The eight sub-counties are further sub-divided into twenty-two divisions

### **Land and Land Use**

#### **Land Ownership Categories/Classification**

Land is a very important factor of production in the economy. It is mostly used for agriculture, livestock keeping, ranching, industrialization, mining, forestry, government reserve, housing and urban development. The absence of a county spatial planning framework in Machakos has led to the proliferation of informal settlements, congestion, environmental degradation, unplanned urban centres, pressure on agricultural land and land use conflicts.

Land use in Machakos County urban centres is generally mixed development. There are no clear-cut zones for specific land uses in the county. This is because all the existing physical development plans except Machakos New Town Local Physical Development Plan are outdated hence not in force. There is no well-defined zoning policy in the county that guides land use development in all its urban centres sometimes leading to overlaps and mixing of incompatible land uses. There are 2 basic land use structures which are rural and urban. Rural: Agriculture (arable), Urban: residential, commercial, industrial, recreational, wildlife, rangeland.

#### **Agriculture land use**

Agriculture is the dominant land use in Machakos County with over 75% of the land in Machakos County is used for agricultural purpose. About 20% of the total land of Machakos County is cultivated. Most people live on their farms and sub-divide them for different uses

#### **Major Contributors to Environmental Degradation**

Environmental degradation is a concern in the County. Unsustainable and rampant sand harvesting has contributed negatively to the environment through reduced water retention capacity in water bodies. The quality of water has been compromised through discharges of industrial wastes into the rivers" up streams. Moreover, emissions from industries have led to air pollution related negative effects. Most of the County residents use unsustainable cooking

#### **Effects of Environmental Degradation**

Rampant and unsustainable sand harvesting has led to substantial decrease in water holding capacity of rivers. This has caused drying of rivers resulting to water scarcity for both domestic and commercial use. A good example of affected water mass is River Thwake.

Emissions from factories and industries have caused airborne related illnesses to the part of population that live in these areas. Moreover, pollution of rivers through discharge of industrial wastes has negatively affected aquatic life and quality of agricultural yields produced through irrigation farming along the rivers.

Deforestation has led to great reduction of trees which has negatively affected attraction of rain across the County.

### **Agricultural Extension, Training, Research and Information Services**

The following agricultural institutions are located within the County:

- Machakos Agricultural Training Centre
- National Youth Service Yatta School of Agriculture
- Athi River Meat Training Institute
- Machakos University
- South Eastern Kenya University

### **Research Institutions**

- Kenya Agricultural Livestock Research Organization (KALRO)
- Agricultural Mechanization Research Institute within Katumani
- Machakos University
- South Eastern Kenya University

### **Demonstration Farms**

- Machakos Veterinary Farm
- Machakos Agricultural Training Centre
- Kenya Agriculture and Livestock Research Organization, Katumani

### **3.5.6 Kitui County**

Kitui County is about 160 kilometres from Nairobi City on the eastern part of Kenya. The county is the sixth largest County in Kenya by land area covering an area of approximately 30,496.4 KM<sup>2</sup>. It shares its borders with seven other counties, namely, Machakos and Makueni counties to the west, Tana River County to the east and south-east, Taita Taveta County to the south, Embu to the north-west, and Tharaka-Nithi and Meru counties to the north. It is located between latitudes 0°10 South and 3°0 South and longitudes 37°50 East and 39°0 East.

Physical and Topographic features

The general landscape is flat and gently rolls down towards the east and northeast where altitudes are as low as 400 meters. The altitude of the Kitui County ranges between 400m and 1800m above sea level. The Yatta Plateau is in the western part of the County and stretches from the north to the south of the County between Rivers Athi and Tiva.

### 1.2.2. Ecological Conditions

The County has seven agro-ecological zones. These are: Upper-Midland 3-4; Upper-Midland 4; Lower-Midland 3; Lower-Midland 4; Lower-Midland 5; Inner Lowland 5; and Inner Lowland 6. The actual and potential agricultural development activities are as summarized in Table 1.

<b>Table 1: Agro-Ecological Zones by Sub-County Zone</b>	Sub County	Agricultural Development Potential
UM 3-4	Kitui Central, Kitui East, Mwingi West, Kitui Rural	Coffee, Maize, Sunflower, Vegetables, Sorghum, Avocado, Millet, Sweet Potatoes, Cabbage, Pawpaw
UM4	Kitui Central, Kitui Rural, Kitui West, Mwingi West, Mwingi North	Coffee, Maize, Sunflower, Vegetables, Sorghum, Avocado, Millet, Sweet Potatoes, Cabbage, Pawpaw, Bananas, Mango, Fodder and Pasture
LM3	Kitui East, Mwingi North	Cotton, Dry Land Maize Varieties, Sweet Potatoes, and Beans
LM4	Kitui Central, Kitui Rural, Kitui West, Kitui East, Kitui South, Mwingi Central, Mwingi West, Mwingi North	Sorghum, Millet, Dry Maize Varieties, Green Grams, Ground Nuts, Cow Peas, Sunflower, Vegetables, Dolichos
LM5	Kitui East, Kitui South, Kitui Rural, Kitui Central, Kitui West, Mwingi Central, Mwingi North	Livestock, Millet, Sorghum, Fodder and Pasture
IL5	Kitui East, Mwingi North, Mwingi Central	Livestock, Millet, Sorghum
IL 6	Kitui South, Kitui East, Mwingi Central, Mwingi North	Livestock, Millet, Sorghum

### Administrative and Political Units

Administrative Subdivision (sub-counties, wards, villages)

The County is divided into eight (8) sub-counties namely; Kitui Central, Kitui West, Kitui East, Kitui South, Kitui Rural, Mwingi North, Mwingi Central and Mwingi West. It is further sub-divided into forty (40) wards. There are 247 County villages established through the Kitui County Villages Act, 2015.

### **Population size and composition**

The County's population was 1,012,236 in 2009, according to the population and household census report of 2009. Kitui County population is estimated at 1,123,401 and is projected to reach 1,176,650 in 2022

### **Infrastructure Development**

#### **1.7.1. Roads and Rail Network**

The County has one Class A road passing through the County, the A3 Thika-Garissa road. The Kibwezi-Kitui-Mwingi Road is being upgraded to be completed by 2020. There are other roads proposed in the Road Sub-Sector Investment Programme (RISP) 2010-2024 including: D478-Kola to A3-Nguni; B6-Kitui to A3-Ngooni; D507-Nuu to A3-Nguni; D507-Voo to B7-Ikutha; B7-Chuluni to D507-Mwitika; and E731-Miambani to D509-Mikuyuni. The County has Class E earth road network covering about 1,172.20 Kms. Upgrading of major roads to all-weather status and open up more feeder roads in the County will enhance connectivity and open the region for businesses and economic opportunities.

### **Crop, Livestock, Fish Production and Value addition**

#### ***Main crops produced***

The economy of the County is dependent on agriculture, which contributes to rural employment, food production and rural incomes. The level of food self-sufficiency in the County is 51%, however approximately 10 percent of the entire population is absolutely food insecure. The sector plays a major role by contributing about 87.3% of income earned by the rural population. The main food crops grown in the County include cereals such as maize, sorghum, and millets; pulses such as green grams (Ndengu), cowpeas and pigeon peas; root crops such as cassava, sweet potatoes and arrow roots; industrial crops such as cotton, sisal and sunflower, and horticultural crops represented mainly by fruits such as mangoes, pawpaw, and water melons as well as vegetables such as tomatoes, kales, onions and bullet chilies

#### ***3.5.7 Makueni County***

Makueni County is one of the forty-seven counties in Kenya. It is situated in the South Eastern part of the country and borders the following counties: Machakos to the North, Kitui to the East, Taita Taveta to the South and Kajiado to the West. Makueni lies between Latitude 1° 35' and 3° 00' South and Longitude 37°10' and 38° 30' east and covers an area of 8,008.7 Km<sup>2</sup>.

**Physical and Topographic Features**

The county lies in the arid and semi-arid zones of the eastern region of the country. The major physical features in Makueni County include the volcanic Chyulu hills which lie along the southwest border of the county in Kibwezi West Constituency, Mbooni Hills in Mbooni constituency and Kilungu Hills in Kaiti constituency which rise to 1,900m above sea level. The county terrain is generally low-lying from 600m above sea level in Tsavo at the southern end of the county. .

**Hydrology**

The main river in the county is Athi River, which is perennial and fed by tributaries such as Kambu, Kiboko, Kaiti, Thwake and Mtito Andei, which drain from various parts of the county. A few other streams flow from the Mbooni and Kilungu Hills but their flow becomes irregular as they move to the low-lying areas. These rivers provide a high potential for both large and small-scale irrigation. Tsavo National park which lies in the southern part of the county, in Kibwezi West Constituency is considered as one of the world's biodiversity strongholds. It is home to diverse wildlife species which include the famous 'big five' consisting of lion, black rhino, cape, elephant and leopard. The park also has a great variety of bird life such as the black Kite, crowned crane, lovebird and the sacred Ibis among others.

**Ecological Conditions**

The county is largely arid and semi arid and usually prone to frequent droughts. The lower side which is very dry receives little rainfall ranging from 300mm to 400mm. The depressed rains in the lower part of the county hardly sustain the major staple food of maize and beans. Unfortunately, the traditional crops which are drought tolerant have largely been abandoned. This means livestock rearing remains the common viable economic activity being undertaken by the local people in the lower region. The condition has negatively affected agriculture which is the main economic activity in the county

**Climatic Conditions**

The county experiences two rainy seasons, the long rains occurring in March /April while the short rains occur in November/December. The hilly parts of Mbooni and Kilungu receive 800-1200mm of rainfall per year. High temperatures of 35.8 °C are experienced in the low-lying areas causing high evaporation which worsens the dry conditions. Climate variations and extreme differences in temperatures can be explained by change in altitude. The areas to the North such as Kilungu and Mbooni hills are usually cool with temperatures ranging from 20.2° C to 24.6° C, while the low-lying areas of the South such as Kitise are usually hot. Generally, the county experiences high temperatures during the day and low temperatures at night. During the dry periods between May and October the lower parts of the county experience severe heat. The Northern part of the county is hilly with medium rainfall ranging from 800mm to 1200mm and has high potential for food crop production. This part of the County , covering mainly in Kilungu and Kaiti has few natural and planted forests the area is therefore suitable for horticulture and dairy farming. Over time, the county has experienced climate change and variability which includes insufficient rain and prolonged dry spells among others. Human activities such as farming on hill tops, charcoal burning,

and sand harvesting have contributed to this scenario. As a result there has been crop failure affecting the food security and thus economic activities. Water scarcity has also become worse due to this condition. Increase in population puts a lot of pressure on land and other resources. To mitigate the effects of water scarcity, the community has resulted into construction of sand dams which are capable of retaining water. Soil erosion control measures are also being undertaken.

### **Soils**

The soils in the centre are well drained, deep, dark red to dark reddish brown, weak structured clay. They have moderately low organic matter content. To be able to attain potential yields the fertility status needs to be enhanced.

### **Population size and composition**

The 2012 projected population in the county stands at 922,183 consisting of 449,036 males and 473,147 females. This is an increase from 884,253 persons as per the 2009 by Kenya National Population and Housing Census. The annual population growth rate stands at 1.4 per cent while the male-female sex ratio stands at 100:105. Table 2 shows population by age cohorts in 2009 and projections for the years 2012, 2015 and 2017.

### **Administrative Structures**

The county is divided into six sub-counties which are also the parliamentary constituencies namely Makueni, Mbooni, Kibwezi East, Kibwezi West, Kaiti and Kilome. The six sub-counties are further subdivided into 30 electoral wards each of which is further subdivided into 60 sub wards. The projected population for 2018 based on the 2009 census is 1,002,979 where 488,378 are male and 514,601 female. The youth (18- 35 years) account for almost 24 percent of the total population hence the need to plan for the current youthful population and the foreseen population growth which will push demand for social services and food higher. The population density in the county is 125 persons per Km<sup>2</sup>.

## **3.6 North Eastern region**

### **3.6.1 Tana River County**

Tana River County is located in the coastal region of Kenya. The county borders Kitui County to the West, Garissa County to the North East, Isiolo County to the North, Lamu County to the South East and Kilifi County and Indian Ocean to the South. The county straddles between latitudes 000'53" and 200'41" South and longitudes 380 30' and 40015' East and has a total area of 38,862.20 Km<sup>2</sup>. The county has a coastal strip of only 76 Km.

Physiographic and Natural Conditions

### **Physical and Topographic Features**

The major physical features in Tana River County is an undulating plain that is interrupted in a few places by low hills at Bilibil (around Madogo) and Bura administrative sub-units which are also the highest points in the county. The land in Tana River generally slopes south eastwards with an altitude that ranges between 0m and 200m above sea level.

The most striking topographical feature is the river Tana that traverses the county from the Aberdares in the North to the Indian Ocean in the South covering a stretch of approximately 500km. Besides the river Tana, there are several seasonal rivers in the county popularly known as *lagas*, which flow in a west-east direction from Kitui and Makueni Counties draining into river Tana and eventually into the Indian Ocean. The river beds support livestock as well as wildlife during the dry season since they have high ability to retain water. River beds are most appropriate sites for shallow wells, sub-surface dams as well as earth pans.

### **Ecological Conditions**

The county is divided into four agro- ecological zones namely: CL 3 Coconut – Cassava zone (non ASAL), CL4 Cashew nuts- Cassava zones where the main economic activity is peasantry mixed farming; CL5 Lowland Livestock zone and CL6 Lowland Ranching zones where the locals are involved in pastoral activities. The soils range from sandy, dark clay and sandy loam to alluvial deposits. The soils are deep around the riverine environments but highly susceptible to erosion by water and wind. Soils in the hinterlands are shallow and have undergone seasons of trampling by livestock, thus are easily eroded during rainy seasons.

The vegetation ranges from scrubland to thorny thickets within the riverine area. Shrubs and annual grasses dominate most parts of the region. However, there are enclaves of trees and perennial grasses dominating wetter parts. An invasive tree species called *Prosopis Juliflora*, commonly known in the area as ‘*Mathenge*’ (named after the person who introduced it) has spread rapidly in the area and is threatening to replace most of the indigenous vegetation. It was introduced for fuel-wood production in the Bura Pilot Irrigation Scheme. It grows fast and chokes other vegetation, watering points and the canals, and is colonizing most of the areas that are not cropped, including the riparian environments.

### **Climatic Conditions**

The region has a hot and dry climate within ecological zones ranging from III (in the very high grounds) to VII (in the plains or lowlands). Average annual temperatures are about 30°C with the highest being 41°C around January-March and the lowest being 20.6°C around June-July. Rainfall is low, bimodal, erratic and conventional in nature. The total annual rainfall ranges between 280 mm and 900 mm with long rains occurring in April and May, short rains in October and November with November being the wettest month. The Inter Tropical Conventional Zone (ITCZ), which influences the wind and non-seasonal air pattern for the river Tana, determines the amount of rainfall along the river line. The dry climate in the hinterland can only support nomadic pastoralism.



### **3.7 Coastal Region**

#### **3.7.1 Lamu County**

Covering an area of approximately 6,607 km<sup>2</sup>, Lamu County is located on the North coast of Kenya and is one of the six counties in the coastal region of Kenya. It borders Tana River and Garissa counties to the southwest and north respectively. Republic of Somalia is to the northeast and the Indian Ocean to the south. It lies between latitudes 1° 40' and 2° 30' South and longitude 40° 15' and 40° 38' East. The county is divided from the rest of the Country by an extended and dry zone - the Taru desert.

#### **Physical and Topographic features**

Lamu County is generally flat and lies between altitude zero and 50m above sea level with the exception of the coastal sand dunes and the Mundane sand hills which hardly exceed 100 m above sea level. The flat topography makes the county prone to flooding during the rainy seasons and periods of high tides. The flood prone areas include areas around Lake Kenyatta (Mkungunya) in Bahari Ward, along Tana River delta especially around Moa and Chalaluma areas in Witu, archipelago islands such as Pate and Manda and areas along the coastal line. Most disturbing is that, some areas of the County's mainland such as Mokowe, are below the sea level as a result of the areas being a limestone karst terrain (NEMA, 2015). The highest areas of Lamu County are around Samburu Sand Hills (GoK, 1985) and the Boni-Lungi Forest ecosystem.

The main topographic features found in the county include: the coastal plains, island plains, Dodori River plain, the Indian Ocean and the sand dunes. The coastal plain, though not extending to the coastline, creates the best agricultural land in the county. The island plain is found in the coastal, northern and western parts of the county which have good potential for agricultural development. The Dodori River plain which is in the Dodori National Reserve is home to many wildlife species. The Indian Ocean provides a wealthy marine ecosystem which supports livelihoods of the county mainly through fishing and tourism activities. The most extensive terrain in Lamu County is the Inland Plain which occupies the northern and

#### **Hydrology and Drainage**

There are four major catchment areas each with unique characteristics. They are: Dodori, Coastal zone, Duldul, the Lamu Bay drainage and Tana River catchments. The county has no permanent river but only few seasonal streams which flow from the west towards the south eastern part of the county, with none reaching the sea. The only permanent open water site in the county is Lake Kenyatta in Mpeketoni which has been known to dry during exceptionally dry years. The county also has several swamp areas occasioned by rain water with the main ones located in Dodori, BeleBele in Hindi, Ziwa la Magarini, and Chomo Ndogo - Chomo Kuu along the Hindi-Bargoni road, Luimshi and Kenza on Nairobi Ranch and Kitumbini and Ziwa la Gorjji in Witu.



**Ecological conditions**

The different agro-ecological zones in the county are highly influenced by the rainfall variability patterns experience throughout the County and somehow define the natural potential of Lamu County. As such the county can be sub divided into two livelihoods zones with varying economic diversities which are distinct in terms of ecology, infrastructural network and population distribution. The zones are; the rich agricultural and livestock zones in the mainland (mainly settlement schemes) and the fishing and marine zones (Islands).

The difference in physiographic, climatic and other natural conditions therefore categorizes the county into four agro-ecological zones namely Coastal lowland (CL) Coconut-cassava zone (CL-3), Cashew nut-cassava zone (CL-4), Livestock-millet zone (CL-5) and Lowland ranching zone (CL-6). The areas under CL-3 and CL-4 are sustainable for agricultural activities whereas those under CL-5 and CL-6 are suitable for livestock keeping.

**Climatic conditions**

The Climate of Lamu County is difficult to describe accurately because there are very few local recording stations. However, based on the Köppen-Geiger climate classification, Lamu County can be said to be between the Tropical Monsoon and Arid Steppe Hot climate. The rainfall pattern in Lamu County is bimodal and is greatly influenced by the Monsoon winds with the long rains falling between late March and early June with May being the wettest month. Light showers fall in July and decreasing from August. The short rains come in November and December decreasing rapidly to a minimum in January and February. January to March are usually dry months.

The degree of reliability of the short rains decreases from South to North. The amount of rainfall in the long rains decreases from a strip of about 10km wide from the coastline into the main land at a rate of about 100mm per kilometre. The short rains increase from the coastline for the first 10km and then decreases again. The highest average rainfall above 1000mm occurs about 5-20 km inland. It is however interrupted by the Mkunumbi Bay. Generally, rains in the County are likely to be heavy every 3 or 4 years and relatively light in the intervening periods. The highest rainfall is recorded around Lake Kenyatta settlement scheme, Hindi, immediate area surrounding Witu, and the western side of Lamu Island. The total rainfall recorded range is between 100 mm-1100 mm with . The rest of the County receives 600 mm - 700 mm with some recording less than 500 mm and these zones are suitable for development of ranches.

Temperature is usually high ranging from 230 C to 300 C. The mean annual minimum and maximum temperatures range between 240 C to 340 C. Celsius respectively. The hottest months are December and April while the coolest months are May and July. The mean relative humidity in the County is 75%. The total amount of evapo-transpiration is 2,230m per annum, with the highest values occurring in March and September and the lowest in May. The high relative humidity levels in Lamu discourage certain development land use aspects

Administrative Units

Lamu county is composed of has two constituencies comprising the Lamu East and Lamu West. The county is also made of seven divisions, 23 locations and 39 sub locations

#### Population size and composition

Table 4 provides the county population data based on the 2009 Kenya Population and Housing Census where there were a total of 101,539 persons comprising 53,045 males (52%) and 48,494 females (48%). In 2018, it is estimated that the population has increased to a total of 137,053 persons comprising 71,348 (52%) males and 65,705 (48%) females. Given the inter-census population growth rate of 3.3%, it is projected to increase to 155,031 by the year 2022 comprising 80,599 (52%) males and 74,432 (48%) females

#### Infrastructure and Access

Lamu County has notably three major options of transport comprising Water; Road; and Air. These options connect the County both externally and internally. Rail connection is not established within the County despite there being a need of a rail connection. The LAPSSET project is anticipated to offer this opportunity and bridge this gap of rail connection to the County once its implementation takes course. From the foregoing statement, it is also notable that there is need to connect Lamu County with the existing rail in Mombasa port. This is in a bid to promote inter-County trading but also to realize the economic gains of product export as Lamu County has a lot to offer the world. There are several jetties but the most important ones are the customs (KPA) jetties on Lamu Island and the Mokowe jetty on the mainland. The two are the busiest registering the highest number of boats carrying both passengers and goods. The Manda Island jetty (shown below) connects Lamu Island with Manda Airport.

#### Crops Production

A wide range of crops that include maize, cowpeas, cassava, coconut, cashew nut, bixa, cotton, simsim, citrus, and tomatoes among others are grown in the county under rain-fed system. Crops' farming produce about 314,000 tons of both food and cash crops annually from 69,025 ha. The county is Kenya's largest producer of cotton, simsim and bixa, producing approximately 40% of cotton, 50% of simsim and 40% of bixa grown in the country, Kenya. This has significant implications on income generation, food security and poverty reduction efforts in the county. Crop production in the county for the last 5 years has remained rain-fed. About 80% of crops are planted during long rains and the remaining 20% during short rains. Short rains are not reliable for crops production. The drought experienced in the county in 2014 and 2016 and 2017 had impact on both food and cash crop production

#### Agricultural Extension, Training, Research and Information Services

Provision of extension service in the county is mainly by the government. The public extension service aims at enhancing adoption of new farming technologies to improve crop production and incomes. However, the effectiveness of extension services has declined due to inadequate research-extension-farmer linkages, lack of demand-driven research, low staff: farmer ratio and low

budgetary allocation to support extension service delivery to farmers to understand and apply the acquired knowledge. Private sector, Non-Governmental Organizations (NGOs) and civil society players have not effectively complemented public sector extension in the field. The few who are in the county may lack professionalism and also disseminate conflicting extension messages to our farming community.

The existing agricultural institutions have not been fully utilized by farming community and stakeholders in the county to acquire knowledge to improve production and income. Agricultural research infrastructure in the county mainly deals with on-farm trials for technology testing and adoption. An overriding challenge for both public and private sector extension provision is how to mobilize sufficient resources to provide the required services and formulate a strategy for increasing private sector participation.

#### **Sustainable Land Use Practices**

The county continues to experience accelerated loss of forest cover, drying of watering points and increased soil erosion. At the farm level, farmers are faced with the problem of land degradation impacting negatively on crop production mainly due to reduction of soil fertility, increased soil compaction and reduced water infiltration. Some farming practices such as shift cultivation and “slash and burn” practiced mostly in Lamu East and the indiscriminate bush clearing (“*Witemere*”) in Lamu West exacerbate degradation of the land

### **3.7.2 Kilifi County**

Kilifi County is one of the six counties in the Coast region of Kenya. The County lies between latitude 2°20' and 4°00' south, and between longitude 39°05' and 40°14' East. It borders Kwale County to the South West, Taita Taveta County to the West and Tana River County to the North, Mombasa County to the South and Indian Ocean to the East. The county covers an area of 12,370.8km<sup>2</sup>

### **3.7.3 Kwale County**

Kwale County is one of the six counties in the coastal region of Kenya. It borders Taita Taveta County to the North West, Kilifi County to the North and North East, Mombasa County and Indian Ocean to the East and South East and the United Republic of Tanzania to the South West. The County is located in the Southern tip of Kenya, lying between Latitudes 3°05' to 4°75' South and Longitudes 38°52' to 39°51' East. Kwale County covers an area of about 8,270.2 Square Kilometres, of which 62 is water surface. The area excludes the 200 miles' coastal strip known as the Exclusive Economic Zones (EEZ).

#### **Climatic Conditions**

The County has a tropical type of climate influenced by the monsoon seasons. The average temperature is about 23°C with maximum temperature of 25°C being experienced in March during the intermonsoon period and minimum temperature of 21°C experienced in July a month after the start of the southwest monsoon (also known as Kusi). Rainfall is bi-modal with short rains (Mvua ya

Vuli) being experienced from October to December, while the long rains (Mvua ya Masika) are experienced from March/April to July. There is a strong east to west gradient of decreasing precipitation with eastern (coastal) parts of the County receiving greater than 1000 mm of precipitation per year, while a majority of the County central to west around 500-750 mm. Some areas along the western side of the County receive less than 500 mm of precipitation per year. As such, heat stress, dry spells, and drought are hazards that strongly contribute to agricultural risks in the County, especially in the central and western parts of the County. However, flooding due to intense rains has also occurred historically and as such is a risk to the County, especially in the central to eastern parts (including the coast) of the County.

### **Physical and Topographical Feature**

The coastal setting and the geology control the geomorphology of the County. The evolution of the physical environment has also been influenced by climate, wave and tidal regime, sedimentation and river discharge. Geologically, the County is underlain by the Karoo Sediments also called Duruma Sandstones consisting of the Taru Formation, the Maji-ya-Chumvi Formation, the Mariakani Formation and the Mazeras Formation which cover the middle strip of the county to the foot of Shimba Hills. The County comprises of the following main topographic features which are closely related to the geological characteristics of the area:

**The Coastal Plain:** The Coastal plan is sometimes referred as the “coral rag”. It is a narrow strip of land, three to 10 kilometres wide, with a distance of approximately 255 kilometres from Likoni to Vanga. It lies 30 meters above sea level and extends 10 kilometres inland. This strip of land consists of corals, sand and alluvial deposits.

**The Foot Plateau:** Behind the coastal plain is the foot plateau. It lies at an altitude of between 60 and 135 meters above sea level on a flat plain surface with high potential permeable sand hills and loamy soils. This is the sugar cane zone of the region.

**The Coastal Range/Uplands:** Commonly known as Shimba Hills, the area rises steeply from the foot plateau to an altitude between 150 metres and 462 metres above sea level. This topographical zone is made up of many sandstone hills. The hills include Shimba Hills (420 m), Tsimba (350 m), Mrima (323 m) and Dzombo (462 m). This is an area of medium to high agricultural potential.

**The Nyika Plateau (Hinterland):** This zone stands at an altitude of about 180 to 300 meters above sea level on the western boundary of the region. The zone is underlain by a basement rock system with exception of reddish sand soils. Occupying over a half of the region, it is semi-arid with the exception of occasional patches of reddish sand soils and is, therefore, generally poor. The main activity in the area is livestock rearing.

**Drainage and Water Resources**

Generally, the County is well drained by seven major rivers and numerous minor streams. Of the seven rivers (7), three (3) are permanent which drain into the Indian Ocean.

**Administrative and Political Units**

The county is divided into four sub-counties namely; Kinango, Matuga, Msambweni and Lunga-Lunga. The sub counties are further divided into wards as shown in Fig. 3. Table 2 below summarizes the distribution of wards as per sub-county.

**Population Size and Composition**

The County population projections for 2018 through 2022 based on the 2009 Kenya Population and Housing Census by age cohort and gender is shown in Table 3. In 2017, the County population was estimated at 820,199 persons, 397,841 of which were males and 422,358 were females. The population is projected to rise to 909,929 in 2018 and by 2022, the population is projected to total 1,914,796 with 930,960 being males and 983,836 being females.

**Crop, Livestock, Fish Production and Value Addition**

Agriculture is one of the main economic activities carried out in Kwale County with 85% of farmers practicing subsistence farming. The agricultural sector plays a crucial role in guaranteeing food security, poverty reduction and employment creation in the County. In spite of the importance of agriculture, food insecurity is still a challenge in the county. Most of the farmers in the county practice mixed farming.

**Agricultural Training and Extension Services**

The County has one Agricultural Training Centre, which is situated in Mkongani ward in Matuga Sub County. The institution is a hub for disseminating modern agricultural technologies. The County Government also has an Agricultural Mechanization Services centre in Msambweni Sub County which offers extension and mechanization services.

## CHAPTER FOUR

### 4.0 LEGISLATION, POLICY AND INSTITUTIONAL FRAMEWORK

#### 4.1 Introduction

The ESIA/EA Regulations require that relevant environmental guidelines and standards which include Kenya government policies and strategies, national legislation, multi-lateral environmental agreements and the institutional arrangements to be reviewed during an Environmental and social assessment process. These are aimed at providing important safeguards for the protection and conservation of fragile environments, vulnerable communities and enhancing the implementation of the EMPs. This section therefore provides a review of the sets of laws, international agreements and institutions relevant to the proposed Bt-Cotton commercialization.

#### 4.2 Policy framework

##### *4.2.1 National environment policy*

The National Environment Policy was approved by the Ministry of Environment, Water and Natural Resources in 2013. The policy's overall objective is to provide better quality of life in Kenya for the present and future generations through sustainable management and use of freshwater resources and wetlands. It provides for the use of environmental-friendly development strategy that integrates and promotes cohesion of development and environmental policies and enhances transfer of environmentally sound technologies. The policy also stipulates that:

- Environmental impacts of developments may have effects on flora and fauna, cause social and psychological disruption and vegetation clearance among others.
- Developments ensure environmental quality and health; and the need to ensure a clean and health environment for all.

##### *4.2.2 National Land Policy, 2009*

Provides guidelines for sustainable land use and management practices

##### *4.2.3 National Wildlife Conservation and Management Policy, 2017*

The policy provides a framework for conserving diversity of species, habitats and ecosystems for the benefit of the citizens of Kenya and the global community.

##### *4.2.4 National Forest Policy, 2014*

Ensure sustainable development, management, utilization and conservation of forest resources and equitable sharing of accrued benefits for the present and future generations of the people of Kenya

#### ***4.2.5 National Climate Change Framework Policy***

The policy aims at enhancing adaptive capacity and resilience to climate change, and promoting low carbon development for the sustainable development in Kenya.

### **4.3 Legal framework**

#### ***4.3.1 The constitution of Kenya, 2010***

The Constitution of Kenya 2010 is the supreme law of Kenya so that all laws, actions by individuals or the state that contravenes the constitution are null and void. Chapter 4 on the Bill of Rights confers to every person the right to a clean, healthy environment. This incorporates the right to have the environment protected for the benefit of the present and future generations. Chapter 5 deals with the land and environment with part two providing the obligations of a developer with regards to environmental protection.

##### **Relevance to the proposed project**

The proponent and the farmers must ensure that:

- ✓ All the activities of the project do not infringe on the right of the people of clean and health environment

#### ***4.3.2 Environmental Management and Coordination Act, EMCA (1999)-amended in 2015***

The Act provides the legal framework for environmental management and administration. It aims at improving the legal and administrative co-ordination of the diverse sectoral initiatives in the field of environment so as to enhance the national capacity for effective environmental management.

Section 58 of the Act requires that developments likely to have adverse effects on the environment to be subjected to an ESIA and the assessment report submitted to NEMA for consideration and subsequent decision making.

Major developments in biotechnology such as the introduction and testing of genetically modified organisms are also to undergo ESIA. Section 58 (1-2) provides a platform for the Environmental Agency to waive any requirements for an ESIA especially a case where a lead agency, NBA (for this case), has already conducted an Environmental Risk Assessment and where the environmental Agency may have already contributed to the process.

##### **Relevance**

This ESIA is prepared in compliance to this provision

#### ***4.3.3 Sessional Paper No. 6 (1999)***

The key policy objectives of Sessional Paper No. 6 of 1999 include:

- Ensuring that all development projects at the inception stage and programs, as well as policies, consider environmental conditions;

- Ensuring that an ESIA report is prepared for any undertaking or development project before implementation; and
- Coming up with effluent treatment standards that will conform to acceptable health guidelines.

It is important to note that issues of waste water management and human settlements are given prominence and, therefore, the policy recommends re-use and recycling of residues (i.e. waste water), use of low waste generation technologies and increasing public awareness on the benefits of a clean environment. It also recognizes the role of stakeholders in all these initiatives within their localities.

#### ***4.3.4 Environmental Impact Assessment and Audit Regulations 2003 (Legal Notice No.101) and (Amendment) 2009***

##### ***Regulation 24–ESIA license***

Environmental Impact License shall be issued after the authority approves the report under Regulations 23.

##### ***Regulation 24 – Annual Environmental Audit***

Annual environmental auditing after presentation of an ESIA study report shall be undertaken by the licensee to ensure implementation of environmental management plan is audited on regular basis, an audit report submitted to NEMA annually, and ensuring that the criteria to audit is based on environmental management plan developed during the ESIA process or after the initial audit.

##### ***Regulation 40 - Monitoring changes after project implementation***

Monitoring by NEMA and Lead Agencies shall be done to establish any possible changes in the environment and their possible impacts, immediate and long term effects of its operations, identify and determine parameters and measurable indicators, and assess changes that occurred after implementation. The aim of this section is to provide the Proponent and Contractors with quick reference to most critical legal and policy provisions to enable proper planning and impact assessment during project planning and implementation. The Environmental Management and Coordination Act (EMCA)-amendment 2015) is the main framework environmental law in Kenya. The Act guarantees every Kenyan the right to a clean and healthy environment. However, there are other sectoral laws that guide management of various environmental components. It is worth noting that if a sectoral law conflicts with EMCA, EMCA prevails and the other law is null and void to the extent of that inconsistency.



#### ***4.3.5 Environmental Management and Coordination (Air Quality) Regulations, 2014***

The objective is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources, such as mobile sources and stationary sources. It also covers any other air pollution source as may be determined by the Minister in consultation with the Authority. Emission limits for various areas and facilities have been set.

#### ***4.3.6 National Environmental Action Plan (NEAP) 1994***

According to this plan, it is recognized that development projects, i.e. industrial, economic and social development programs that do not take care of environmental considerations in their operations are not sustainable. Under the NEAP process, ESIA was introduced, and among the key targets recognized were industrialists, the business community, and local authorities, among others.

#### ***4.3.7 Biosafety Act 2009***

Biosafety Act, 2009 Part III Section 18 (1) states that a person shall not conduct any contained use activity involving genetically modified organisms without the written approval of the National Biosafety Authority. Section 19 (1) of the Act states that no person shall introduce into the environment a genetically modified organism without the written approval of the Authority. Section 20 (1) emphasizes that no person is allowed to import into Kenya a genetically modified organism without written approval of the Authority.

This law is an Act of Parliament to regulate activities in genetically modified organisms, to establish the National Biosafety Authority, and for connected purposes. This Act may be cited as the Biosafety Act, 2009 and came into operation 1 July, 2011.

The objects of this Act are;

- a) To facilitate responsible research into, and minimize the risks that may be posed by, genetically modified organisms;
- b) To ensure an adequate level of protection for the safe transfer, handling and use of genetically modified organisms that may have an adverse effect on the health of the people and the environment; and
- c) To establish a transparent, science-based and predictable process for reviewing and making decisions on the transfer, handling and use of genetically modified organisms and related activities.

The Biosafety Act provides for the conduct of Environmental Risk Assessment and Food Safety Assessment for products of modern biotechnology. It also requires applicants and licensees to adhere to monitoring and stewardship provisions and to coordinate with regulatory agencies listed in the First schedule of the Act during research and environmental release. Subsequently the applicants and the regulatory agencies should submit monitoring reports periodically to the NBA.

#### **4.3.8 Public Health Act (Cap 242)**

The Public Health Act is the principle instrument for ensuring the health and safety of the people. Its core function is the prevention of disease, treatment and care of the sick (curative services) and control of nuisance. The Act therefore makes regulations and lays standards for a healthy living environment. Part XI Section 129 of the Act places the responsibility of protecting water supplies on the local authorities. The Ministry of Health is in charge of administration of the Act, with the Director of Medical Services as the Principal Officer. However, where a municipality is capable of discharging responsibilities under the Act, such a municipality is designated as a local health authority. In such a situation, the relevant powers under the Act are delegated to the municipality, but the Director of Medical Services may take over if the Authority is in default. During the execution of the proposed project, this Act is relevant in various ways. The Director of Public Health is a member of the National Biosafety Board due to the significant role of the sector in modern biotechnology.

##### **Section 115**

During construction, nuisance is prohibited especially for all conditions liable to be injurious or dangerous to health.

##### **Section 118**

It outlines nuisance liable to be dealt with, i.e. accumulation or deposit of refuse, offal, manure or any other material that is offensive or injurious or dangerous to health, and an accumulation of stone, timber or other machine likely to harbour rodents and other vermin.

##### **Section 126 Rule 62 -Drainage and Latrine Rules**

It is a statutory requirement that drainage, latrines, septic and conservancy tanks and any other pre-treatment methods of sewerage effluents seek written permission or/and approval from the local authority, and be built in conformity to provisions of sub-rules (a) to (e) of this section.

##### **Section 127 -Buildings for Foodstuffs**

In case a proposed project indicates the premises shall have a staff canteen, the proponent must consider using materials recommended by a medical officer of health, and complemented by sub-sections (1) to (3) in these areas.

##### **Sections 136–143 -Breeding Places of Mosquitoes**

The civil and building contractors will ensure that during construction, breeding places of mosquitoes and nuisance yards are kept free from bottles, whole or broken. The project area shall not be overgrown by grass. The wells and any pits should be covered. Gutters may be perforated. Larva should be destroyed to eradicate mosquitoes completely, as mere presence of mosquito larvae is an offence.

**Section 163-Powers of Entry and Inspection**

It should be noted that a medical officer, health inspector or a police officer above the role of an inspector shall enforce compliance, and offences are punishable by law.

**4.3.9 Waste Management Regulations, 2006 (Legal Notice No.121)**

These are meant to streamline the handling, transportation and disposal of various types of waste. The regulations emphasize on waste minimization, cleaner production and segregation of waste at the source. Under the Regulations, NEMA licenses transporters, incinerators, landfills, composers, recyclers and transfer stations. Licensing employs a risk based approach by concentrating on facilities considered to pose a high risk to the environment.

**4.3.10 The Wildlife (Conservation and Management) Act**

The Wildlife Act was first adopted in 1976 with a series of eight subsequent amendments and revisions the latest being 1990. This reflects on the ideal arrangements for the protection, conservation and management of Wildlife in Kenya. The functions of the Kenya Wildlife Service include formulate policies regarding the conservation, management and utilization of all types of fauna (not being domestic animals) and Flora. Due to the importance of wildlife as Kenya's natural heritage and an integral component of biological diversity, the Kenya Wildlife Service is listed as a regulatory agency on matters of Biotechnology and Biosafety.

**4.3.11 Water Act, 2016**

The Water Act, 2016 provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; provides for the regulation and management of water supply and sewerage services; and repeals the Water Act (Cap 372) and certain provisions of the Local Government Act. In Kenya, water is regarded as a national resource and is therefore owned by the state for and on behalf of the people (Section 3). Thus, the Cabinet Secretary in-charge of water is empowered under the Act to control, plan and regulate the use of water. Further, the Cabinet Secretary is vested with the duty to promote investigations, conservation and proper use of water.

The Act has set up subsidiary bodies with power to operate and regulate functions assigned to them by the Act. Such bodies include water service Boards, National Water Conservation and Pipeline Corporation, and Water Resources Authority, among others. The Act further gives conditions relating to construction of works in its Second Schedule.

Part II section 18 of this Act provides for national monitoring and information system on water resources. Following on this, sub-section 3 allows the Water Resource Authority to demand from any person or institution, specified information, documents, samples or materials on water

resources. Under these rules, specific records may be required to be kept by the entrepreneur in farming operations and the information thereof furnished to the authority.

Section 6 (a) of the same Act states that no person shall discharge any effluent from sewage treatment works, industry or other point sources without a valid effluent discharge licence issued in accordance with the provisions of the Act. Part (b) of the same section restricts the abstraction of ground water or carrying out any activity near lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of the water, without an environmental impact assessment licence issued in accordance with the provisions of the Act.

Part IV section 20 of the Act states that where the Cabinet Secretary, in exercise of his powers conferred under section 42 (3) has issued an order for the management of a natural water body, no person shall abstract water from such body for irrigation purposes unless such water meets the standard set out in the ninth schedule to these regulations. Part IV section 21 stresses the need for the owners or operators of existing irrigation schemes to create a buffer zone of at least fifty meters in the width between the irrigation scheme and the natural water body into which such irrigation scheme discharges its waters. As such, the Client shall observe these conditions, which are in line with the spirit of ESIA.

#### ***4.3.12 Water Quality Regulations, 2006, (Legal Notice No.121)***

Water Quality Regulations apply to water used for domestic, industrial, agricultural and recreational purposes; water used for fisheries and wildlife purposes; and water used for any other purposes. Different standards apply to different uses. These regulations provide for the protection of lakes, rivers, streams springs, wells and other sources. The overriding objective of the regulations is to protect human health and the environment. Proper enforcement of the regulations can lead to marked reduction in water-borne diseases. The regulations provide guidelines and standards for the discharge of poisons, toxins, radioactive and other pollutants into the aquatic environment. Standards have also been set for discharge of effluent into the sewer and aquatic environment. The National Environment Management Authority regulates discharge into the aquatic environment.

The regulations provide for the creation of a buffer zone for irrigation schemes of at least fifty (50) metres in width between the irrigation scheme and the natural water body. The Ninth Schedule of the Regulations stipulates standards for irrigation water. Persons (real or legal) discharging effluent into the environment are required to submit quarterly discharge monitoring records to NEMA.

#### ***4.3.13 Seeds and plant varieties (plant breeder's rights) (scheme) regulations, 2001***

These Regulations, cited as the Seeds and Plant Varieties (Plant Breeder's Rights) (oil and fibre crops scheme) Regulations, 2001 establish a scheme called the Oil and Fibre Crops Scheme, which applies to all plant varieties of oil and fibre crops which conform with the characteristics of

cultivated plant varieties of the species *Gossypium sp.*

According to these regulations, the period for which plant breeder's rights shall be exercisable in respect of the plant varieties referred to in regulation 3 is fifteen years. In relation to the plant varieties referred to in regulation 3, the class of plant varieties prescribed for the purposes of section 21 of the Act shall consist of all plant varieties of cotton.

For the purposes of section 23(4) of the Act, a compulsory licence granted by the authorized officer in respect of a plant variety specified in regulation 3 shall not have effect for a period of two years after the date of grant of rights in that variety.

A person who infringes the plant breeder's rights in the registered name of a variety of cotton covered by the Oil and Fibre Scheme commits an offence and is liable to a fine of three thousand shillings or to imprisonment for a term of three months or to both.

#### **4.4 Relevant Multilateral Environmental Agreements (MEAs)**

##### **4.4.1 Introduction**

A multilateral environmental agreement (MEA) is a legally binding agreement between three or more states relating to the environment. They are predominantly produced by the United Nations. It is called a bilateral environmental agreement if the agreement is between two nation states.

##### **4.4.2 Cartagena Protocol on Biosafety**

The **Cartagena Protocol on Biosafety** is an international agreement on biosafety, as a supplement to the Convention on Biological Diversity. The Biosafety Protocol seeks to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology.

The Biosafety Protocol makes clear that products from new technologies must be based on the precautionary approach and allow developing nations to balance public health against economic benefits. The Protocol for example, lets countries exercise stricter regulatory oversight for genetically modified organisms if they feel there is not enough scientific evidence that the modified product is safe or let countries proceed with use of such products where there is considerable experience in use of the product.

The principle implies that there is a social responsibility to protect the public from exposure to harm, when scientific investigation has found a plausible risk. These protections can be relaxed only if further scientific findings emerge that provide sound evidence that no harm will result.

#### ***4.4.3 Convention on Biological Diversity (CBD-1992)***

Article 14 of the CBD (Impact Assessment and Minimizing Adverse Impacts) calls on member states to take measures to prevent the degradation of systems that support biodiversity such as seas and oceans. Specifically the Convention calls upon contracting Parties to act as follows:

- (i) Introduce appropriate procedures requiring Environmental Impact Assessment and audits of its proposed or on-going projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures;
- (ii) Introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account;
- (iii) Promote, on the basis of reciprocity, notification, exchange of information and consultation on activities under their jurisdiction or control which are likely to significantly affect adversely the biological diversity of other States or areas beyond the limits of national jurisdiction, by encouraging the conclusion of bilateral, regional or multilateral arrangements, as appropriate;
- (iv) In the case of imminent or grave danger or damage, originating under its jurisdiction or control, to biological diversity within the area under jurisdiction of other States or in areas beyond the limits of national jurisdiction, notify immediately the potentially affected States of such danger or damage, as well as initiate action to prevent or minimize such danger or damage; and
- (v) Promote national arrangements for emergency responses to activities or events, whether caused naturally or otherwise, which present a grave and imminent danger to biological diversity and encourage international cooperation to supplement such national efforts and, where appropriate and agreed by the States or regional economic integration organizations concerned, to establish joint contingency plans.

#### ***4.4.4 The International Union for the Protection of New Varieties of Plants (UPOV)***

Established in 1961, the International Union for the Protection of New Varieties of Plants (UPOV) is an intergovernmental organization based in Geneva, Switzerland. The mission of UPOV is to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society. The UPOV Convention provides the basis for members to encourage plant breeding by granting breeders of new plant varieties an intellectual property right: the breeder's right. The Convention is domesticated in Kenya in the Seeds and Plant Varieties (Plant Breeder's Rights), Regulations, 1994 (2002) within Chapter 326 - The Seeds and Plant Varieties Act (1991).

## **4.5. Institutional Framework**

### ***4.5.1 Introduction***

Environmental management is highly interdisciplinary and transcends legal and institutional differentiation. As such, all the laws referred to in the preceding section and the institutional roles are relevant institutions vis-a-vis the project. Indeed, there have been over 20 institutions and departments, dealing with environmental issues in Kenya. Some of the key institutions include the National Environment Management Authority (NEMA), the Forestry Department, the Kenya Wildlife Service (KWS), Ministry of Environment and Natural Resources, Ministry of agriculture, Livestock and fisheries, Ministry of Water and Irrigation, the Kenya Forestry Research Institute (KEFRI), the National Museums of Kenya (NMK), the Kenya Agricultural and Livestock Research Organization (KALRO), the Kenya Marine and Fisheries Research Institute (KEMFRI), Regional Development Authorities and Public Universities among other organizations. Further various lead agencies have been designated under the Environmental Management and Coordination Act of 1999. There have also been local and international NGOs involved in environmental issues in the country. The main international agencies involved in environmental issues in Kenya include Environmental Liaison Centre International (ELCI), International Union for the Conservation of Nature and Natural Resources (IUCN), World Wildlife Fund for Nature (WWF), United Nations Environment Programme (UNEP). The local NGOs include East African Wildlife Society (EAWLS), the Green Belt Movement, Forest Action Network (FAN), African Water Network (AWN), Wildlife Clubs of Kenya (WCK) and the Environment Trust of Kenya (ETK) among other Non-Governmental Organizations and Community Based Organizations. Of the above institutions, NEMA plays the regulatory role in the management of environment in the country.

Under EMCA, several institutions have been established, but there are two key ones i.e. the National Environment Council (NEC) and the National Environmental Management Authority (NEMA).

In addition, matters of genetic engineering and therefore modern biotechnology are dealt with under the lead agency called the National Biosafety Authority. In the Biosafety Act, there are 8 regulatory agencies listed in the First Schedule that should work in harmony to regulate and monitor the technology as outlined below;

### ***4.5.2 The National Environmental Council (NEC)***

NEC is chaired by the Minister for Environment and Natural Resources with membership from all relevant ministries as well as a broad range of other interests. It functions to formulate national policies, goals, and objectives and the determination of policies and priorities for environmental protection. The Council also promotes co-operation among all the players engaged in environmental protection programmes.



#### ***4.5.3 The National Environmental Management Authority (NEMA)***

NEMA is a corporate body responsible for the administration of the EMCA 2015 (amendment). The Director General appointed by the President heads NEMA. The NEMA functions include the co-ordination of various environmental management activities, initiation of legislative proposals and submission of such proposals to the Attorney General, research, investigations and surveys in the field of environment. NEMA also undertake to enhance environmental education and awareness on the need of sound environmental management. In addition, NEMA will advise the Government on regional and international agreements to which Kenya should be a party and issue of an annual report on the state of environment in Kenya. NEMA is charged with the responsibility of the execution of Environmental Impact Assessment (ESIA) and Environmental Audits as well as provisions of other Legal Notices emanating from EMCA, 1999.

NEMA has initiated various Regulations so as to fully operationalize the EMCA 1999 and it plays a critical role in the processing and issuing of ESIA Licenses in Kenya.

#### ***4.5.4 The Kenya Plant Health Inspectorate Service (KEPHIS)***

KEPHIS is a State Corporation under the Ministry of Agriculture, Livestock and Fisheries that is mandated to regulate and facilitate all plant materials coming into the country or produced locally. They are responsible for implementing phytosanitary and quarantine measures. They are also mandated to implement the national policy on the introduction and use of GM plant species in liaison with the National Biosafety Authority. KEPHIS is also responsible for regulating imports of GM seeds. KEPHIS is the lead Agency in the conduct of National Performance Trials to ensure the country is compliant with the UPOV convention and the Seeds and Plant Varieties Act.

#### ***4.5.5 Department of Veterinary Services (DVS)***

The Department of Veterinary Services performs regulatory services with respect to livestock. The Service is mandated to regulate matters of GMO (animals) in liaison with the National Biosafety Authority.

#### ***4.5.6 The Kenya Bureau of Standards (KEBS)***

KEBS is the institution charged with the responsibility for developing standards, including food safety standards. The institution has developed standards pertaining to various products. KEBS is responsible for regulating GMO foods in liaison with the department of Public Health and the National Biosafety Authority. KEBS has developed several standards regarding handling of foods derived from modern biotechnology. Kenya's standards for biotechnology are based on international standards, in particular those created by the Codex Alimentarius Commission (CAC) of which Kenya is a member.



#### ***4.5.7 The National Commission for Science Technology and Innovation***

The National Commission for Science Technology and Innovation is a body corporate established under the Science, Technology and Innovation Act, No. 28 of 2013, succeeding the National Council for Science and Technology which was in operation since 1977. The Commission is mandated to regulate and assure quality in the science, technology and innovation sector and advise the government on matters related thereto. The Commission is managed by a Board appointed by the Cabinet Secretary responsible for matters of science and technology and is a member of the National Biosafety Authority Board.

#### ***4.5.8 National Biosafety Authority***

The National Biosafety Authority (NBA) was established by the Biosafety Act No. 2 of 2009 to exercise general supervision and control over the transfer, handling and use of genetically modified organisms (GMOs).

The objective and purpose for which the Authority was established is to regulate research and commercial activities involving GMOs with a view to ensuring safety of human and animal health and provision of an adequate level of protection of the environment. To achieve this objective, the Authority has established a transparent science-based process to guide decision making on applications for approval of research and commercial activities involving GMOs.

The National Biosafety Authority implements the Cartagena Protocol on Biosafety, a protocol under the Convention on Biological Diversity, which Kenya has also signed and ratified, in order to address safety for the environment and human health in relation to modern biotechnology. The National Biosafety Authority is under the Ministry of Higher Education Science & Technology and has the following duties & responsibilities:

- Creating a National Biosafety Clearing House (BCH) where information on all approvals is posted.
- Data sharing with the International Biosafety Clearing House located in Montreal Canada.
- NBA is Kenya's Focal Point for Cartagena Protocol on Biosafety which Kenya has signed and ratified.
- Co-ordinating Biotechnology & Biosafety issues in the country to all the relevant stakeholders.
- Collaborating with relevant Government Departments and University faculties, to develop strategies in the fields of Biotechnology & Biochemistry.
- Conducting Environmental Risk Assessment for all GMO and products of modern biotechnology.

To do this, the NBA board is comprised of representatives of the following institutions.

1. National Environment Management Authority - NEMA
2. Department of Public Health.
3. Department of Veterinary Services.

4. Kenya Bureau of Standards.
5. Kenya Plant Health Inspectorate Services.
6. National Council for Science and Technology (now National commission for Science Technology and innovation)
7. Ministry of Agriculture of Agriculture
8. Ministry of Education Science and Technology
9. Ministry of Finance

The NBA is also required to consult and work with;

1. Kenya Industrial Property Institute.
2. Kenya Wildlife Service.
3. Pest Control Products Board.

The Environmental Risk Assessment (ERA) conducted by the NBA together with NEMA and the other 8 institutions takes 150 days. In the case of the Bt-Cotton application, it took 257 days due to frequent clock stoppage or administrative actions.

#### ***4.5.9 Agriculture and Food Authority (AFA)***

The Authority is the successor of former regulatory institutions in the sector that were merged into Directorates under the Authority, with the commencement of Crops Act, 2013 on 1st August 2014, including Coffee Board of Kenya, Kenya Sugar Board, Tea Board of Kenya, Coconut Development Authority, Cotton Development Authority, Sisal Board of Kenya, Pyrethrum Board of Kenya, Horticultural Crops Development Authority.

According to AFFA Act, 2013, crops Act 2013 and the Kenyan Constitution (2010), the Authority has the following mandate:

- a) To administer the Crops Act in accordance with the provisions of these Acts;
- b) To promote best practices in, and regulate, the production, processing, marketing, grading, storage, collection, transportation and warehousing of agricultural and aquatic products excluding livestock products as may be provided for under the Crops Act;
- c) To collect and collate data, maintain a database on agricultural and aquatic products excluding livestock products, documents and monitor agriculture through registration of players as provided for in the Crops Act;
- d) To be responsible for determining the research priorities in agriculture and aquaculture and to advise generally on research thereof;
- e) To advise the national government and the county governments on agricultural and aquatic levies for purposes of planning, enhancing harmony and equity in the sector.

- f) To carry out such other functions as may be assigned to it by this Act, the Crops Act and any written law while respecting the roles of the two levels of the Government

AFFA collaborates with the following institutions and government departments; Kenya Agricultural and Livestock Research Organization (KALRO), Kenya Industrial Research and Development Institute (KIRDI), Kenya Plant Health Inspectorate Service (KEPHIS), Kenya Bureau of Standards (KEBS), National Irrigation Board (NIB), Kenya Industrial Property Institute (KIPI), Kenya Revenue Authority (KRA), Kenya Industrial Estates (KIE), Ministry of Industrialization (MOI), Ministry of Water and Irrigation (MOW&I), Ministry of Finance (MOF), MoAL&F, Ministry of Industry, Trade and Cooperatives (MITC), Co-operatives (Societies & Unions), Cotton Growers, Ginners Associations, spinners, weavers, Development partners and Non- Governmental Organizations (NGOs).

#### ***4.5.10 National Taskforce for Commercialization of Bt-Cotton***

A 12 member inter-ministerial Taskforce was appointed by the Cabinet Secretary, Ministry of Agriculture, Livestock and Fisheries to oversee the commercialization of Bt-Cotton in Kenya.

*Table 8: Taskforce Membership*

No.	Institution
1.	Ministry of Agriculture, Livestock and Fisheries
2.	Pest Control Products Board (PCPB)
3.	Rivatex East Africa Limited
4.	National Irrigation Board (NIB)
5.	Ministry of Industry, Trade and Cooperatives (MITC)
6.	National Biosafety Authority (NBA)
7.	Kenya Agricultural and Livestock Research Organization (KALRO)
8.	Agriculture and Food Authority (AFA)
9.	Kenya Plant Health and Inspectorate Services (KEPHIS)
10.	National Environmental Management Authority (NEMA)

#### ***4.5.11 National Irrigation Board***

The National Irrigation Board (NIB) was established and incorporated in 1966 as a state corporation through the Irrigation Act, Cap 347 of the Laws of Kenya. The objective of this Act is “to provide for the development, control and improvement of irrigation schemes, for purposes incidental thereto

and connected therewith.” Currently, NIB manages seven (7) national irrigation schemes and stations with four operational research stations.

#### ***4.5.12 Kenya Agricultural and Livestock Research Organization***

KALRO is a corporate body created under the Kenya Agricultural and Livestock Research Act of 2013 to establish suitable legal and institutional framework for coordination of agricultural research in Kenya with the following goals:

- Promote, streamline, co-ordinate and regulate research in crops, livestock, genetic resources and biotechnology in Kenya.
- Expedite equitable access to research information, resources and technology and promote the application of research findings and technology in the field of agriculture.

While striving to fulfil the stated goals, KALRO is obliged to:

- (a) Formulate policy and make policy recommendations to the Cabinet Secretary on agricultural research.
- (b) Prioritize areas for, and co-ordinate, agricultural research in Kenya in line with the national policy on agriculture.
- (c) Determine and advise the Government on the resource requirements for agricultural research in Kenya both at the national and county level.
- (d) Regulate, monitor and ensure that all agricultural research undertaken by research institutes and other institutions or persons undertaking agricultural research is consistent with the national priorities specified in the relevant policy documents.
- (e) Establish and exercise control over the research institutes, committees and research centres established pursuant to this Act.
- (f) Formulate or approve medium and long term research plans, strategies and budgets of research institutes, committees and organizations established pursuant to this Act.
- (g) Provide grants to research institutes and persons desirous of carrying out research and training programs which are consistent with the national research priorities and plans of the Organization.
- (h) Support and promote the training and capacity building in relation to agricultural research.
- (i) Promote the dissemination and application of research findings in the field of agriculture and the establishment of a Science Park.
- (j) Liaise with and ensure the co-ordination of institutions, agencies and persons involved in agricultural research.
- (k) Establish platforms for the purposes sharing of research information, advancing research and

transfer of technology and dissemination of information relating to advancements made in agricultural research.

- (l) Ensure continuance of performance improvement in the field of agricultural research.
- (m) Perform such other functions as may be conferred on it by this Act or any other written law.

#### ***4.5.13 BAYER East Africa Limited***

Bayer East Africa Ltd. is a subsidiary of Bayer AG, a global innovation enterprise with core competencies in the Life Science fields of agriculture and health care. Bayer AG has a base and registration in Germany with the global headquarters in Leverkusen. The company deals agriculture (Crop Science) and health care (Pharmaceuticals and Consumer Health).

#### ***4.5.14 MAHYCO***

Mahyco Private Limited is focused on research and development, production, processing, and marketing of seeds. Founded in 1964, MAHYCO is the pioneer of hybrid and open pollinated seeds. The company will be importing the BT seeds and distributing to farmers.

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## **CHAPTER FIVE**

### **5.0 PUBLIC PARTICIPATION**

#### **5.1 Introduction**

The role of public consultation and involvement in ESIA process is to assure the quality, comprehensiveness and effectiveness of the assessment and ensure that the public views are adequately taken into consideration in decision making process.

During the preparation of this ESMP, public consultations were carried out with the Ministry of Agriculture, the private sector, and respective beneficiary/farming communities. Meetings were held with members of the Central Projects Coordinating Unit, the National Environmental Agency Officials, technical officers in the field and various local leadership including, farmers cooperatives societies and unions in various cotton growing regions that was attended by several stakeholders.

The purpose of consultations was:

- ✓ To obtain the main concerns and perceptions of the population and their representatives regarding the proposed project;
- ✓ To reduce conflict through the early identification of contentious issues
- ✓ to generate a good understanding of the project by all stakeholders;
- ✓ to enhance ownership of the project by local leadership, the community and local farmers;
- ✓ To obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures;
- ✓ to understand people's and agency expectations about the project;
- ✓ to understand and characterize potential environmental, social and economic impacts of the project;
- ✓ to enhance local benefits that may accrue from the Bt-Cotton commercialization project; and
- ✓ to enable stakeholders involved in the project to provide views, hence participating in or refining project rollout. In addition, site-specific investigations were also conducted to gain insight to the likely impacts of the Bt-Cotton commercialization on the environment.

#### **5.2 Methodology**

Due to the complex nature of the socio-ecological environment, a combination of tools was used to conduct the environmental and social impact assessment. Both participatory methods and analytical tools were applied to ensure the inclusion of the opinions of all stakeholders. Data collection involved consultations meetings held with Farmers and affected & interested community members, societies, unions and the general public; discussions and interviews with key informants provided relevant information representing all the socio-economic classes from the various divisions.

1. Resource person/ key informants who involved interviews with the proponent, Ministry of Agriculture, County government officials, local administration, cotton farmers and societies.
2. Administration of simple questionnaires to the general public. Filled questionnaires are annexed to this report. Virtual meetings were also held due to the COVID-19 pandemic.

It is the responsibility of the project proponent and the ministry of Agriculture to adequately ensure effective distribution of the information to the affected persons to mitigate against unnecessary delays in decision making and project implementation

### **5.2.1 Key Informant Interviews:**

These were interviews with members of the project proponent, who were identified to be knowledgeable enough about the area. They included local representatives such as the project proponent, local practitioners, institutions in the neighborhood, .

*The list of Key informants is attached at the annex of this report.*

### **5.3 Views from public consultation and participation**

The following were some of the views of the people consulted

- ✓ Creation of more business opportunities; direct and indirect job opportunities
- ✓ Development of the area
- ✓ Some members indicated that the revitalization of cotton industry through introduction of Bt-Cotton will create employment and open up other development activities e.g. cotton auxiliary industries.
- ✓ Cotton farmers noted that introduction of Bt-Cotton will help in reduction in the pesticides spray regimes in cotton fields thus reduction in production cost, less exposure to health and environmental risks from pesticides and other agro-chemicals used in the farms
- ✓ The communities noted that Bt-Cotton commercialization project would Improve Infrastructure due to expansion of the rural access roads and ginneries which will ultimately lead to opening up to the markets and improving transportation of cotton and other farm produce.
- ✓ Will provide beneficial use of the farms that cannot support other crop due to climate and soil
- ✓ Bt-Cotton commercialization would attract youths into farming thus reducing the level of crime in the area
- ✓ Some communities expressed fears of the uncertainties since the crop may bring with it negative impacts such as safe edible oil and animal feeds can be derived from it, possibility of cross pollination between Bt-Cotton and other cotton varieties resulting in less yields, cotton of low value etc
- ✓ This was noted to have a possible negative impact on other species of herbivorous insects

and mites which are considered pests on cotton crops. Outbreaks of these and other pests may pose a challenge to management of pest. It was suggested that extensive research should be done to ensure that safety of the environment, human health and animals.

- ✓ Some farmers pointed out that there were emergence of new aphids (never observed before)
- ✓ Family wrangles- it was reported that in most areas where residents get lump sum payments, families experience than without such payments. This was attributed to husbands mismanaging the monies, abandoning homes etc. it was suggested that couples to own joint accounts and be trained on financial management.
- ✓ Increase in clearance of vegetation for expanding land for Bt-Cotton cultivation was also anticipated. Members of the community suggested that farmers needed to be sensitized on good farm management and the importance of forests conservation.
- ✓ It was also noted that Bt-Cotton commercialization will generate a considerable amount of waste, from used fertilizer and pesticides containers and agrochemicals. Elevated concentration of the chemicals may find their way to water bodies leading to pollution and eventually degrading aquatic ecosystems around the farms. Some of the ways recommended for management of the wastes included: the solid wastes be collected by the agrochemical suppliers, collect the wastes in leak-proof containers
- ✓ Food insecurity due in case farmers abandon food crops for cotton farming. To ensure sustainability, the government should produce the Bt-Cotton locally instead of importing
- ✓ Exploitation of farmers by charging exorbitant prices.
- ✓ The government in conjunction with the farmers to establish cottage in to ensure maximum benefit by the locals i.e from the by-products of the cotton processing eg seeds
- ✓ Farmers to be sensitized on risks associated with the use of chemical containers, use of PPEs

These and others have been incorporated in the report.

*A great majority of the respondents indicated that the project should go).*



## **CHAPTER SIX**

### **6.0 ANALYSIS OF PROJECT ALTERNATIVES**

#### **6.1 Introduction**

This section examines and analyses feasible alternatives to the proposed project, technology scale and waste management. The benefits of the proposed project will be considered against any potential environmental cost. The general principle involved in identifying alternative option(s) to a proposed development is to ensure that the option chosen would result in optimal social, environmental and capital benefits not only for the farmers and proponent but also for the environment and other stakeholders in the sector. These take into account the cost and benefit criteria: environmental impacts, social acceptability, economics (including productivity of land-use) and design feasibility.

#### **6.2 Relocation Option**

The relocation option to different sites is an option totally unavailable to the project. This option would mean getting pieces of land with the favourable conditions for cotton growing; which the proponent has (the project sites), other available sites may not have the required conditions. Moreover, the alternative sites, if found, would require sensitization of the locals since the areas may not be cotton growing areas. The locals may not accept the change or it may take too long for them to embrace cotton growing. Besides, the said project is already underway in terms of seeking approvals in various government departments. The project planning before the stage of implementation would call for cost; already encountered in the proposed development i.e. whatever has been done and paid for to date would be loss to the proponent. This project will be located in areas where cotton farming is already practiced hence the project will be consistent with the activities in the surrounding areas and is not likely to result in increased negative environmental impacts as opposed to implementing the project in a virgin land.

#### **6.3 The 'proposed project' alternative**

This option means that this E.I.A project report will be presented to the National Environmental Management Authority for approval (after approval by KEPHIS and National Biosafety Authority- this is already done). This will help in evaluating and examining the effects of the project on the environment. After the evaluation and under the proposed development alternative and Environmental Impact Assessment License would be issued. This way, NEMA would approve for the implementation of the project subject to compliance with all environmental and safety measures and legislations. The alternative consists of the proponent's final proposal with the inclusion of the NEMA guidelines and regulations and procedures as stipulated in the Environmental Management and Co-ordination (Amendment) Act (EMCA) of 2015; this aims at reducing environmental impacts to minimum extent practicable.

With this alternative, there will be increased cotton production spurring other economic development activities in the proposed areas, decreased chemical spraying regimes in the farms thus less production cost and negative impact to the environment among other benefits. Further, the introduction of the cotton variety has been approved by KALRO, KEPHIS and National Biosafety Authority allowing for growing in the farms.

#### **6.4 The 'no action' Alternative**

The 'No Project' Alternative option in respect to the proposed project implies that the project achievements be reversed and no Bt-Cotton growing goes on. This option however involves several losses not only to the project proponent but to the public and the government as well, unemployment and the government will lose revenue it could have collected, community incurring additional costs in having to transport the bodies of the dead from far away. Under the No action Alternative, the locals will continue growing the cotton varieties that are affected by bollworm, thus the farmers will continue having reduced cotton production and the anticipated social and economic benefits will not be realized, there will be continued environmental degradation from the use of pesticides (that would be reduced if the proposed project is implemented).

The No action Alternative is the least favourable to the proponent, farmers, investors and the government. This option is a suitable alternative in case the action will result in an extreme environmental impact.

#### **6.5 Alternative bollworm control methods**

This involves spraying with pesticides as is currently done. This means that the amount of pollution in the as a result of the chemicals will continue, there will be increased cost of purchasing and spraying the chemicals, the non-target organisms will continue to die as the pesticides currently used kill non target organisms.

#### **6.6 Alternative land uses (using the proposed site for other projects other than Bt-Cotton production)**

The option allows the farmers to explore other alternative land-uses for the site other than the proposed project. This option may require application for change or extension of use to allow for the alternative development. The alternative land use may not be compatible with the proposed sites since the proposed sites are already cotton growing zones, the climatic conditions may not be conducive for other crop farming, it would be difficult to convince the farmers to shift to another crop/ venture or this may take long. The returns from other crops that can grow in these areas (cassava, sorghum, millet, maize, rice and horticultural crops-in Bura, Pekerra) are low compared to the anticipated income from Bt-Cotton.

In conclusion, this Environmental Assessment report addressed both environmental and socio-

economic issues concerned with Bt-Cotton commercialization. Environmental issues have been given due consideration during all the project cycle. Considering the environmental and social-economic concerns, the project sites were determined to be more suitable due to availability of suitable land and other physical factors, the land use system, accessibility, potential use, compatibility to the environment and acceptability of the project by the local communities and farmers.

## **6.7 Waste Management Alternatives**

### **6.7.1 Solid waste management alternatives**

Solid waste will be generated from wrappings of seeds, used pesticide containers and used fertilizer packages.

#### *6.7.1.1 Burying*

This technique involves collecting the wastes, dumping them in a dug ditch and then covering with soil. This may lead to soil and water pollution as the packages may contain traces of chemicals.

#### *6.7.1.2 Burning*

Burning is an easy disposal method however it can lead to serious negative environmental and health impacts. Burning of the wastes containing plastics generate dioxins and other pollutants that are cancerous, allergens, respiratory system irritants among others.

#### *6.7.1.3 Contracting the county government of the respective counties*

In this case, the wastes will be collected and disposed of by the county governments at a fee. This can be an easy and convenient. However, the farms are scattered and some of them are not accessible to the tracks. This would make collection difficult and expensive as little wastes will be generated over time.

#### *6.7.1.4 Farmers agreeing with the seed and fertilizer/chemical suppliers to collect used containers/packaging materials*

This involves the suppliers collecting the packages after the contents have been used.

An integrated solid waste management system is hereby recommended- where the suppliers/manufacturers will give priority to Reduction at Source of the materials, Recycling and Reuse of the wastes will be the second alternative in priority. The reusable and recyclables may also be sold to waste buyers. Finally, sanitary land-filling will be the last option to consider. Landfilling is however not feasible for the proposed project as it needs a lot of wastes- small quantity of wastes is expected from the sites which are widely spread. This option will demand a solid waste management awareness programme.

## CHAPTER SEVEN

### 7.0 POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

#### 7.1 Introduction

The environmental baseline information collected and the project characteristics discussed form the basis for impact identification and evaluation. Assessment of impacts depends on the nature and magnitude of the activities being undertaken as well as the type of environmental control measures that are envisaged as part of the project proposal. The impacts that are expected to arise from the proposed project could either be termed as positive or negative, direct or indirect, short-term or long-term, temporary or permanent depending on their nature, area of coverage and their duration in the environment. Impacts have been identified and discussed in all phases of the proposed project cycle; pre-commercialization of Bt-Cotton, commercialization of Bt-Cotton, and project decommissioning.

#### 7.2 Potential adverse impacts during Bt. Commercialization phase

Specific impacts during the proposed project activities are related to vegetation, herbivores in the ecosystem. There are wide ranges of potential environmental impact expected to be caused by Bt-Cotton commercialization.

##### 7.2.1 *Impacts on other species in the ecosystem*

###### 7.2.1.1 *Assessment*

There are wide ranges of potential environmental impact expected to be caused by Bt-Cotton farming. Those impacts are Exposure in the agroecosystem, Exposure via the food chain, Exposure on other plants after gene flow, Potential effects of transgenic cotton on non-targeted herbivores

##### **Probable exposure in the agroecosystem**

Bt-Cotton material and transgene products and metabolites can enter the soil as plant residues during the growing season and after harvest, as sloughed roots and root exudates. Bt-Cotton proteins adsorbed to clays in soil can persist for considerable amounts of time in soil aggregates, retaining their insecticidal activity. Pollen and anthers can also land on other plants in the crop field or along the margins, leading to exposure of species on these plants.

##### **Probable Exposure on other plants after gene flow**

Transgenic trait of Bt-Cotton may be expressed in other plants (crops or weeds) that have received the transgene via gene flow; organisms in habitats other than the Bt-Cotton crop may be exposed to transgenic plant material and the protein.

##### **Probable exposure via the food chain and potential effects of transgenic cotton on non-targeted herbivores**

Other species in the ecosystem may be exposed to the transgene product and/or its metabolites by feeding on the Bt-Cotton plant (bitrophic exposure: leaves, stem, roots, buds and bracts, flower tissues, fruit, seed, pollen and root exudates), or through another organism, such as a herbivore or detritivore prey or host (tritrophic or multitrophic exposure via feeding on prey or hosts). Exposure can also occur via herbivore excretion products, such as honeydew from aphids, thrips or leafhoppers.

A considerable number of species of herbivorous insects and mites are considered pests on cotton crops. Outbreaks of these and other pests as a result of the introduction of Bt-Cotton could be a challenge to integrated pest management systems. The effects of Bt-Cotton on non-target herbivores could be positive; fewer pests or more non-pest herbivores or negative; more pests or fewer non-pest herbivores, and reduced or more selective insecticide use on Bt-Cotton could allow greater biological control.

#### *7.2.1.2 Mitigation*

- Assess potential direct and indirect exposure pathways to transgenic product or metabolites in the Bt-Cotton plant for the high priority species
- Formulate research hypotheses based on risk hypotheses and design experiments for risk assessment based on the exposure pathways and the adverse effects pathways, to confirm or refute the risk hypothesis
- Formulate improved risk hypotheses and design laboratory, greenhouse and field experiments to test these hypotheses
- A general ecological monitoring plan should be developed to be used to assess the unanticipated or long term, incremental environmental impacts of the Bt-Cotton
- Post commercialization validation testing should be done to assess the adequacy of the pre-commercialization environmental testing on Bt-Cotton
- Regulatory bodies should maintain an environment in which the decision making process can be adjusted based on the knowledge gained from past risk assessment and regulatory decisions and process be developed that allows for clear regulatory responses to findings from environmental monitoring
- Substantial increases in public sector investments in the following research areas
  - ✓ Improvement in pre-commercialization testing methods and the transgenic methods that will minimize risks
  - ✓ Research to improve the environmental risks characterization process; and research on social, economic, and value-based issues affecting environmental impacts of the Bt-Cotton
- Conduct regular inspections of the Bt-Cotton fields to ensure compliance with safety guidelines

### **7.2.2 Potential adverse consequences of resistance**

The main potential adverse consequences of resistance are control failures, yield loss and economic hardship when the pest is otherwise difficult to control; increased use of pest management tactics, such as insecticides, that have significant adverse effects on human health and the environment, and reduced management options for growers, which can increase production costs.

#### **7.2.2.1 Mitigation**

Develop distinctive protocol to define resistance operationally, so that cases of resistance as a result of Bt-Cotton commercialization can be looked for in advance.

### **7.2.3 Impacts on vegetation, water and soil**

The impacts on vegetation and soil will be born from removal and disturbance of vegetation & forest covers to create space for cotton growing land, movement of people and machinery during planting and harvesting. These impacts are short-lived and localized and thus of no major concern. The effects of these impacts are discussed below.

#### **7.2.3.1 Loss of Vegetation and Deforestation**

The decline of forests and woodlands in most developing countries has occurred primarily as a result of converting the land for crop production (Food and Agriculture Organization [FAO], 1997). There is anticipated increase in clearing of vegetation through the process of expanding land for Bt-Cotton agriculture, construction of ginneries and other cotton peripheral infrastructure. With the projected high production of Bt-Cotton, most farmers with low farm land may also resort to clearing forest to grow Bt-Cotton. This might have adverse effect on environment.

##### **7.2.3.1.1 Mitigation**

- Sensitize farmers on farm management and the importance of forests to the environment. There is need create specific zoning system by classifying land resources into categories of residential areas, forest areas and agricultural areas; divide the agricultural lands to food crops and cash crops – e.g. Bt-Cotton.
- Where possible, the clearing of vegetation, particularly of indigenous trees needs to be avoided as much as possible during construction, and the clearing needs to be carried out only where necessary. where clearing is done, land should be landscaped and reclaimed by planting more trees and other forms of vegetation

#### **7.2.3.2 Loss of Biodiversity and destruction of the natural habitat**

Parts of the land which will be used to grow Bt-Cotton are under some grasses, shrubs and forbs. The clearing of vegetation and the subsequent loss of habitat is likely to lead to loss of biodiversity especially of organisms that are prevalent in the micro-areas.

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#### **7.2.3.2.1 Mitigation**

- Avoid clearing and construction within key sensitive habitats such as wetlands, culturally protected areas, unique and special habitats
- Where possible, buffer the special, sensitive and ecologically important habitats.

#### **7.2.3.3 Soil compaction and destabilization of the geological balance**

The use of farm machineries and increased traffic both farming, harvesting and during the construction work of infrastructures in the cotton value chain is likely to lead to compaction of the soil structure which may lead to reduced soil infiltration capacities and subsequently resulting in increased run-off. The increased run-off may lead to soil erosion and subsequently gully formation. It may also affect soil-water balance and the general hydrological cycle.

#### **7.2.3.3.1 Mitigation**

- Minimize heavy machinery movements and other equipment and away from designated transportation and operational areas.
- Unnecessary vehicular and machinery movements should be avoided as much as possible.
- Reclaim and re-vegetate excavation sites once work is completed to reduce run off.

#### **7.2.3.4 Soil and water pollution**

Bt-Cotton plant residues during the growing season and after harvest, as sloughed roots and root exudates, May be retained in the soil and can persist for considerable amounts of time in soil aggregates, retaining their insecticidal activity; over use of fertilizers and the improper use and disposal of pesticides to control other pests attacking the cotton. Elevated concentration of these wastes can lead to eutrophication of water bodies which may eventually damage aquatic ecosystem, animals and human. Pollution could also come from Construction wastes such as sediments from earthworks, oils and fuels from machinery used in the farms and construction site of other cotton infrastructure.

#### **7.2.3.2 Mitigation**

- Develop protocols for monitoring changes in soil particle aggregation and water-holding capacity which are likely to be consequences of changes in the soil management practices as result of Transgenic plant material, transgene products and metabolites
- Regular monitoring of the liquid water system in cotton growing areas
- Treat waste emanating from the pesticide that is deemed potentially infectious prior to disposal by a number of different technologies that either disinfect or sterilize them
- Ensure adequate and regular checks on the equipment in use to ensure they are well maintained and in good working condition to prevent leaking oils and fuels
- Refueling should be done in safe locations where there is no likelihood of spillages

- Apply sediment control procedures to prevent sediment returning into the rivers
- Ensure usage of the right chemical types and in right quantities; appropriate application of chemicals and in the right quantities; measures should be put to minimize leaching and chemical run-off through appropriate soil and water conservation measures

### **7.3 Impacts cutting across phases**

The following impacts will adversely affect the environment in one or more phases.

#### **7.3.1 Pollution: Noise, Dust and Air quality concerns**

##### *7.3.1.1 Assessment*

The construction activities of infrastructures in the cotton value chain mostly the excavation and transportation of construction materials are likely to generate a significant amount of dust as well as emitting smoke and fumes from engines and oil spills that will lead to pollution of air, water and other environmental resources.

##### *7.3.1.2 Mitigation*

- Minimize the impacts of temporary construction noise and vibration by:
  - i. Posting notices at the construction sites informing the public of the construction activities, time and day.
  - ii. Planning the construction work to take place only during the day preferably between 0700 hours and 1800 hours when the neighbours are out at work and maintaining reasonable working hours of not more than 8 hours within any 24-hours working duration so as to reduce the number of complaints concerning noise from the workers and neighbours. In this case workers will work in shifts.
  - iii. Providing ear protective devices to workers and visitors in noisy environments to prevent high frequency noise emitted by the high frequency machines.
  - iv. Ensuring that the workers and the visitors to the site wear Ear plugs and/or earmuffs
- Minimize noise at the sites and in the surrounding areas by:
  - v. Sensitizing drivers and machine operators to switch off their engines while they are not in use especially when offloading and loading materials and to avoid hooting especially when passing near noise-sensitive areas such as health facilities, other educational and research institutions, courts, worship places, and residential areas among other noise-restricted areas;
  - vi. Restricting hooting of vehicles at various construction sites by conspicuously displaying warning signs and attaching penalties to the same. Placing some noisy equipment such as generators in sound-proof rooms or in enclosures to minimize ambient noise, installing silencer; and



- vii. Properly servicing and tuning construction machinery such as generators and other heavy duty equipment to reduce noise generation.
- viii. Have strict rules prohibiting unnecessary noise at the facility especially on the church/mosque going days for the local religious gathering areas near the site
- ensuring that all vehicles transporting raw materials especially soil should be covered or avoid overloading to reduce dust emissions
- the workers in dusty areas should be provided with requisite protective equipment such as dust masks and dust coats for preventive and protection purposes
- the movement and speed of the construction machineries and vehicles should be controlled and properly managed
- most noisy machinery should be fitted with proper silencers to minimize noise emissions
- sprinkle water in construction yards, on dusty roads and soil heaps; to keep down the dust produced
- Ploughing the farms when the soil moisture does not allow for generation of dust

### 7.3.2 Generation of wastes (Solid and liquid wastes)

The project will generate and dispose solid wastes during all the phases of Bt-Cotton farming and processing. The wastes include: used agrochemical containers, wrappings, runoffs contaminated with pesticides, effluent and fumes from ginneries and textile factories. The environmental consequences for generating and disposing the waste will be: *Trash and litter pollution; Smoke and fumes from burning; Degraded water quality; and Degraded air quality*. Value addition of Bt-Cotton produce will result in generation of both solid wastes and wastewater which may have negative impacts unless properly managed.

#### 7.3.2.2 Mitigation

The proponent and cotton farmers will be responsible for efficient management of solid waste generated by the construction and/or repair and maintenance of the ginneries and wastes from land preparation and farming. These include:

- Putting in place distinctive protocol for classification and segregation waste related to Bt-Cotton planting activities
- Agreement with the fertilizer and pesticides suppliers to collect the used chemical containers
- Putting in place appropriate waste management mechanisms for both solid wastes and wastewater
- Educating and sensitizing the population on being mindful of and responsible for their own environments
- Providing waste handling facilities such as waste bins for temporarily holding of wastes generated.

- Putting in place distinctive protocols for the classification and segregation of wastes in order for treatment systems to work properly and to ensure proper handling and therefore safety of workers handling those wastes;
- All workers handling wastes will be provided with appropriate PPE.
- All workers handling wastes must be trained in safe practices and in legally-mandated requirements for managing wastes to ensure safety when handling the wastes
- The leadership of cotton societies and unions should develop mechanisms to supervise the disposal of farm wastes from cotton farming activities. Farmers should also be trained and sensitized on handling farm wastes
- Putting in place an efficient waste management scheme that will ensure regular collection and disposal of the wastes to prevent the accumulation of wastes at collection areas.
- Treating liquid wastes before disposing in to the environment
- Installing double bins at every collection point for separate collection of recyclable, non-recyclable, hazardous and re-usable wastes for ease of management.
- Covering solid waste collection bins and/or enclose them in a wire mesh to prevent habitation by scavenging by straying animals.
- Managing solid wastes using appropriate methods such as biological organic matter management (decomposition), incineration, recycling, re-use and sanitary land filling.

### ***7.3.6 Transmission of HIV/AIDS and other communicable disease***

#### ***7.3.6.1 Assessment***

The prevalence of HIV/AIDS in the areas where Bt-Cotton will be planted could increase due to free-flow and high influx of people particularly during the construction and operation of ginneries. The influx of people into the project areas may result in increased infections of diseases, particularly HIV/AIDS and COVID-19. During project implementation and operation activities such trade and employment are also likely to increase hence increased interactions consequently leading to increased infections.

#### ***7.3.6.2 Mitigation***

- Comply with the government's directives for combating Covid-19
- Development of brochures and other materials that will convey information about the diseases and infections
- Regular provision of adequate prevention measures such as condoms and provision of drugs such as anti-retroviral drugs (ARVs)
- Enhancing education and sensitization of workers and the local communities on the dangers and prevalence of disease

- Regular sensitization campaigns and monitoring of the spread diseases

### ***7.3.6 Food insecurity***

This may result from abandoning food crop farming for cotton growing due to improved production and returns (from cotton), land infertility due to monocropping. This may lead to increased famine, malnutrition.

#### ***7.3.6.1 Mitigation***

- Sensitize farmers on the importance of producing their food crops
- Provision of high yielding food crops to farmers to encourage them to plant food crops
- Intercrop food crops with cash crops (when this would be viable)

### ***7.3.7 Sustainability problems of Bt-Cotton farming***

This may arise from high cost of acquiring seeds, running the ginneries beyond the reach of farmers. As a result, farmers may be discouraged and resort to other crops.

#### ***7.3.7.1 Mitigation***

- Government to produce seeds locally and provide to farmers at a subsidized cost
- Revitalizing the ginneries and textile industries to provide ready market for the produced cotton
- Make loans to farmers Bt-Cotton farmers accessible so that farmers can obtain machinery and seeds
- Make cotton prices competitive to encourage farmers

### ***7.3.8 Water pollution***

The widespread use of fertilizers and pesticides will result in increased degradation of water quality. This will render the waters unfit for human and animal use-leading to health issues, and even death. The use of fertilizers is likely to lead to eutrophication of water bodies resulting in death of aquatic organisms, hindrance to fishing, and transport among others due to growth of algae, water hyacinth and other plants in water bodies. This is especially possible in areas that border the lakes, rivers, and dams.

#### ***7.3.8.1 Mitigation measures***

- Establish a buffer zone between the farms and the water bodies. The buffer zones are to be vegetated with plants so as to absorb the nutrients before the runoffs from the farms drain into water bodies.
- Proper soil erosion measures to be put in place to prevent sedimentation
- Farms to be located at least 30m from the surface water bodies

- Sensitize the farmers to report any incident of poisoning suspected to be from water contamination
- Recommended agronomic and soil fertility maintenance measures will be applied
- Treatment of the waste from ginneries before disposal into the water bodies

### ***7.3.9 Occupational Safety and Health and community health impacts***

Due to over working due to increased acreage farmed, inhalation of chemicals during spraying, allergic reactions from inhaled suspended cotton particles, poor working posture in the ginneries, workers are likely to develop health problems such as backaches, respiratory problems, headaches among others.

#### ***7.3.9.1 Mitigation***

- Farmers to be sensitized to go for medical checkups regularly and seek medical attention immediately in case of health issue
- Workers should be trained on first aid, good working positions
- The chemicals used to be stored away from human habitation, flood prone areas, in non-corrodable containers
- Strict adherence to the instructions for handling the seeds, fertilizers and pesticides
- Danger and warning signs to be mounted on the hazardous chemicals and their storages
- Install particle arresters at the cotton handling areas eg ginneries, stores
- Comply with the Occupational Safety and Health Act, 2007
- Ensure all components extracted from cotton are subjected to thorough scrutiny before allowed for use as oil for humans, animal feed etc

### ***7.3.10 Human-wildlife conflict***

This is likely in the areas with wild animals. The animals are likely to cause destruction of crops and farms. Farmers may also encroach the animals' habitats in a bid to expand land for farming- this would lead to migration, death, stress of the wild animals.

#### ***7.3.10.1 Mitigation measures***

- Formation a joint committee between the community and KWS to manage the animals at the communities and monitor the farming activities to ensure habitats are not encroached
- Where possible, erect a barricade between the farms and the wild animals' areas without blocking the migratory routes.
- Use of human security to guard the farms against invasion by the wild animals

### ***7.3.11 Moral decadence:***

With the expected increase in income among communities, there is likelihood in change behaviour among the community members. Members may turn to alcohol and Substance abuse, prostitution, robberies- due to increased income and bad influence.

#### ***7.3.11.1 Mitigation***

- Sensitize the farmers to embrace Christian principles

- The local administration to enforce of law
- Educating farmers and the communities on effects of drug and substance abuse
- Money should be paid to bank and not cash

### ***7.3.12 Child labour and school drop outs***

There is a possibility that parents or guardians would opt to engage their children work in the farms due to the improved returns from cotton farming. Children are also likely to abandon schools for monetary gains in the farms.

#### ***7.3.12.1 Mitigation measures***

- Enforcement of the law prohibiting child labour
- Educating the farmers and the students on the benefits of education as opposed
- Work closely with teachers to ensure pupils and students stay in school

### ***7.3.13 Fire hazards at cotton storage sites and ginneries- cotton can easily catch fire***

Fire outbreaks are likely in cotton storages and ginneries.

#### ***7.3.13.2 Mitigation measures***

- Cotton storages to be sited away from fire sources
- The ginneries to be fitted with fire detection devices
- Installation of firefighting equipment that are duly serviced
- Designate and mark fire assembly points and create awareness on its importance
- Firefighting equipment such as fire extinguishers should be provided at strategic locations such as stores and construction are
- Signs such as “NO SMOKING” must be prominently displayed within the premises where cotton and other inflammables are stores
- Formulate and enforce fire action plan

### ***7.3.14 Grievances among the community members, community and other cotton stakeholders***

Conflicts may arise form disagreements among farmers on boundaries,lack of consultations/ participation, cattle belonging to a community member destroying another’s crops, between farmers and AFA among others. Conflicts may result in deaths, lack of interest in farming, insecurity

#### 7.3.14.1 Mitigation measures

- Conduct meaningful community consultations. The project proponent should continue the process of consultation and dialogue throughout the project cycle.
- Providing sufficient and timely information to communities. Many grievances arise because of misunderstandings; lack of information; or delayed, inconsistent or insufficient information. Accurate and adequate information about a project and its activities, plus an approximate implementation schedule, should be communicated to the communities, especially affected parties, regularly.
- Sharing information, reporting on project progress, providing community members with an opportunity to express their concerns, clarifying and responding to their issues, eliciting communities' views, and receiving feedback on interventions will benefit the communities and the project management.

#### 7.4.15 Malaria and other waterborne diseases

Malaria is caused by anopheles mosquitos that breed stagnated water bodies. Thus irrigated farms may have patches of stagnant waters that provide these breeding grounds. This would mean increased cases of malaria. Some snails that cause Bilhazia also reside in water bodies; this too can affect humans when they come in contact with the snails.

##### 7.4.15.1 Mitigation

- Locating the residential places away from farms to be irrigated
- Create awareness of the effects of the waterborne diseases
- Use treated mosquito nets
- Spray mosquitoes with environment friendly insecticides
- Drain the stagnant waters around dwelling places

### 7.5 Potential beneficial impacts

- Reduction in the number of pesticides sprays in cotton fields will improve on the farmers' health and reduce exposure to health and environmental risks associated with multiple sprays of poisonous agro-chemicals used in the farms.
- **Reduction in cotton production cost and improved cotton production:** Bt-Cotton is proved to provide inherent resistance to the devastating African bollworms that contribute to about 60% of the crop loss to pests, thereby reducing the dependency on the expensive agro-chemical (reduction in the quantity of the pesticide use); this is projected to boost the country's cotton production from the current low of 25,000 bales annually to 200,000 bales per year. This will meet the current country's soaring demand of cotton in the textile industry
- **Minimize cotton import and savings on the foreign exchange:** increase in local production

of cotton. Other positive impacts are will boost the manufacturing pillars of the president's "Big 4 agenda" where Kenya is seeking to establish itself as a regional leader in the textile and apparel production.

- **Employment generation:** Increased cotton production will see the revitalization of the textile and apparel industry, and other auxiliary industries like oil industry will also be boosted. This will ensure better income for families and create both direct and indirect employment in the whole value cotton value chain especially youths and women and contribute to poverty reduction especially farmers in arid and semi-arid areas.
- **Capacity Building** will enhance the knowledge base of the technical officers and local communities hence enhancing their production potentials resulting in improved cotton production
- **Improved Infrastructure** due to expansion of the rural access roads and ginnery which will ultimately lead to opening up to the markets and hastening of transportation of cotton and other farm produce.
- **Increased revenue:** The project will translate into increased revenue to both the county and the national governments in terms of tax and other charges in the cotton value chain.
- Bt-Cotton commercialization will strengthen the local cotton farmers' cooperatives and empower ginners to increase capacity and new cotton facilities.
- **Investment:** Bt-Cotton commercialization will attract other investments especially in auxiliary industries in the cotton value chain.
- **Improved living standards:** farmers and employees in the cotton value chain will earn income and use it to improve their living standards.
- **High quality cotton that would fetch high prices** for the farmers thus improved standards of living

## **CHAPTER EIGHT**

### **8.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**

The Environmental and Social Management Plan (ESMP) has been developed to assist in prioritizing the key findings of the ESIA, suggesting necessary mitigation actions and allocating responsibilities and the estimated cost of implementation.

From ESMP, a schedule for the project implementation could also be drawn that takes into consideration all issues that could develop into serious risks to environment, health and safety during all the phases of the project and operational phases.

The key aspects of the ESMP are based on:

- Environmental policy
- Nature and scale of operations,
- Pollution prevention strategies,
- Legal compliance,
- Social aspects
- Objectives and targets,
- Employees' involvement

#### **8.1 Planning**

- Identification of potential impacts and their sources,
- Setting objectives and targets,
- developing an environmental management programme

#### **8.2 Implementation and operations**

- Allocate responsibilities and cost involved,
- Undertake training and capacity building,
- Ensure communication at all levels.
- Corrective actions
- Scheduled monitoring and measurements,
- Identification of area not conforming to standards,
- Carry out prevention and corrective measures,
- Carry out environmental audits.

#### **8.3 Strategies for ESMP implementation**

The strategy in managing the impacts should be one that has least/ no impact on the environment. Not all impacts can be managed by a single strategy. Thus a hierarchy of strategies is recommended (from the more preferred to the less preferred) as follows:



- i. **Avoidance-** this involves avoiding the project activities that could lead to adverse impacts
- ii. **Prevention-** involves putting in place preventative measures to stop adverse impacts from occurring
- iii. **Minimization-** limit or reduce the degree, extent, magnitude, or duration of adverse impacts through scaling down and redesigning the elements of the project
- iv. **Mitigation** – employing measures to minimize the adverse impacts
- v. **Enhancement** -improvement of the positive/ beneficial impacts
- vi. **Impact compensation-** this involves Rehabilitation(repairing the affected areas) and restoration (restoring the affected resources to their former original/ near original status before the interference)

#### 8.4 Set up phase ESMP

This ESMP is for the seed distribution and land preparation. The activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts of the proposed project are outlined in the table below.

Table 9: ESMP for Start-up phase

Environmental Impact	Recommended Mitigation and monitoring	Responsible party	Timeframe	Cost
<b>human-wildlife conflict</b> (in areas bordering/ with wild animals)	<ul style="list-style-type: none"> <li>• use human security to keep off the wild animals</li> <li>• fence off the farms to keep off the wild animals away from the farms</li> <li>• avoid areas not earmarked for cotton growing</li> <li>• allow provisions for wildlife corridors and buffer zones</li> <li>• avoid migratory routes of the wild animals</li> </ul>	farmers and proponent	throughout the project cycle	
<b>Biodiversity loss</b> - clearance of vegetated areas,	<ul style="list-style-type: none"> <li>• Avoid areas with rare plant species</li> <li>• Clearance to be done only in areas earmarked for growing cotton</li> <li>• allow provisions for wildlife corridors and buffer zones</li> <li>• Creation of awareness among the farmers on the importance of conserving biodiversity</li> </ul>	farmers, proponent,		nil
soil erosion and storm water runoff	<ul style="list-style-type: none"> <li>• Practice Contour ploughing, construction of gabions to control soil erosion.</li> <li>• Practice conservation agriculture</li> <li>• Avoid clearing areas susceptible to soil erosion</li> <li>• A storm water management plan that minimizes impervious areas</li> <li>• Workers to avoid compacting activities in areas outside the area demarcated for the developments</li> </ul>	proponent, farmers		nil
Occupational Safety and Health- due to over working due to	<ul style="list-style-type: none"> <li>• Use appropriate PPEs</li> <li>• Sensitize workers on the negative health impacts of overworking</li> </ul>			

increased acreage farmed	<ul style="list-style-type: none"> <li></li> </ul>			
increased prevalence of HIV/AIDS- due to increased informal labourers from different backgrounds	<ul style="list-style-type: none"> <li>Promote awareness to the community and the farm workers on the risk and prevention of the disease</li> <li>Instill discipline on the farm workers</li> </ul>			
Increased water demand and consumption	<ul style="list-style-type: none"> <li>Prompt reuse and recycling of water as much as possible where necessary</li> <li>Install a discharge meter at water outlet to monitor and determine total water usage.</li> <li>Conduct regular checks, inspections and maintenance of pipes, taps and storage containers and tanks to fix leakages</li> <li>Sensitize the workers on water conservation</li> <li>Obtain water abstraction permit where necessary</li> </ul>	Proponent, WRA	Throughout construction of ginneries/ stores	Nil  5000/= for discharge meter
<b>Air pollution</b> dust generated during ploughing, fumes from machineries used, tracks delivering construction materials	<ul style="list-style-type: none"> <li>Avoid ploughing on extremely dry and windy weathers/ sprinkle water on the surfaces to be ploughed</li> <li>Sprinkle water on graded access routes when necessary to reduce dust generation by machineries</li> <li>Personal Protective equipment to be worn by people ploughing</li> <li>Proper maintenance of the machinery</li> </ul>	proponent and farmers	always during ploughing	Nil  Nil  30,000/=  Nil

### 8.5 Operation phase ESMP

This is ESMP for the operation phase that involves planting, farm maintenance (spraying, weeding), harvesting, and transportation of cotton to the ginneries.

*Table 10: EMP for the operation phase*

Environmental Impact	Recommended Mitigation and monitoring	Responsible party	Timeframe	Cost
Food insecurity- due to abandonment of food crop production	<ul style="list-style-type: none"> <li>Train and encourage farmers to do farm planning- apportioning certain portions of farms to other crops</li> <li>Educate farmers on better farming methods to increase food production</li> <li>Provision of high yielding food crop seeds</li> </ul>	Respective Farmer Cooperative Societies (RFCS) Proponent AFA,	continuous	depends on the prevailing prices of seeds
<b>Malaria and other waterborne diseases</b>	<ul style="list-style-type: none"> <li>in case of irrigation, locals will be sensitized and urged to sleep under treated mosquito nets</li> <li>periodic vector control to be done by the Ministry of Health</li> </ul>	KALRO, Farmers, Ministry of Health	continuous	to be determined
<b>human-wildlife conflict</b> (in areas bordering/ with wild animals)	<ul style="list-style-type: none"> <li>use human security to keep off the wild animals</li> <li>fence off the farms to keep off the wild animals away from the farms</li> <li>avoid areas not earmarked for cotton growing</li> <li>avoid migratory routes of the wild animals</li> <li>engage KWS to manage the wild animals</li> </ul>	KWS, Farmers, proponent RFCS	Throughout project cycle	20,000 per month for each security personnel, farm fencing : depends with the size of the farm

<b>Biodiversity loss</b> – through invasion thus outcompeting local plants,	<ul style="list-style-type: none"> <li>• A buffer zone shall be provided between the Bt-Cotton farms and other cotton farms as will be directed by concerned authorities.</li> <li>• Use certified pesticides that do not harm non-target organisms</li> <li>• Proper monitoring for early detection of invasion by Bt-Cotton</li> <li>• Immediate action to be taken to contain invasion</li> </ul>	KEPHIS, Ministry of Agriculture (AFA), NBA, NEMA	continuous	
<b>Occupational Safety and Health; community health impacts</b> Due to over working due to increased acreage farmed, inhalation of chemicals during spraying, allergic reactions from inhaled suspended cotton particles	<ul style="list-style-type: none"> <li>• Use appropriate PPEs</li> <li>• Sensitize workers on the negative health impacts of overworking</li> <li>• Farmers to be sensitized to go for medical checkups regularly and seek medical attention immediately in case of health issue</li> <li>• The chemicals used to be stored away from human habitation, flood prone areas, in non-corrodable containers</li> <li>• Strict adherence to the instructions for handling the seeds, fertilizers and pesticides</li> <li>• Danger and warning signs to be mounted on the hazardous chemicals and their storages</li> <li>• Install particle arresters at the cotton handling areas eg ginneries, stores</li> <li>• Comply with the Occupational Safety and Health Act, 2007</li> <li>• Ensure all components extracted from</li> </ul>	farmers proponent, respective farmer cooperative societies (RFCS), AFA, DOSHSS	Continuous	15,000 per season per Acre

	cotton are subjected to thorough scrutiny before allowed for use as edible oil, animal feed etc			
<b>Increased demand of energy-</b> during construction of ginneries and stores; and running the machines	<ul style="list-style-type: none"> <li>• Monitor energy use during construction and set target for reduction of energy use.</li> <li>• Install energy saving fluorescent tubes at all lighting points instead of bulbs which consume higher electric energy</li> <li>• Ensure electrical equipment, appliances and lights are switched off when not being used</li> <li>• Proper maintenance of the machineries used at the ginneries</li> </ul>	ginneries' management , proponent, RFCS	throughout operations and construction	50,000 per year
<b>Noise and vibration-</b> during construction of ginneries and stores	<ul style="list-style-type: none"> <li>• Monitor noise levels to ensure that levels do not exceed 75dB(A)</li> <li>• Comply with noise and excessive vibration pollution control regulations of 2009.</li> <li>• provide PPE (ear protection) to persons who must operate within or visit the identified high noise areas;</li> <li>• Inform neighbors of noise generating construction activities to minimize disruption to local residents</li> <li>• No discretionary use of noisy machinery;</li> <li>• Maintenance of machinery</li> </ul>	Proponent NEMA	throughout operations	PPEs: 50,000 per month
<b>Emergence of new pests</b>	<ul style="list-style-type: none"> <li>• Regular monitoring to detect the pests early</li> <li>• Employ integrated pest control at early stage before pests get out of hand</li> </ul>	KEPHIS, NEMA, Ministry of Agriculture, RFCS	continuous	to be determined

Increased water demand and consumption	<ul style="list-style-type: none"> <li>• Prompt reuse and recycling of water as much as possible where necessary</li> <li>• Install a discharge meter at water outlet to monitor and determine total water usage.</li> <li>• Conduct regular checks, inspections and maintenance of pipes, taps and storage containers and tanks to fix leakages</li> <li>• Sensitize the workers on water conservation</li> <li>• Obtain water abstraction permit where necessary</li> </ul>	Proponent, WRA	Throughout construction of ginneries/ stores and irrigation	Nil  5000/= for discharge meter
<b>Soil degradation</b> - loss of soil fertility, salinization and water logging	<ul style="list-style-type: none"> <li>• irrigation to be done only when necessary to reduce salinization</li> <li>• Proper management will enhance soil quality and increase productivity.</li> <li>• use recommended fertilizer and pesticides that do not degrade the soil</li> <li>• Sensitize farmers to practice conservation agriculture</li> <li>•</li> </ul>	AFA, proponent	throughout operations	20,000 per acre/ planting season
<b>water pollution</b> – from surface runoff contaminated with pesticides and fertilizer	<ul style="list-style-type: none"> <li>• A vegetated buffer zone between the water bodies and the Bt-Cotton farms shall be provided with suitable plants to absorb nutrients</li> <li>• Proper soil erosion measures to be put in place to prevent sedimentation</li> <li>• Farms to be located at least 30m from the surface water bodies</li> <li>• Sensitize the farmers to report any incident of poisoning suspected to be from water contamination</li> </ul>	Contractor and workers	Throughout construction	-

	<ul style="list-style-type: none"> <li>• Recommended agronomic and soil fertility maintenance measures will be applied</li> <li>• Treatment of the waste from ginneries before disposal</li> <li>• Where surface run off from the farms could flow residual pesticides and fertilizer (nutrients) into the water bodies,</li> <li>• Treatment of contaminated water from the farms will be done before drained in to the environment</li> <li>• Erection of buffer plants at the lower edges of the farms to take up plant nutrients that may cause eutrophication to water bodies</li> <li>• Annual Environmental Audits and Impact evaluation be done to assess the impacts of Bt-Cotton adoption</li> </ul>			
<b>Solid waste generation-</b> seed, fertilizer packaging	<ul style="list-style-type: none"> <li>• Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3.Composting and reuse 4. Combustion 5. Sanitary land filling.</li> <li>• Use packaging materials that have minimal packaging to avoid the generation of excessive packaging waste</li> <li>• procure cotton seeds with packaging materials that are environment friendly</li> <li>• special containers to be used for storing used chemical containers/ packaging</li> <li>• wastes with hazardous chemical content to be collected by an approved handler</li> <li>• have a waste/ agrochemical management</li> </ul>	MAHYCO, fertilizer suppliers, NEMA, proponent	Throughout operation	5,000 per planting season/ 10 acres within 5km radius



	plan			
<b>Accidents, inconveniences</b> due to Increased Traffic- during cotton collection and transportation	<ul style="list-style-type: none"> <li>Alert other road users of the unusually increased traffic in the area (using posters, sign posts)</li> <li>Planning on collection times to avoid heavy traffic</li> <li>Provision of several collection points to avoid jamming at one point</li> <li>Drive at less than 20km/h where there is high human and animal populations</li> <li>Insurance covers for workers and property</li> </ul>	Ministry of Health (MOH), DOSHS	Throughout the operation of the project	depends with magnitude of the accident
<b>Air pollution</b> dust generated from vehicular movements, fumes from generator and vehicles, excavations for laying foundations for ginneries, cotton stores	<ul style="list-style-type: none"> <li>Sprinkle water on graded access routes when necessary to reduce dust generation by vehicles</li> <li>do rain water harvesting from ginneries/stores' roofs to reduce surface runoff</li> <li>proper maintenance of the machinery</li> <li>vehicles to move at less than 20km/h in centers</li> </ul>	proponent and farmers track/vehicle drivers	continuous	depends on the length of the road and drought span  maintenance cost varies with machine and part
<b>Increased prevalence of HIV/AIDS, COVID 19-</b> due to increased informal laborers from different backgrounds	<ul style="list-style-type: none"> <li>Promote awareness to the community and the farm workers on the risk and prevention of the diseases</li> <li>Instill discipline on the farm workers</li> <li>Contractor shall comply with the HIV/AIDS Prevention and Control Act (2006) which</li> </ul>	Ministry of health (MOH), Police	Continuous	100,000

	prohibits discrimination of persons living with HIV and AIDS. <ul style="list-style-type: none"> <li>• Adhere to the Government directives on containment and control of COVID-19</li> <li>• promotion of awareness to the employees and the</li> <li>• neighbouring communities on the risks and prevention of HIV/AIDS and Covid – 19</li> <li>• Promote personal Hygiene especially frequent handwashing and sanitization of farm equipment</li> <li>• Encourage employees to go for the voluntary scanning &amp; testing</li> </ul>			
<b>Moral decadence:</b> Alcohol and Substance abuse, prostitution, robberies- due to increased income and bad influence	<ul style="list-style-type: none"> <li>• Enforcement of law</li> <li>• Educating farmers and the communities on effects of drug and substance abuse</li> <li>• Money should be paid to bank and not cash</li> </ul>	local administration, police, farmers	Continuous	-
Approval from relevant authorities	<ul style="list-style-type: none"> <li>• Ensure the project goes through all the procedure required by the law before implementation</li> </ul>	The proponent KALRO, KEPHIS, NBA, NEMA	Before rollout	As per the respective department.
School drop outs and child labour due to improved returns	<ul style="list-style-type: none"> <li>• Enforcement of the law prohibiting child labour</li> <li>• Educating the farmers and the students on the benefits of education</li> <li>•</li> </ul>	local administration, farmers		-

Family conflicts and breakups- due to mismanagement of money, prostitution	<ul style="list-style-type: none"> <li>• Educate the farmers on financial management</li> <li>• Train the community on conflict resolution mechanisms</li> <li>• Encourage couples to have joint bank accounts</li> </ul>			-
Security at cotton storage sites and ginneries	<ul style="list-style-type: none"> <li>• Providing day and night security guards and adequate lighting within and around the stores and ginneries.</li> <li>• Fencing off the sites</li> </ul>	RFCS	Always	20,000/= monthly  depends on the size of area to be fenced
Fire hazards at cotton storage sites and ginneries- cotton can easily catch fire	<ul style="list-style-type: none"> <li>• Firefighting equipment such as fire extinguishers should be provided at strategic locations such as stores and construction are</li> <li>• Signs such as “NO SMOKING” must be prominently displayed within the premises</li> <li>• Training workers on fire emergencies</li> <li>• Formulate and enforce fire action plan</li> </ul>	(RFCS), DOSHSS	Throughout	5, 000 on each trainee 7,000 for a 9Kg fire extinguisher
Misunderstandings leading to conflicts	<ul style="list-style-type: none"> <li>• Have in place grievance redress mechanisms</li> <li>• Farmers to be enlightened on every aspect of the project</li> <li>• Give priority to locals during employment</li> </ul>	AFA, RFCS, Local administration	during conflicts	throughout the project

## 8.6 Decommissioning phase ESMP

Decommissioning of the project will involve abandoning the project or some part of it and restoring the farms and other affected resources to their original or near original as possible. Decommissioning could be due to a court order, decision by regulatory authorities due to uncontrollable negative impacts, it becomes uneconomical, (less returns from the project), when due process was not followed among others.

The proponent shall then plan and implement the decommissioning. The detailed decommissioning plan is contain ways of handling hazardous and dangerous materials, restoring the native species, soil fertility and other degraded aspects of the environment. An ESIA for decommissioning may be necessary.

*Table 11: ESMP for the Decommissioning phase*

Environmental Impact	Recommended Mitigation and monitoring	Responsible party	Timeframe	Cost
Air pollution- when filling back erosion channels, planting of trees etc	<ul style="list-style-type: none"> <li>sprinkle water on loose surfaces to quell dust</li> <li>workers to use appropriate PPEs</li> </ul>	opponent NEMA,	throughout decommissioning	will depend on the size of land to restored
Injuries/accidents, occupational safety and health	<ul style="list-style-type: none"> <li>have PPEs while collecting potentially hazardous wastes</li> <li>hazardous wastes to be handled by approved waste handlers- to be transported, disposed of according to the required protocols</li> <li>sensitization of the workers on the health impacts of wastes</li> <li>provide first aid kit at the sites</li> </ul>	NEMA, Proponent, farmers	continuous	30,000 per one acre. May vary depending on the type and amount of wastes
Noise and vibration- during dismantling of ginneries and cotton ad chemical stores	<ul style="list-style-type: none"> <li>Adhere to the Environmental Management and Coordination (Noise and Excessive Vibrations pollution) (control) Regulations, 2009</li> </ul>	NEMA, proponent,	throughout dismantling period	

	<ul style="list-style-type: none"> <li>• Provide appropriate PPEs</li> <li>• Notify the community before demolitions</li> </ul>			
waste generation	<ul style="list-style-type: none"> <li>• Putting in place proper waste management Systems including waste recycling and reuse of debris</li> <li>• Selling the reusable parts</li> <li>• Clear the wastes as soon as they are generated</li> </ul>	proponent	throughout decommissioning phase	
visual intrusion due to accumulated waste	<ul style="list-style-type: none"> <li>• Do landscaping by leveling the area, planting of trees</li> <li>• Clear the wastes as soon as they are generated</li> </ul>	proponent	throughout decommissioning phase	

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## CHAPTER NINE

### 9.0 ENVIRONMENTAL MONITORING PLANS

#### 9.1 Invasion and biodiversity monitoring plan

This is a concern since the chemicals used for the spraying of Bt-Cotton may harm non-target organisms, Bt-Cotton being genetically modified may have competitive advantage over the indigenous and other effects that may affect the local plant and animal species thus leading to their loss. Therefore, close monitoring to be done to detect any effect at early stages. This should involve taking stock of the variety, abundance and conditions of the plants and animals before the rollout. Subsequent observations to be done as will be directed by KEPHIS, NEMA, KFS and other bodies. This should be done with plants and animal species within the farms and at the edge of the farms. Records to be kept for reference. Risk assessment for Bt-Cotton in the country by NBA reported that invasion is unlikely.

#### 9.2 Water quality monitoring plan

The possible sources of water quality degradation will be sediment loads from farms, roads whose soils are loosed by far machineries; oil spills/ leaks from machineries, oil handling and storage; chemicals, fertilizers among others. Poor water quality can negatively affect the groundwater aquifers, freshwater habitats, flora and fauna. Therefore water quality monitoring plan is to provide data and information to improve water quality by assessing the variation of water quality parameters and comparing with the standard contained in the Environmental Management and Coordination (Water Quality) Regulations, 2006.

#### 9.3 Soil quality monitoring plan

The potential sources of soil degradation are fertilizers applied during planting and dressing, pesticides used in spraying the cotton, oil spills from machineries in the farms, salinization in case of irrigation, non-biodegradable solid wastes, removal of fertile top soil by erosion among others. These may have the effect of lowering the productivity of the soils, affecting the living organisms in the soil, affecting human and animal health. The data obtained to be compared with baseline information and the ministry of agriculture standards for any variations. Samples should be taken from within the farms and the areas not planted with cotton for comparison. The sampling should be done every season. The presence of harmful chemicals such as heavy metals among others are to be monitored.

#### 9.4 Air quality monitoring

Air quality deterioration is expected to insignificant from land tilling farming is expected to be of small scale and the use of machineries will be minimal, if any. The air pollutants from the farms include dust and smoke. Fumes and fine suspended cotton particles from ginneries are likely to be the major sources of poor air quality. These pollutants have the effect of eliciting allergic reactions, respiratory problems, eye irritation, reduced photosynthesis (when the particles settle on plants' leaves), and acid rain among others. Monitoring of the fumes and suspended particles is therefore of essence. This should be done to ensure compliance to First Schedule of the Environmental Management and coordination (Air Quality) Regulations, 2014 (Table 12).

Table 12: possible pollutants from the proposed project and the EMC (Air Quality) Limits

Pollutant	Limits as per the EMC (Air Quality) Regulations, 2014
PM2.5	35 $\mu\text{g}/\text{m}^3$
Non methane hydrocarbons	700ppb
Sulphur Oxides (SOX)	80 $\mu\text{g}/\text{m}^3$
Nitrogen Dioxide	150 $\mu\text{g}/\text{m}^3$
Suspended Particulate Matter	360 $\mu\text{g}/\text{m}^3$
Respirable Particulate matter (< 10 $\mu\text{m}$ ) (RPM)	70 $\mu\text{g}/\text{m}^3$
Total VOC	600 $\mu\text{g}/\text{m}^3$
Oxides of Nitrogen	80 $\mu\text{g}/\text{m}^3$
Carbon monoxide/ carbon dioxide	10 $\text{mg}/\text{m}^3$

## 9.5 Grievances redress mechanism

### 9.5.1 Introduction

Since there has not been a similar project like the proposed one in the country, there may be misunderstandings and unforeseeable impacts that make grievances a possibility. The persons affected by the proposed commercialization may raise their grievances and dissatisfactions about actual or perceived impacts in order to find a satisfactory solution. It is possible that grievances may arise from physical, situational and/or social losses different stages of the project cycle. Satisfactory solutions should be arrived at that mutually benefit both the affected persons and the project; with efficient institutional mechanisms that are responsive to their complaints.

### 9.5.2 Grievances prevention

Grievances cannot be avoided entirely but they can be reduced to manageable levels. This can be achieved by;

- ✓ Providing sufficient and timely information to communities. Many grievances arise because of misunderstandings; lack of information; or delayed, inconsistent or insufficient information. Accurate and adequate information about a project and its activities, plus an approximate implementation schedule, should be communicated to the communities, especially affected parties, regularly.
- ✓ Sharing information, reporting on project progress, providing community members with an opportunity to express their concerns, clarifying and responding to their issues, eliciting communities' views, and receiving feedback on interventions will benefit the communities and the project management.
- ✓ Conduct meaningful community consultations. The project proponent should continue the process of consultation and dialogue throughout the project cycle.

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## **CHAPTER TEN**

### **10.0 CONCLUSION AND RECOMMENDATIONS**

Agriculture is the mainstay of the economy of Kenya. Therefore an improvement in the agriculture sector will result improve the economy of the country. The commercialization of Bt-Cotton is expected to result in colossal benefit to the counties where they will be implemented, the country and as a whole and the region. The benefits include improved cotton production of high quality cotton, thus improved income, establishment of new ginneries and revival of non-functional ones, creating of multiple indirect/ direct job opportunities along the value chain, reduced pollution to the environment since less pesticide will be used as opposed to the conventional cotton, reduced cost of cotton production, improvement of economy, cotton leaves add fertility to the soil among others. Besides, the project will contribute to the achievement of Kenya's development blueprint of Vision 2030 and the government's Big Four Agenda.

Nevertheless, there are potential negative impacts from the proposed project including increased and widespread environmental degradation from use of fertilizers, pesticides and over cultivation of land, moral decadence, conflicts, fears of unforeseen impacts, and invasion from Bt-Cotton leading to loss of biodiversity, emergence of new diseases and pests, occupational health issues among others. Mitigation measures, environmental management plans, monitoring plans for air quality, biodiversity, soil and water quality have been proposed in this study report for the management of the negative impacts. The ginneries and stores should also be subjected to ESIA and annual Environmental Audits to monitor compliance to the legal requirements. Further, sustained stakeholder engagement, prompt and effective relaying of information among the stakeholders to be adopted to avoid misunderstandings, conflicts in case of an occurrence of a negative impact among others. Effective and prompt implementation of these will ensure these possible impacts are mitigated against.

It is against this backdrop that the experts recommend that the project be approved and license issued for its implementation.



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## Annex 1: Photo Gallery



Baypal Consultants having a session with Pala cotton cooperative Society, Homa Bay County



Some of the Bt. Cotton demonstration farms in Homa Bay county



Seme Kisumu Cotton Farmers Cooperative society giving their view on Bt. Introduction



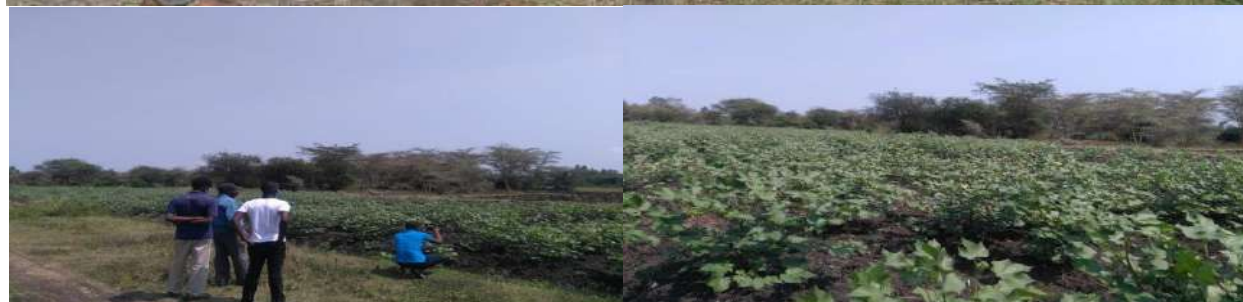


Mr. Joseph Odinga , a farmer showing Baypal team his highbred cotton demo farm with high expectation on introduction of the Bt. Cotton



Some of the cotton farms in Seme





Baypal Team having a session with Kobura Multipurpose Cooperative society in cotton field, Nyando Sub-county in Kisumu County



Nambale cotton Farmers cooperative society having a session with ESIA Study team during public participation forum in Nambale, Busia Sub-County





Matayos Cotton Farmers giving their views on the proposed Bt - Cotton commercialization Matayos Sub-county, Busia County.



Bt - Cotton demonstration farm in Matayos, Busia County



Bt-Cotton demonstration farms visit with Muhoroni Cotton Farmers Society and ESIA Study team





Public consultation forum with Jairos Cotton Farmers' Cooperative society, Teso North, Busia County



ESIA Study visit to Jairos Cotton Farmers' Bt-cotton demonstration farms in Busia county



A view of KSA cotton seeds and harvested cotton at Jairos Cotton ginneries, Teso North, Busia County





Public consultation forum with Uyoma Farmers Cooperative society, Rarieda Sub-County, Siaya County



Mr. Nicholas Odhiambo, Secretary, Uyoma Farmers Cooperative society showing ESIA Study team some of the pest infested KSA cotton in his farm



A view of stalled Madiany Cotton Ginnery in Rarieda Sub-county, Siaya County





A view of stalled Jairos Cotton Ginnery in Teso North Sub-county, Busia County



Cotton Farmers giving their views on the proposed Bt-Cotton commercialization in Elgeyo Marakwet County



A view on the public consultation forum with cotton farmers in Malakisi, Bungoma County



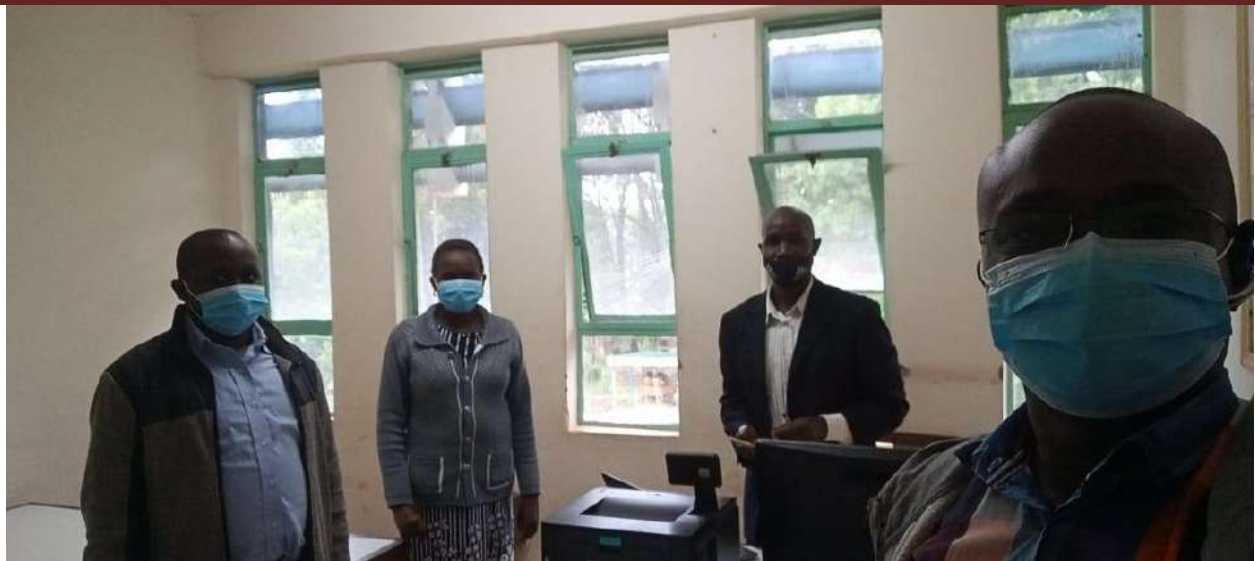


Cotton Farmers in Baringo County giving their views on the proposed Bt-Cotton commercialization during public consultation at Salwa ginnery



A farmer leading BAYPAL team n AFA officer to his cotton farm in Malakisi just after the FGD session





Consultants with AFA Officer and Cotton Desk Officer, after KII interview in Baringo County



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Annex 2: Interview Attendants Lists (FGD & KII)

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Annex 4: Summary Risk Assessment Report (for: Application for the Environmental Release of Insect Protected Mon 15985 Bt-Cotton and Its Varietal Derivatives)

## **Annex 5: Experts' licenses**





# KII GUIDE

PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR  
PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	NIXON CHEBUCHE
Organization/Institution	AFA - FIBRE CROPS DIRECTORATE
Represented & Contacts	P.O. BOX 3637-40100, KISUMU
Designation	F. D. A
Signature & Official stamp	
Date	



1. Give a brief of the institution's roles and mandate

To develop, promote and regulate  
scheduled crops in the country.

2. How is your institution involved in the cotton Value chain?

- Promoting cotton production by provision of  
inputs such as chemicals and seeds.  
- Market linkages of stakeholders  
- Regulation of value chain actors.

3. Does your institution have any experience with BT Cotton crops? If yes, how?

NO



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- Increase in area under cotton
- Increase in farmers income
- Reduction in chemical spraying rates is environmentally friendly
- With BT succeeding there will be room to research on another technology say herbicide resistance varieties

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

No

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- Increase in cotton farmers income
- Less chemical sprays

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

- pests (bollworm) developing resistance with time



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Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

Sensitive farmers on planting  
refuge conventional cotton alongside  
BT cotton with time

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

With increased income then living  
standards improve.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

To develop a seed system in  
the country.

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

YES

10. Should the project continue?

YES

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







## KII GUIDE

**PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.**

Ministry of Agriculture, Livestock and Fisheries propose to commercialize BT Cotton farming in the Country to boost cotton production and stimulate industrialization Kenya. BAYER EAST AFRICA LTD has contracted BAYPAL CONSULTANCY FIRM to conduct the above mention study on behalf of the Ministry. In a bid to ensure a safe and sustainable environment, the National Environment Management Authority (NEMA) under EMCA (Amendment) of 2015 Section 58 requires that an Environmental Assessment and Public Participation be undertaken for a project of such magnitude to enable NEMA make informed decisions. As a key stakeholder in cotton value chain production, we kindly request for your comments on the expected socio-economic and environmental impacts of the proposed project (Commercialization of BT Cotton).

**CLIENT: BAYER EAST AFRICA LTD**

**CONSULTANT: BAYPAL CONSULTANCY FIRM**

Name of the stakeholder	SYLVESTER OKETCH
Organization/Institution	KISUMU COUNTY
Represented & Contacts	
Designation	DALF - Director.
Signature & Official stamp	COUNTY DIRECTOR OF AGRICULTURE P.O. BOX 1700-40100
Date	27/8/2020 KISUMU

1. Give a brief of the institution's roles and mandate

- Provide Agricultural Extension Services

2. How is your institution involved in the cotton Value chain?

- Provision of extension.

3. Does your institution have any experience with BT Cotton crops? If yes, how?

Yes. Together with AFA we have identified farmers and provided seeds for demonstration.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- High yields
- Less use of pesticides
- More income.

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

**Positive impacts**

**Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}**

- Uncertainty of the effects of the GMo in future.





6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV AIDS, COVID-19 status of the area? Explain.

Reduced frequency of spraying will reduce the impacts of such activities on sick people

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

- Reduce the cost to make it affordable.  
- Domesticated production of the seeds to make it available

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

Yes.

10. Should the project continue?

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







# KII GUIDE

PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

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CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	DAVID KIREMBU
Organization/Institution	KERIO VALLEY DEV. AUTHORITY
Represented & Contacts	Phone: 0724329930
Designation	AGRICULTURAL OFFICER
Signature & Official stamp	KERIO VALLEY DEVELOPMENT AUTHORITY P.O. BOX 2660 ELDORET TELEPHONE 63361
Date	25/8/2020

1. Give a brief of the institution's roles and mandate

Water development, Food security, employment creation, Community empowerment and environmental conservation

2. How is your institution involved in the cotton Value chain?

Farmer level through Crop demonstrations and Commercial farming. Also undertake farm extension services for farmers within KADA Irrigation Schemes.

3. Does your institution have any experience with BT Cotton crops? If yes, how?

So far not, but plans are underway to do crop demonstration on small scale (2.5 acres)



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Ministry of Agriculture, Livestock and Fisheries







before full commercialization under irrigation.

What benefits will be derived from adopting BT cotton in Kenya?

Self-reliance on lint, hence minimizing imports, high incomes to farmers since Bt Cotton is high yielding and disease resistant compared to previous varieties.

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

No, since Bt Cotton will be used as a rotational crop.

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

Biological:- this is a new crop developed from other countries hence may come with other challenges such as new diseases.  
Socio-economical:- uplift the living standards of farmers due to improved incomes from crop sales.  
Physical impacts:- Cotton generally is a good cover crop, hence less damage to environment due to erosion.

**Negative Impacts** {the risks and challenges that may come with the adoption of BT Cotton}

Biological mainly:- Risk of introduction of new diseases and pests into the environment.



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Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

Kenyan Research Institutions should continue carrying out more trials on Bt Cotton with a view to addressing emerging issues/challenges on crop husbandry.

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Positive: - High community incomes results in improved awareness of disease challenges in the community.

Negative: - High incomes could also result in high human mobility hence easier disease spread.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

1. Offer credit schemes to farmers or subsidize input costs.
2. Form Cooperatives for easier marketing of produce.
3. Offer price incentives to farmers.

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

Currently on initial stages, but the frameworks can be developed based on experiences from other nations, particularly India.

10. Should the project continue?

The project should continue so that the country realizes the full potential of the textile industry which was once vibrant but almost collapsed leading to job losses and capital flight.

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







## KII GUIDE

PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

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CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	CHARLES LAGAT
Organization/Institution	
Represented & Contacts	RIVATEX E.A. LTD
Designation	COTTON PROGRAM MANAGER
Signature & Official stamp	
Date	26/8/2020

1. Give a brief of the institution's roles and mandate

Textile Mill; processing of fibres (cotton etc) into yarn and manufacture of fabrics and garments.

2. How is your institution involved in the cotton Value chain?

processing of cotton lint into yarns and manufacturing of fabrics and garments

3. Does your institution have any experience with BT Cotton crops? If yes, how?

YES. We are part of the cotton revitalization task force



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Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- Reduction in cost of production from the farm level due to less usage of pesticides/insecticides
- production of good quality cotton fibres as a result of minimal damage by pests
- Less chemicals being used hence good for the environment & farmer
- Improved yarn quality because of good quality fibres

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

YES  
Good quality cotton fibres will result in blowroom operation in spinning department being less intense

5. If the cotton commercialization is implemented, what do you foresee as the environmental impacts (socio-economical, Biological and Physical Impacts) during the commercialization process? (during land preparation, seed distribution, planting and growing, harvesting, transportation and processing)

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P.O. Box 4744, ELDORET-30100

Tel: 053 2088961-3

#### Positive impacts

- less cost of production by farmers hence increased income
- Reduced environmental degradation due to less chemicals being used
- Curbing of bollworm will lead to less usage of chemicals hence impacting positively to the farmer
- Reduced degradation of the fibres due to curbing of bollworm will result in high quality lint which will ultimately lead to reduced spinning cost and improved yarn and fabric quality.

Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

- Uncertainty with respect to the usage of the seed in oil, soap, and animal feed



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6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

More awareness to stakeholders concerning B.T. cotton and specifically the safety of the byproducts

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

YES

The positive impacts in Q5 marks will lead to increased income as a result of high production and good quality products hence more money to the stakeholder

8. How can commercialization and adoption of BT cotton be sustained to benefit current and future generations?

aid in  
→ Government and other stakeholders to subsidizing the cost of the seed.  
→ Further improvement/innovation using local varieties

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

YES

10. Should the project continue?

YES

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P. O. Box 4744, ELDORET-30100  
Tel: 053 2030901-3

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Ministry of Agriculture, Livestock and Fisheries





# KII GUIDE

PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR  
PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	DIANA ELCIE AWUOR
Organization/Institution	COUNTY GOVERNMENT OF SIAYA
Represented & Contacts	Department of Water, Environment and Natural Resources
Designation	Environment Officer
Signature & Official stamp	
Date	19th August 2020

1. Give a brief of the institution's roles and mandate

- To conserve, develop and sustainably utilize a healthy environment.
- Provision of efficient and affordable water and sanitation.

2. How is your institution involved in the cotton Value chain?

Indirectly as the watchdog to ensuring cotton farmers adhere to environmentally friendly practises and that their activities do not harm the local environment.

3. Does your institution have any experience with BT Cotton crops? If yes, how?

NO



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What benefits will be derived from adopting BT cotton in Kenya?

Revival of the textile industry hence creation of employment to many Kenyan youths.

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

No.

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- Creation of employment to local farmers
- Improved living standards due to availability of finances from sale of cotton
- Reduced crime rates as idleness of youth will be reduced as they work in cotton farms.
- Increased urbanisation as roads leading to farms will have to be well developed to ease transportation of cotton produced.

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

- Clearance of natural vegetation to pave way for the growing of cotton (especially trees)
- Use of chemicals during planting and growing may lead to contamination of water for domestic use.
- Loosening of top soil during land preparation may expose top soil to erosion and degradation.
- Use of tractors and other fuel consuming machinery as well as during transportation may contribute to release of carbon to the atmosphere.





6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

- Practising agroforestry (mixing cotton planting with growing relevant tree stands)
- Ensuring that there is minimal use of chemicals on farm and that those used have little to no effects on the environment
- Practising climate smart agriculture that ensures no soil erosion among other best practises

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV

AIDS, COVID-19 status of the area? Explain.

Yes. COVID-19 <sup>cases</sup> may shoot up due to close interjection. HIV/AIDS is spread through sexual intercourse among other ways. Interaction between farmers and villagers in their surrounding due to availability of finances hence may lead to increase in immorality (sexual workers)

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

- By ensuring that the market is always available and offers favorable prices to farmers.
- By regulating/restricting importation of cotton products and encouraging purchase of locally made products.

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

No.

10. Should the project continue?

Yes.

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







# KII GUIDE

PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR  
PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	Agricultural Extensionist
Organization/Institution	Department of Agriculture
Represented & Contacts	Bondo Sub-county, P.O. Box 113, Bondo 07 23580012/07227 980171
Designation	Sub-county Agricultural Engineer Sub-county Crops Dev. Officer
Signature & Official stamp	 SUB-COUNTY AGRIC. OFFICE BONDO DISTRICT P. O. Box 113, BONDO
Date	25/08/2020 DATE: 20/08/2020

1. Give a brief of the institution's roles and mandate

- Farmers Training on technology adoption
  - Staff Training on technology of cotton growing
  - providing marketing information to farmers
  - mechanization during land preparation
- our mandate is agricultural extension mainly

2. How is your institution involved in the cotton value chain?

- Mobilising farmers on skills of growing cotton i.e agronomic practices
- Giving farmers seeds and chemicals for cotton growing
- Marketing of cotton through cooperative societies

3. Does your institution have any experience with BT Cotton crops? If yes, how?

NO.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- Reduced cost of production of cotton
- Increased cotton yields due to
- reduced pests and diseases of cotton
- Increased household income

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- Lower cost of cotton production
- Increase cotton production and productivity
- Increased overall household income
- Increased usage under cotton
- Faster growth of cotton is early maturity
- Increased demand for labour during harvest
- Increased demand and cost of transportation and processing machines

Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}



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Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

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7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV AIDS, COVID-19 status of the area? Explain.

YES. The economic status of the household will increase hence making them more capacitated to counter the negative effects of the HIV/AIDS and COVID-19.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

.....

.....

.....

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

NO

10. Should the project continue?

YES

THANK YOU FOR YOUR TIME

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55661/-



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries








## KII GUIDE

PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR  
PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	WANGOTI C-5
Organization/Institution	Nation Government Administration department
Represented & Contacts	Natayo Division
Designation	SCC
Signature & Official stamp	 ASSISTANT COUNTY COMMISSIONER NATAYOS DIVISION
Date	17/8/2020

1. Give a brief of the institution's roles and mandate

Coordination of National Government Functions

2. How is your institution involved in the cotton Value chain?

Mobilizing farmers to venture into the farming  
lower between organization is the proposed farmers

3. Does your institution have any experience with BT Cotton crops? If yes, how?

No in the client part



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





What benefits will be derived from adopting BT cotton in Kenya?

improving livelihoods of the local communities

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

Yes. Monitoring to ensure <sup>pesticide</sup> activities are carried out within their premises of land.

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- improved livelihoods due to incomes generated.
- proper / timely utilization of land which would have been underused fallow.
- Reduced societal management due to engagement by the population.

#### Negative Impacts (the risks and challenges that may come with the adoption of BT Cotton)

- the impacts on soils <sup>and water sources</sup> due to use of inorganic fertilizers.



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6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

Adoption of use of Organic Manure - green farming

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

- Reduction of HIV/AIDS since the vulnerable population / farmers with be engaged hence little time for irresponsible sexual behaviours. Reduced which may encourage new infections. For the already infected / affected they'll have better management due to improved income

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

Setting up strong Value Chains

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

10. Should the project continue?

Yes

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





# KII GUIDE

PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR  
PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
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CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	Bernard Nyagah
Organization/Institution	KCSM-Siaya
Represented & Contacts	
Designation	County Environmental and Social safeguards officer
Signature & Official stamp	
Date	18/08/2020

1. Give a brief of the institution's roles and mandate

- 1) Increase Agricultural Productivity (Productivity)
- 2) Increase resilience to climate change in smallholder farmers
- 3) Reduction of greenhouse gases (mitigation)

2. How is your institution involved in the cotton Value chain?

Not involved.

3. Does your institution have any experience with BT Cotton crops? If yes, how?

No.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

No

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

**Positive impacts**

Business Agricultural Productivity  
employment creation

**Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}**

Subsistence  
Land degradation  
Diseases (HTVs and MDC)



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6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

Plant y trees.  
- Create awareness on HIV and AIDS.

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV AIDS, COVID-19 status of the area? Explain.

Yes. People who would get harvest when they have their money and after unemployment.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

- Capacity building of community on the new seed variety  
- Capacity building of community on the new cotton production technology

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

No.

10. Should the project continue? Yes.

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries








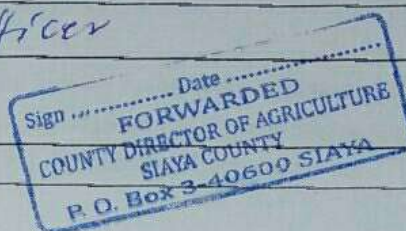
## KII GUIDE

PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR  
PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	Wapula Omboko
Organization/Institution	Agriculture Siaya County
Represented & Contacts	
Designation	Extension officer
Signature & Official stamp	
Date	19/08/2020



1. Give a brief of the institution's roles and mandate

- Provision of public extension services in Agriculture.
- Promotion of food security programs
- Promotion of climate resilient technologies.

2. How is your institution involved in the cotton Value chain?

- Promotion of production and marketing of cotton.

3. Does your institution have any experience with BT Cotton crops? If yes, how?

No. However this long rain season BT cotton seed was distributed to farmers for demonstration and we are yet to see the results.



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Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- Less production cost. Due to ~~less~~ reduced use of chemicals.
- High production making the farmer make high profit
- Clean cotton produced due to reduced damage by the pests & diseases.

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

Yes. The staff will need to be capacity build on cotton agronomy in the entire County.

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- more people will be involved in the value chain hence creating employment during land preparation, planting, distribution etc.
- The population in the County will have purchasing power increased hence economic progress.
- Employment creation for youth in transport and processing of cotton.

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

- No so sure if it will reduce beneficial insects in the field.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

The BT cotton should not kill but instead  
repel the insects

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Yes. The HIV/AIDS & COVID-19 households  
and are either affected or infected will  
have source of income which will help  
improving nutrition at household level  
hence improved immunity. seek for medication.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

- Let the soil health issues be promoted  
to ensure that production is sustainable.  
- Strengthening of cooperatives dealing  
in cotton.

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

Not sure.

10. Should the project continue?

Yes. This will bring back cotton production as  
an economic activity in otherwise areas  
without cash crop.

THANK YOU FOR YOUR TIME



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## KII GUIDE

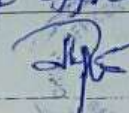
PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

Ministry of Agriculture, Livestock and Fisheries propose to commercialize BT Cotton farming in the Country to boost cotton production and stimulate industrialization Kenya. BAYER EAST AFRICA LTD has contracted BAYPAL CONSULTANCY FIRM to conduct the above mention study on behalf of the Ministry.

In a bid to ensure a safe and sustainable environment, the National Environment Management Authority (NEMA) under EMCA (Amendment) of 2015 Section 58 requires that an Environmental Assessment and Public participation be undertaken for a project of such magnitude to enable NEMA make informed decisions. As a key stakeholder in cotton value chain production, we kindly request for your comments on the expected socio-economic and environmental impacts of the proposed project (Commercialization of BT Cotton).

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	John C. Kibogo
Organization/Institution	Baringo County government
Represented & Contacts	Box 53-30400-16666
Designation	Chief officer - Water & Irrigation
Signature & Official stamp	 20 AUG 2020
Date	

1. Give a brief of the institution's roles and mandate

Supply of water to all residence of the county for domestic use and irrigation purpose

2. How is your institution involved in the cotton Value chain?

→ Cotton can be planted in irrigated dry lands

3. Does your institution have any experience with BT Cotton crops? If yes, how?

NO



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

Improvement of livelihood to benefit inhabitants and regions at large

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

YES → More staff will be recruited in irrigation schemes

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

→ More areas with in drylands will be brought under irrigation  
→ More youth will get employment  
→ Reduced flooding - resulting from diversion of rivers into irrigation canals

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

→ Rise in Malaria outbreaks due to irrigated water  
→ Disease spread due to influx of person/external customers



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

- Purchase of Mosquito nets
- Dispensaries constructed in cotton production areas

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Yes. The spread will escalate due to movement of the traders.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

- Develop irrigation agriculture
- Introduction of research works.

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

No. Policies and legal frameworks need to be improved.

10. Should the project continue?

Yes

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







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CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	Baringo County - Department of Agriculture
Organization/Institution	Agriculture.
Represented & Contacts	0721579150
Designation	Deputy Director of Agriculture - Extension COUNTY DIRECTOR
Signature & Official stamp	 OF AGRICULTURE P.O. Box 4 - 30400, KABARNET
Date	19/08/2020

1. Give a brief of the institution's roles and mandate

Role - Extension  
- Agricultural project implementation.  
Mandate - Improvement of Agricultural productivity.

2. How is your institution involved in the cotton Value chain?

- provision of extension services - latest technologies.  
- purchase and distribution of inputs (seeds, chemicals, equipment)

3. Does your institution have any experience with BT Cotton crops? If yes, how?

Yes - participated in the NPT trials and monitoring of the crop in the field.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- Increased production
- reduced costs of production

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

Yes - The institution has shortage of staff and commercialization of BT cotton would stretch the existing staff.

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- increased yields (change in fields)
- Decreased chemical pollution (savings in chemical control)
- improved health of farmers
- improved living standards of farmers due to increased farmer income.

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

Risks - low extension services on BT cotton to farmers & staff in the ministry of Agriculture.

Challenges - the cost of the seed may be exorbitant  
- low resource allocation by the counties to support the farmers.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

- more sensitization on production, handling of BT cotton
- remit more staff at county level.
- More budgetary allocations

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Yes - Improved standards of living due to increased income will make poor farmers have access to various food stuffs which will improve nutritional status at household level.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

- The marketing system should be strengthened and farmers get returns from the crop cultivated
- Regulate the importation of clothes and encourage Kenyan textile industries to grow. (cushion the textile industry from external competition)

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

Yes - but at county level the frameworks are not cascaded and crop integrated into the CIDPs.

10. Should the project continue?

Yes. but after exhaustive & conclusive studies on probable impacts of the Bt Cotton are reached with relevant stakeholders along the value chain.

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





## KII GUIDE

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**CLIENT:** BAYER EAST AFRICA LTD

**CONSULTANT:** BAYPAL CONSULTANCY FIRM

Name of the stakeholder	BORESHA SACCO - BARWESSA BRANCH
Organization/Institution	
Represented & Contacts	BORESHA SACCO
Designation	BRANCH MANAGER
Signature & Official stamp	Boresha Sacco Society Limited P.O. Box 538-30400, Kabaret. BRANCH MANAGER
Date	20/8/2020

1. Give a brief of the institution's roles and mandate

Offer Savings and Credit services

2. How is your institution involved in the cotton Value chain?

Giving loans to farmers in terms of farm inputs

3. Does your institution have any experience with BT Cotton crops? If yes, how?

No



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- Increase of cotton production
- Increase of cotton quantity

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

Yes. This is because the whole process involve assessment and lots of monitoring. Thus there will be need for more staff.

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- It will improve the living standards of the farmers.
- It will create employment.

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

- No survival on power.
- Lack of <sup>more</sup> information about BT Cotton.







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

(1) Sensitization of farmers and giving them more information about BT cotton.  
(2) Offering training to personnel undertaking the task.

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Commercialization and adoption of BT cotton will have a direct impact on HIV & AIDS & COVID-19 status because people in the area will be earning a living from it hence indirectly affecting them.

8. How can commercialization and adoption of biotechnology be utilized to benefit current and future generations?

— Improvement of living standards.  
— Creation of employment and job opportunities.

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

Yes.

10. Should the project continue?

The project should continue because it will greatly promote the living standards of the area and also cotton itself will be the cash crop for people living in arid and semi arid areas.

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





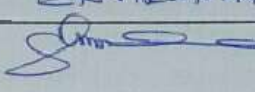


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PROJECT: PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR  
PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	FRANCIS OTIENO OBWANGA
Organization/Institution Represented & Contacts	WATER AND ENVIRONMENT HBC
Designation	ENVIRONMENT OFFICER
Signature & Official stamp	 DEPARTMENT: ENVIRONMENT AND NATURAL RESOURCES COUNTY GOVERNMENT OF HOMA-BAY
Date	24/08/2020 DATE: 24/08/2020 SIGN: [Signature]

1. Give a brief of the institution's roles and mandate

To ensure people of Homa Bay county  
have ready access to adequate safe and healthy  
sanitation and let them live in a clean and well well  
conserved environment.

2. How is your institution involved in the cotton Value chain?

3. Does your institution have any experience with BT Cotton crops? If yes, how?

NO



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- High cotton production
- Increased income for farmers
- Reduction on production cost for farmers

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

Yes, since it is a new idea, it will require monitoring and evaluation on its implication to environment i.e. fauna and flora

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- Create employment opportunities
- Improved infrastructure such as roads, opening
- Increase tree cover
- Improve carbon sequestration
- Increase business opportunities

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

- Increase waste (both solid and liquid) generation which will lead to poorly disposed and drainage blockage
- Increase demand for water and electricity supply during processing and transportation



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

- Solid waste should be collected properly and disposed by NEMA licensed disposal site  
- Rain water should be harvested to be used especially from pans and dams.

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Yes, due to interaction in different factor will lead to behavioral change.   
Heightened awareness creation on topical issues among the residents such as HIV, Aids and COVID 19

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

Through working with the legal framework and ensuring the reliable stakeholders.

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

Yes

10. Should the project continue?

Yes

THANK YOU FOR YOUR TIME

11/5/2021



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







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PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
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CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	Department of Agrics Animal Resource (Buda)
Organization/Institution	KEMHAT OTIENO
Represented & Contacts	(CARTH CROPS OFFICER)
Designation	CARTH CROPS OFFICER
Signature & Official stamp	
Date	18.8.2020

1. Give a brief of the institution's roles and mandate

- provision of public extension service  
to crop based farmers

2. How is your institution involved in the cotton Value chain?

- Capacity building of farmers (extension  
service)  
- Input supply (seed/fertilizer)  
- Information (extension)  
- Funding through AOT

3. Does your institution have any experience with BT Cotton crops? If yes, how?

- YES. - Same extension officer here  
in Kibera since commercialization  
- Training farmers  
- Participation during the awareness  
creation for the Biosafety bill/Act



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- High yield
- Profitability/high income to farmer
- Low pesticide use
- Spacing industrialization

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

- No

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- Increase in farmer income
- Reduction of pesticide use
- Better quality of cotton
- Low cost of production

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

- Loss of biodiversity
- Introduction of new pests



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

- Regular sensitization training or  
community building  
- Good Governance Practice

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Yes - Availability of more  
positive inputs can result  
into either negative or positive  
behaviour

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

- proper regulations and policies  
- proper system and system  
- stable government policy  
- continue community building

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

- The regulatory policy for  
Bt

10. Should the project continue? Yes

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries



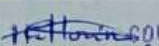


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PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	HALLORINE A. OTIENO.
Organization/Institution Represented & Contacts	DEPARTMENT OF AGRICULTURE & FOOD SECURITY, HOMA BAY COUNTY. BOX 71, 40300, HOMA BAY.
Designation	COUN AGRIULTURE OFFICER.
Signature & Official stamp	 COUNTY DIRECTOR OF AGRICULTURE HOMABAY COUNTY
Date	24 <sup>TH</sup> AUGUST 2020.

1. Give a brief of the institution's roles and mandate

To promote food security by enhancing production  
through efficient agricultural practices, value addition  
and post harvest management.

2. How is your institution involved in the cotton Value chain?

1. Seed cotton production through seed distribution.
2. Transfer of technology through cotton model farms.
3. Field visits and farmer trainings.
4. Promoting marketing of cotton through groups.

3. Does your institution have any experience with BT Cotton crops? If yes, how?

No. BT Cotton has not been adopted yet.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

Increased production

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

Yes: Bt cotton may require regular monitoring since it's a new variety and therefore may require additional staff to do the additional tasks on Bt cotton management.

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive Impacts

Socio-economical:

1. Improved livelihoods due to increased levels of income

Biological & Physical Impacts:

= New pests and diseases.

Mechanization should be improved from the open to machines

- \* from harvesting, seed selection, planting, weeding, harvesting to processing.

#### Negative Impacts (the risks and challenges that may come with the adoption of BT Cotton)

= New pests and diseases



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

1. Scouting and monitoring of the emerging pests and finding out adequate control chemical or any other method for control/prevention.

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Adoption of BT cotton would improve income of households and this would in turn help to change lives of people living with HIV/AIDS by enabling them to acquire access to medical services and better foods.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

1. sensitization of farmers on best Agronomic practices for BT cotton.
2. Provision of seeds and sustaining seed availability.
3. Putting in place rules and regulations on pricing and processing

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

A. Not sure.

10. Should the project continue?

Yes.

THANK YOU FOR YOUR TIME

11/5/2021



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







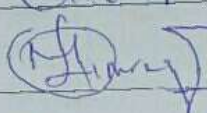

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**CLIENT:** BAYER EAST AFRICA LTD

**CONSULTANT:** BAYPAL CONSULTANCY FIRM

Name of the stakeholder	MOSES LOKODOR
Organization/Institution	BARINGO COUNTY GOVERNMENT
Represented & Contacts	Chief Officer
Designation	Chief Officer
Signature & Official stamp	 
Date	21/08/2020

1. Give a brief of the institution's roles and mandate

To facilitate the cooperative registration, election, Audits of cooperative funds, support in training & awareness to cooperative members on cooperative operations. Financial empowerment through loans and grants. Advise Agribusiness and resolve conflicts around cooperative rights & issues.

2. How is your institution involved in the cotton Value chain?

- Helping farmers

3. Does your institution have any experience with BT Cotton crops? If yes, how?

Yes - but we have not had a serious interaction.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- Creation of employment
- Increased yields
- Cooperatives will come up/active become active

\* 4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

- Generate more revenue for the county - Its a cash crop that we can depend on.
- There will be more work for the staff - Need for more staff.
- Challenge of duplication - cotton not yet diversified.

\* 5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological) and Physical Impacts) throughout the commercialization process? (during land preparation, seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- Create employment

**Negative Impacts** (the risks and challenges that may come with the adoption of BT Cotton)

- GMOS might affect soil fertility
- If the feed from BT cotton affects livestock, it will affect the health of humans - Need to be handled well.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV/AIDS, COVID-19 status of the area? Explain.

Yes. It will lead to more interaction of people where money always require social relations establish leading to the spread of the diseases.

8. How can commercialization and adoption of BT Cotton be made to benefit current and future generations?

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

No. Need to have a policy & regulation on BT cotton.

10. Should the project continue?

Yes. More research need to be done to ensure safety.

THANK YOU FOR YOUR TIME



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







# KII GUIDE

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PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH  
EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	JANE W. GITAU
Organization/Institution	MINISTRY OF AGRICULTURE LIVESTOCK & IRRIGATION - 0722384157
Represented & Contacts	ASSISTANT DIRECTOR - EXTENSION COUNTY DIRECTOR TRAINING OFFICE
Designation	IRRIIGATION & DRAINAGE BUNGOMA COUNTY P.O. BOX 634 BUNGOMA
Signature & Official stamp	
Date	28/08/2020

1. Give a brief of the institution's roles and mandate

Policy formulation for Agric. sector.  
Capacity building of farmers  
Building all the stakeholders in relation to MoA together

2. How is your institution involved in the cotton Value chain?

Capacity building of farmers in the Cotton value chain.  
Linkage to Research Institutions.  
Promotion of the Value chain to stakeholders

3. Does your institution have any experience with BT Cotton crops? If yes, how?

YES Through Capacity building by MoA  
at National Level



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

- Drought resistant varieties
- Increased production & productivity
- Economic growth along the value chain.

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

- Need for more staff.
- Need for renewal of existing policies
- Cascading of activities to County level.

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

- Reduction in use of chemical to control pest and diseases.
- Increased productivity hence improving the livelihood of farmers

#### Negative Impacts (the risks and challenges that may come with the adoption of BT Cotton)

- Need for pre-activity training to farmers and their progress will be monitored
- Need for increased staff on the ground hence increased spending at County level.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

- Cost sharing between the farmers and the Government.

- Use of Media to carry out promotion of BT cotton.

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV AIDS, COVID-19 status of the area? Explain.

- YES - Social Economic impact always increase the spread of diseases due to increased movement in the pocket.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

- Provision of seeds to farmers  
- Increased collaboration with stakeholders  
- Building capacity of our farmers

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

NO.

10. Should the project continue?

YES

THANK YOU FOR YOUR TIME

11/5/2021



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





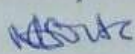
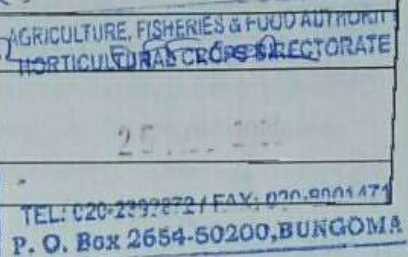


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CLIENT: BAYER EAST AFRICA LTD

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the stakeholder	CARDOL SORTA
Organization/Institution	AGRICULTURE AND FOOD AUTHORITY
Represented & Contacts	HORTICULTURAL CROPS DIRECTORATE 0724166802
Designation	HORTICULTURAL CROPS DIRECTORATE
Signature & Official stamp	 
Date	25/08/2020

1. Give a brief of the institution's roles and mandate

Horticultural crops Directorate is a regulatory of the horticulture sub-sector. Its mandate is to develop & promote scheduled crops through effective regulation.

2. How is your institution involved in the cotton Value chain?

Horticultural crops Directorate is a sister directorate under agriculture and food authority.

3. Does your institution have any experience with BT Cotton crops? If yes, how?

Yes. Especially fibre crops Directorate. We have highly qualified technical staff in the authority.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







What benefits will be derived from adopting BT cotton in Kenya?

1. Source of income for smallholder farmers.
2. Source of employment to the Kenyans.
3. New materials for agro processing.
4. Contribution to the GDP.
5. Foreign exchange earnings.

4. Will the proposed commercialization affect your current operations (staffing, monitoring, regulatory duties)? If yes, How?

No.

We have staff for the disease rate. The policies and regulations are clear and so there will be no effect but comply with

5. If the cotton commercialization is implemented, what do you foresee as the likely Environmental Impacts (socio-economical, Biological and Physical Impacts) throughout the commercialization process? (during land preparation, Seed distribution, planting and growing, harvesting, transportation and processing)

#### Positive impacts

1. Contribution to environmental sustainability
2. Improve rural livelihoods through improved incomes.
3. Reduce the burden of relying on imported seeds and clothes and improve on our local industry.

#### Negative Impacts {the risks and challenges that may come with the adoption of BT Cotton}

1. Low yields that are uneconomical.
2. Inadequate clean planting materials
3. Competition from other enterprises value chains that have high returns
4. High cost of inputs.



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







6. In your opinion, how can the negative impacts identified in the Q5 above be mitigated/prevented/reduced?

1. Research bodies come up with high yielding varieties for promotion.
2. The government promote availability of clear seed.
3. Enhance efforts to increase its competitiveness.
4. Policy issues to address farmers needs. not top down policies.

7. Do you think commercialization and adoption of BT cotton would have a direct impact on the HIV AIDS, COVID-19 status of the area? Explain.

Yes. A positive impact as stated in question 5.

8. How can commercialization and adoption of BT Cotton be sustained to benefit current and future generations?

By addressing the negative impacts mentioned in question 6 and any others.

9. Does the country have adequate enabling frameworks in place for adoption of transgenic crops?

Not at the moment.

10. Should the project continue?

A big YES.

THANK YOU FOR YOUR TIME

11/5/2021



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





THE MINUTES OF THE PUBLIC CONSULTATION MEETING (F&D) OF THE ESIA OF C&BT  
COTTON COMMERCIALIZATION HELD ON 17/08/2020 AT HARVEST CUNGH, MATAYOS TOWN

- |                                                                        |                                   |
|------------------------------------------------------------------------|-----------------------------------|
| 1. Vincent Egesa - Chairman Matayos Cotton Farmers Cooperative Society |                                   |
| 2. Samuel Owino -                                                      |                                   |
| 3. Wilbroda S. Nabwire                                                 | Donat Ojiambo Egesa               |
| 4. Samba I. Juma                                                       | Samuel Owino - M.O.A Matayos      |
| 5. V                                                                   | Amuono Chospine - AFA - FCB BGSIA |
| 6. Livingstone Nyongesa                                                | Baypal Consultancy Team.          |
| 7. Robert Odhore                                                       |                                   |
| Francis Othuku                                                         |                                   |

Min 1 Preliminaries

(10:30)

The Chairman of Matayos <sup>Society</sup> welcomed the farmers after a prayer by one of the members. The members were then introduced.  
Bay Ms Tonny Agutu then welcomed the <sup>team from</sup> Baypal Consultancy.



Min 2. Project Brief

The Agricultural and Food Authority explained to the meeting the current status of cotton farming in the area. He also explained the what BT Cotton entails.

Baypal Consultancy firm <sup>through Tonny Agutu</sup> then explained to its members what ESIA is, why it is done and the role of the farmers in the ESIA Process. Members were then welcomed to give their views freely.

Min 3: Deliberations

The meeting was informed that most farmers have not been informed about BT Cotton. This situation is due to the Covid-19 pandemic that led to stoppage of <sup>planned</sup> awareness of farmers.

The following were identified by the meeting as anticipated benefits:

- a) That its not attacked by most pests as conventional



The meeting suggested the following as mitigation measures for the anticipated negative impacts:

- 1) Train farmers on ~~the~~ financial Management
- 2) Do assessments on to and advise farmers on balanced Cotton and food crop farming to ensure food security.
3. Access to soft loans to
4. The government to cushion farmers in case of price fluctuations drops.
5. Use appropriate PPEs to and sensitize the farmers on the importance of using them - to minimize occupational issues, allergies.
6. Keep the seeds, chemicals away from children and handle well to avoid poisoning.
7. Burn Dump in a deep ditch and Burn the Packagings. Members deliberated and agreed that burning will have negative impacts to the environment and so other waste management <sup>have</sup> were suggested such as: Returning the packagings to seed distributors, buying, keep record of the waste produced.
8. Set aside other areas not used for cotton growing for tree planting to compensate for the cleared ones, Use Soil Conservation measures.

It was suggested that farmers be told early to prepare to buy the farm inputs to ensure sustainability of BT Cotton farming.

The members unanimously agreed that the Project be continued.

Matter Arising

Some members wanted to know the duration BT will take to mature, how sorting will be done (BT Cotton and other varieties).

The members unanimously agreed that the Project continue.

The meeting ended by a word of Prayer at 1300hrs.

Compiled by:

Caleb Obonyo

~~Signature~~

19/08/2020.

Confirmed by:

Vincent L

~~Signature~~





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Compiled by:

Caleb Obonyo

~~Signature~~

19/08/2020.

Confirmed by:

Vincent L

~~Signature~~







### Min 3: Deliberations

Opportunity was then given for the members to give their views on the benefits anticipated from the Commercialization of B1 Cotton. The following were identified:

1. Increased Cotton Production - A member ~~reported~~ <sup>at least</sup> that she attended a training and saw a B1 Cotton field ~~about~~ <sup>at least</sup> 25 bolls of Cotton compared to Less than 50 of Conventional/Local Variety.
2. The B1 Cotton is of high quality (Less of ~~BB~~ <sup>Low</sup> ~~High~~ quality and more of ~~AB~~ <sup>High</sup> quality).
3. Employment opportunities - Ginneries will be established, Secondary businesses will spring up, Labour will be required in the farms - These will ~~be~~ <sup>be</sup> sources of income to the locals thus improving the lives of the locals.
4. B1 Cotton's leaves ~~are~~ will provide nutrients to the soil. and A member gave an account on how ~~they~~ <sup>she</sup> ~~was~~ <sup>was</sup> trained on the benefit of the leaves on the soil - provides nutrients that ~~are~~ <sup>are</sup> favour the (growth of Sorghum).
5. Other Products will be derived from the Cotton during processing eg Cooking oil, <sup>fat</sup> ~~fat~~ product used in making ~~Notes~~ <sup>Notes</sup> - providing additional income.
- \* The members expressed fears ~~that~~ of exploitation <sup>beneficial</sup> ~~since~~ by lack of Ginneries within their Region. That is, all the <sup>by-products</sup> ~~by-products~~ from processing they don't get.

The members then discussed the possible negative impacts of B1 Cotton to the Community. The following were identified:

1. Health Impacts - A member inquired the veracity of what she heard that the pesticides have negative impacts on animals and humans. Another member added that children under 5 and Pregnant women should not be in the farms.



It was agreed by the members that the project of  
Commercializing BT to go on.

The Chairperson of the Cooperative Union thanked every member  
and for their time and contributions.

There being no other business, the meeting ended at  
1630 Hrs by a word of prayer from one of the  
members.

Minutes Recorded by:

NAME: Caleb Obonyo


17/08/2020

SIGN: ~~Signature~~ 

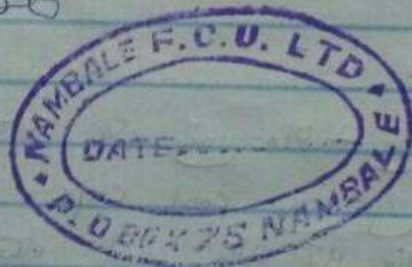
Confirmed by

NAME: MART NANOI ODEMBIA

DESIGNATION: CHAIRPERSON

SIGN: 

DATE: 17/8/2020





Minutes of PFGD Meeting for ESIA of BT Cotton Commercialization held on 18/05/2020 at Jairo's Ginners Premises, Taso North.

### Attendance

1. See attached list of attendees
2. Baypal Consultancy firm Team
3. Chris Amuno - Agriculture and Food Authority (AFA) Officer - Busia County.
4. Gregory - NAFHCO representative.

### Agenda.

- Preliminaries
- Project Brief
- Deliberations
- A.O.B.



### Min 1. Preliminaries

The meeting started at 1050 Hrs with a prayer from one of the members. The AFA officer - Busia County introduced the introductory session for the local community. He then gave the Baypal team the opportunity to introduce the members and facilitate the subsequent sessions.

The chairman of the Cooperative Society then was given opportunity to give a brief history of the society.

### Min 2: Project Brief

Mr. Tony Agutu briefed the meeting on the relevance of Environmental and Social Impact Assessment (ESIA) and how it affects BT Cotton farming. Members were asked if they have heard about/had an encounter with BT Cotton. Members were aware, some having been attended field days/trainings organized to create awareness, some heard from other farmers and some have even received the seeds.



### Min 3: Deliberations

Opportunity was given to members to give their views on the benefits they have heard, experienced from Demonstration farms.

The following were the ~~the~~ likely benefits identified:

- i) The B<sup>i</sup> Cotton Variety shows signs of <sup>improved</sup> good yields as the no. of bolls are more than the Conventional Cotton (KSA),
- ii) B<sup>i</sup> Cotton does not need a lot of spraying (experience from demonstration plots).
- iii) Improved Income due to likelihood of improved Cotton Productivity
- iv) Improved living standard - Improved income.
- v) Youth will be encouraged to stop idling and venture into gainful activity thus reduction in criminal activities
- vi) Will lead to improvement in production of other agricultural products as farmers will have money to buy and grow other crops.
- vii) Employment at the ginnery and farms - A member stated that the ginnery if in the area, ~~will~~ if operational, will employ many people.
- ix) Increased soil fertility - that the leaves have nutrients good for sorghum growing.

### Negative Impacts and Mitigation Strategies

The following were the likely negative impacts that were identified:

- i) There can be total loss if proper care is not given to the cotton.
- ii) Lack of Market - that it is likely the produce be exported to Uganda and other countries thus the region ~~does~~ will not get the best of Cotton farming - area will not develop.

The members suggested that the ginneries be established and maintained within the localities of the farmers and restrict exportation of Cotton.

- iii) Low <sup>crop</sup> food production in case cotton food crops are abandoned.

It was suggested that members be sensitized so that they plan their farming activities to set aside some farms for food crops. Set aside portions of income from cotton to purchase food.

- iv) May lead to deforestation (turning forests to cotton farms) that <sup>will</sup> results in reduced rains, soil erosion, lack of firewood.



Members suggested that the farmers be sensitized to conserve the forests and plant more trees especially in areas that will not be used as farms; plant trees that can be planted with together with crops.

v> ~~Living health imp~~

v> Possible negative impacts on human, animal and environmental health (Containers with chemicals can pollute waters, be ingested by children etc). The members suggested that a special disposal sites be set designated for the waste associated with BT Cotton especially the chemicals;

vi> Increased social issues, - Domestic Conflicts, Persecution, - A member gave examples such as killings, insults, - Mitigation: involve all family members in money mgmt.

vii) Mismanagement of finances - A modality should be arrived at that so that farmers are not given lumpsome cash at once; & Training on financial management.

\* It was suggested that the government to provide loans, insurances to farmers so that in case of losses due to climatic conditions, pests etc they can be compensated. The loans to aid in buying of farm inputs, weeding and harvesting - This will enable farmers to plant and harvest at the right time.

viii) That there might be unforeseen impacts since it is a new variety.

To ensure sustainability of cotton (BT) farming, the members it was suggested that the seeds be packaged in small packets so that all classes of community members can afford. (as opposed to the current packaging.) & the packets & the price be lowered; that the local/conventional variety be ~~not~~ not abandoned.

• Whether the commercialization should continue or not, the ~~most~~ most members agreed that it <sup>should</sup> continue. Some said they would give their views after harvesting from demonstrative plots. - Then they would be sure of the performance of BT cotton.

The meeting ended at 1250 HRS by a word of Prayer from a member.

Compiled by  
Caleb Obonyo

~~Signature~~

18/08/2020.

Confirmed by:  
AGREY EMOJO NJ  
~~Signature~~



Minutes of the FGD Meeting for ESIA of BT Cotton Commercialization held on 21/08/2020. at Madiany Ginnery Premises (Uyoma Cooperative Society), Ravieda.

Present

1. See attached list
2. Baypal Consultancy Firm Ltd Team.

Agenda

1. Introduction
2. Deliberations
3. AOB



Min 1: Introduction

The meeting was started at 2:00 PM by a prayer from the Vice-chairman of Uyoma Cooperative Society. The Society's chairman then welcomed the Consultants and the farmers to the meeting. Mr. Cabb Obonyo then <sup>introduced</sup> ~~welcomed~~ the Consultants and informed the members the mission of the meeting.

The farmers were informed the members that they do not know much about BT Cotton. Mr. Obonyo from Baypal Consultancy Ltd then explained what BT entails and the relevance of the assessment to the ~~BT~~ Proposed Project.

Min 2: Deliberations

The following were raised as ~~be~~ likely benefits from the BT Cotton roll-out in the area:

- i) Reduction of Criminal activities in the area - Youth will be engaged and will be lifted economically.
- ii) Save Farmers money - Because its anticipated to resist ~~p~~ bollworm which is the major ~~part~~ reason for spraying the ~~f~~ Cotton farms.
- iii) Job creation -
- iv) Will save farmers time - The time that would otherwise be utilized in spraying the farms would be used in doing other fruitful activities.
- v) Improve health of farmers - Due to reduced spraying regimes.



- vi) Improved family cohesion - The head of the family would be able to provide for the family thus reducing the risk.
- vii) The farmers expect that BT Cotton could resist a destructive pest 'Onyini' (Cousin like cricket). The ~~last~~ conventional cotton is a better resistant to the pest.
- viii) Improved Cotton Production thus improved standards of living.
- ix) Benefits from other products from cotton processing eg cotton oil, seeds (so farmers would not buy seeds).

The members then deliberated on likely negative impacts. The following were discussed:

- i) Likelihood of reduction in food security in case food crop farming is abandoned in favour of cotton growing - Lack of <sup>food</sup> variety of crops.

- ii) May result in cultural and social disruptions - farmers may decide to live in clusters as opposed to the current cultural setups.
- iii) May lead to clearance of the vegetation, some of which are medicinal, fruit trees, fertilize the soil, conserve soil erosion etc. These may be lost if cotton is embraced in a bid to maximize income from cotton. This will lead to destruction by wind, reduced rainfall.
- iv) The chemicals used in spraying the BT Cotton may have negative impacts on the health of animals and plants. When the chemicals get into the drinking water, eaten by animals.

- v) School dropout among students/pupils <sup>and child labour</sup> - The students would prefer to earn income than go to school. This would lead to early pregnancies, illiteracy etc. - Strict enforcement of anti-child labour laws, embracing boarding schooling, sensitize the community to invest in child educating the children, to minimize/diminish this.

- vi) Negative behavioural changes as a result of increased <sup>income</sup> ~~revenue~~ - Likelihood of increased prostitution, drunkenness, family break-ups etc.

- Educate the farmers on financial management/literacy, the local administration to enforce law and order, & Not paying cases to farmer through bank.

- v) ~~from~~ Increased mismanagement of chemical wastes + leading environmental pollution (health problems). A member relayed to the meeting the current <sup>used</sup> ~~most~~ chemical containers (wastes), is that they are dumped in open areas - which is very risky. Eg 'polytrin' = Pesticide was very corrosive, the containers may emit harmful wastes.

Mitigation :- Adhere to instructions contained in the chemical's Data Sheet.

- Partnership with the companies supplying the chemicals so as to collect the ~~Pesticide~~ containers.



Minutes of the Public Consultation with Sakwa/Imbo FCS for ESIA of BT Cotton Commercialization held on 20/08/2020 at Bondo Cotton Store, Bondo SubCounty.

Present

1. See attached list of Participants.
2. Baypal Consultancy firm Team
- 3.

### Agenda

1. Preliminaries
2. Brief of the Project
3. Deliberations.

#### Min 1: Preliminaries

The meeting started at 10:30 AM with a prayer from a member. The chairman of the Sakwa Imbo Cotton Farmers Cooperative Society then <sup>and introduced</sup> welcomed the Members.

A brief history and mandate ~~was~~ then of the Coop. Society was then described. ~~to the meeting.~~

#### Min 2: Project Brief

The Coop Society <sup>Executive</sup> members were aware of BT Cotton as they had been informed by AFA, various <sup>government departments</sup> ~~of~~ Farmers (other than the executive). Most farmers ~~who~~ are not aware of what BT Cotton entails.

The Bay Facilitator informed ~~to~~ the meeting the relevance of ~~the~~ ESIA and how Proposed BT Cotton need to be subjected to ESIA. Members were then asked to ~~be~~ free to give their views.

#### Min 3: Deliberations

Possible positive impacts of the Proposed Project.

i) High yield translating to high income.

ii) Minimal reduced expenses as spraying is expected to be minimal.



- ii) Will reduce Poverty levels - The currently ~~to~~ unemployed will find an economic activity to do.
- iii) Likely to withstand harsh weather (as is the case in the area) so idle land will be put to gainful use.
- iv) Likely to spur development in the area eg development of Ginnery, Security, Seeds can be locally sourced from the ginneries.
- v) Will be source of <sup>increased</sup> employment in the area.
- vi) Possibility of reduced low quality cotton since the bollworm is that is a major contributor to low quality will be eliminated/reduced.
- vii) Improved standards of living.
- viii) Is in line with the traditional farming in the area.

### Possible Negative Impacts.

- i) May result in infertility of soil - Local variety adds to soil fertility
- ii) Farmers may not embrace the Bt Cotton variety <sup>fully</sup> since ~~it~~ its still new + leading to losses.
- iii) Likelihood of reduced seed production as <sup>is</sup> with the case with other transgenic plants. This would reduce the weight of raw cotton thus reduction in <sup>proportionate</sup> income to farmers.
- iv) May result in families breaking up.
- v) Moral decadence - ~~p~~ with increased income, there is likely increase in prostitution, thuggery, drug abuse etc.
  - Instill discipline in the community.
  - Involve the local administration, police in enforcing the law.
- vi) Clearance of vegetation to give way for farming - will lead to loss of biodiversity, etc increased destruction by wind, reduced + rainfall amounts, dust generation etc.
  - Mitigation: Planting trees <sup>or</sup> a separate piece of land to compensate for the ~~cut~~ cleared trees.
  - Embrace <sup>other</sup> soil erosion prevention measures.



Occupational health Problems: Increased Bt cotton would mean more work in harvesting etc.  
Mitigation: Use PPE.

v) possibility of reduced food crop production - Farmers may abandon food crop farming - This will lead to Malnourishment.

vi) Mitigation: Sensitize farmers not to neglect food crop production.  
- A Carryout soil tests and advise the farmers to plant food crops in areas that may will not favour Cotton growing.

vii) Solid Waste generation - Chemical Containers.

Mitigation: - The Companies distributing the chemicals to partner with farmers to collect the Co. Wastes.

- Bury Bury the Containers beyond the reach of humans.

Other Mitigation measures:

- Advise the farmers on the fertilizer appropriate to the area to improve the soil fertility.

- Farmers to diversify their sources of income to avoid total losses in case of Bt Cotton failures.

\*A member informed the meeting that all the deliberations are not from experience but from what the farmers have heard from training/other farmers.

The members highly welcome the Proposed Project.

There being no other ~~other~~ business for discussion, the Meeting ended at 1220 hours by a prayer from Mr. Madam Ateio.

Compiled by

Caleb Okomo

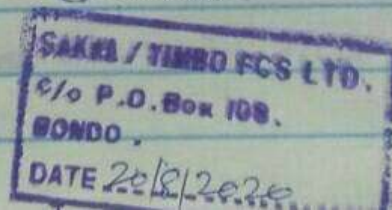
~~James JH~~

Confirmed by

Vitalis Owuor Kanga - Chairman.

Atty.

20/8/2020.





MINUTES OF THE PUBLIC CONSULTATION MEETING WITH MEMBERS OF PALA COTTON GROWERS COOPERATIVE SOCIETY-ON ES/A OF BT COTTON COMMERCIALIZATION HELD ON 21/08/2020 AT THE SOCIETY'S OFFICES.

present

1. See attached list of Participants.
2. Team from Baypal Consultancy firm Ltd.



### Agenda.

1. Preliminaries
2. Brief of the Project
3. Deliberation

#### Min 1: Preliminaries

The meeting started at 10:50 A.M with Mr. Akoko (Coop. Society chairman) welcoming the members and introducing the members and the consultants. The Society's chairman then informed the meeting of what BT Cotton is.

#### Min 2: Project Brief

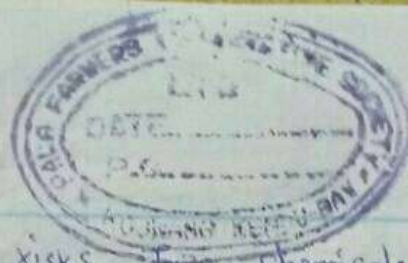
The facilitator asked the group to know their awareness of BT Cotton among members. Generally members are aware from radio, ~~present~~ trainings/field days organized by AFA and from other farmers.

#### Min 3: Deliberations

Members of the meeting identified the following as the probable benefits of BT Cotton upon commercialization.

- i> Possibility that the economy of the area will improve as there will be improved revenue leading to increased money ~~area~~ circulation.
- ii> Reduced cost ~~ing~~ of chemicals used - thus reducing production cost.





- iii> Reduced health risks from chemicals due to reduced spraying regime as opposed to conventional one.
- iv> Reduced amount of wastes p (used chemical containers) - Conventional Cotton requires a lot of spraying ~~producing~~ leading to generation of more solid wastes.
- A member related a situation he observed in Narok County where accumulation of ~~waste from~~ chemical wastes led to death of birds, vegetation.
- v> Improved quality of Cotton - Since BT Cotton is resistant to Bollworm, the BL (Low quality cotton) Cotton will be less as Bollworm is its major cause of low quality Cotton - This will lead to improved revenue to farmers.
- vi> Improved health - Farmers would be able to have ~~enough~~ enough food to boost their immunity - This reduction in diseases.

i> Likelihood of negative impact on animals (Since its impact is not yet ascertained).

Mitigation: Fence off the Cotton farms until <sup>it is</sup> impacts ascertained that it cannot negatively affect the animals.

ii> Conflicts, family disunity - ~~It~~ In case one family member disappears with the money.

iii> Moral decadence in the community - due to increased money in the community.

Mitigation: - Have joint Account (Husband and Wife) where one partner can not withdraw the bank money without the other partner.

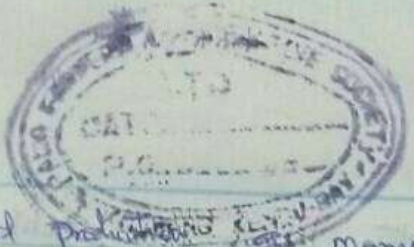
- Embrace Christianity and good Morals.

- Involve the whole family in planning and use of the money.

- Have Self-Control especially among men.

iv> HIV/AIDS - ~~kinship~~ Members discussed and some were of the opinion that BT-Cotton farming will not affect the prevalence of HIV/AIDS Others said the infections are likely to increase.





v) May lower food production ~~lead~~ many farmers may take lightly lightly food crop farming — leading to ~~the~~ famine.  
The Community believes that produce from the farm is better than food bought from the market. — So having money may not satisfy the farmers

Mitigation: — farm planning — planting various crops or not only cotton.  
— Encourage farmers to plant fast growing and high yielding food crops to create interest in food crop production

vi) Increased chemical pollution to <sup>the</sup> water bodies — as the number of farmers doing cotton will increase leading wide spread pollution — this will affect water quality, soil pollution.

vii) Occupational diseases — Those handling the chemicals may be negatively affected. A member <sup>opined</sup> suggested that the chemicals used nowadays have less impact on humans.

a Use PPEs to prevent the diseases/disorders.

— Ensure emergency responses are put in place.

viii) Increase in HIV/AIDS, <sup>COVID</sup> Prostitution — Cotton Buyers would be coming from far and wide which may result in Prostitution, spread of COVID-19, HIV etc.


Mitigation: Adhere to Government's COVID-19 mitigation measures.

— Educate farmers and community on ~~the~~ the likely negative impacts.

The farmers suggested that the seeds of BT Cotton be made readily available and cheaper prices to ensure its sustainability.

Farmers at the meeting ~~also~~ gave a nod to the BT Cotton implementation. Others expressed reservations because they have not had an encounter with the cotton variety.





for delib

Caleb Obonyo

~~James~~ J.

21/08/2020

Confirmed by:

JOHN Kwayya

74250

*[Signature]*

21/8/2020

I.D. 1570026/0712360639





MINUTES OF THE PUBLIC CONSULTATION MEETING, WITH KANTADA COTTON FARMERS COOPERATIVE MEMBERS ON BT-COTTON COMMERCIALIZATION (ESIA) HELD ON 21/08/2020 AT THE SOCIETY'S OFFICE.

Present

1. See attached list of Participants.
2. Term of From Baypal Consultancy firm.



Minute 1: Preliminaries.

Mr. Apirya, the chairman of the Society welcomed and introduced the Society's members who attended the meeting. The chairman then gave a brief history of the Society.

Min 2: Brief of the BT Cotton, ESIA.

Some of the members have ~~been~~ attended <sup>field days about</sup> seminars on BT.

BT. 1

The Consultants then explained the role of ESIA and why it is done.

Min 3 Deliberations.

The members were led to give their views based on the anticipated benefits, negative impacts and <sup>possible</sup> mitigation measures.

There were identified as the <sup>possible</sup> benefits:

- i) Improve fields since it can resist Bollworm, <sup>will have</sup> less more bolls.
- ii) ~~Can~~ possibility of prolonged period of harvesting.
- iii) May lead to improved standard of living if remuneration from cotton is improved, if fields are ~~in~~ high.
- iv) Cost of Cotton production will reduce  $\rightarrow$  less pesticides will be used.
- v) ~~to~~ The farms <sup>water</sup> and farmers are will be healthier as there will be less chemicals used.
- vi) High quality and yield of Cotton.
- vii) May not pose ~~p~~ risks to domestic animals as little chemicals are used.



vii) Its expected to (grow faster thus ~~is~~ more short time as compared to conventional ones.



### Anticipated negative impacts

i) Crop failures due to unpredictable rainfalls in the area.

Mitigation: Have ~~an~~ irrigation in place.

ii) Pesticides and fertilizers <sup>delays</sup> may delay planting/spraying thus leading to losses.

Mitigation: Provide fertilizers and pesticides in time.

iii) Lowered food crop farming leading to famine due to abandonment of food crop farming.

Mitigation: Do land planning, plant various food crops on separate pieces of land to enhance yields.

iv) Mismanagement of finances leading to conflicts in the society.

Mitigation Measures: Family members plan together on how to ~~use~~ spend the revenue from cotton.

- Sensitization and training farmers on financial management.
- Not giving cash to farmers; depositing in banks.

v) Deforestation: - ~~With~~ The area does not have a lot of trees. However some areas will have to be cleared, thus leading to negative impacts eg soil erosion, reduced rainfall in the area.

Mitigation: planting more trees, ~~avoiding~~ only clearing the areas that are earmarked for cotton farming.

To ensure sustainability of Bi Cotton Farming, its members said they will have secure Gov stores that would prevent lowering of ~~the~~ seed quality; Society offering soft loans to farmers; and credit.





Members  
BT Cotton  
does well  
in the piloting BT having additional ability to resist better produce.

The meeting ended at 1500hrs with a word of prayer.

Compiled by:  
Caleb Obonyo  
~~James~~ *[Signature]*

Confirmed by:

~~Richard Opiyo~~  
SECRETARY

*[Signature]*





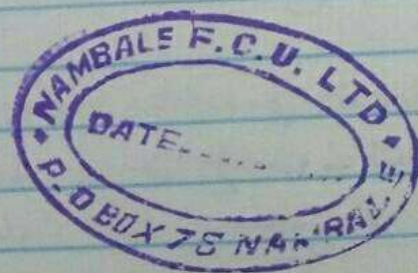
MINUTES OF THE PUBLIC CONSULTATION MEETING ON BT COTTON COMMERCIALIZATION  
HELD ON 17/08/2020 AT NAMBALE COOP UNION OFFICES, NAMBALE.

Present

1. See attached list of attendees (farmers and Cotton Coop. Society members).
2. Baypal Consultancy firm Ltd Team.
- 3.

Agenda

1. Preliminaries - Introduction
2. Project Briefing
3. Deliberations
4. AOB



Min 1: Preliminaries

The meeting started at 1430hrs by a word of prayer from one of the members.

Nambale Cooperative Union Chairperson welcomed everybody in attendance to the meeting and introduced the Cooperative Union members, and ~~he~~ she then welcomed the representative from Baypal Consultancy firm <sup>(BCF)</sup> to welcome the BCF team.

A member from the Cooperative Union then gave the a brief history of Nambale Cooperative Union

Min 2: Brief of the Project

Mr. Wycliffe Opiyo gave a detailed informed the meeting of what ESIA is, its relevance to BT Cotton Commercialization. He went ahead to explain what BT Cotton entails.

All the attendees were aware / or had heard of BT Cotton from the AFA, BT Cotton distributor and Trained Com members of the Coop. Society.

Mr. Gregory from NAHTCO went ahead to ~~ex~~ and explained provided more information on BT Cotton: Reduces Bollworm by over 60%, improved production,

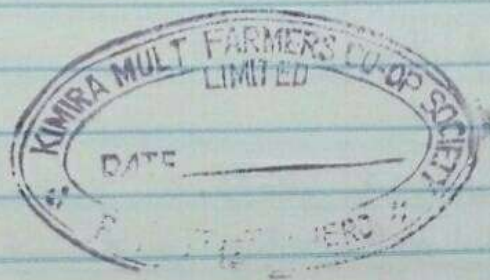


PV

## MINUTES OF THE PUBLIC ~~EDU~~ PARTICIPATION MEETING

### Present

1. Brian Odhiambo
2. David Otieno - Arasi
3. Risper Auma - Member
4. Joseph Okello Okello - Farmer
5. CARILUS Juma - Member - ~~Arasi~~
6. Francis Oigondo - Chairman Kimira Cooperative Society.



### Min 1: Introduction

Mr. Caleb Obonyo from Baykal introduced the team and called on the chairman of the cooperative society to introduce his committee and the farmers in attendance. Mr. Obonyo then briefed the meeting on the aim of the meeting which was to seek the views of the committee members, farmers on the commercialization of BT cotton.

### Min 2: Deliberations.

It was established that members of the society were well aware of BT cotton in the area having been trained by ASPSP.

The following were identified as the possible positive impacts of BT cotton upon inquiry:

- ① High yields arising from bigger balls projected at 3ton/acre
- ② Faster maturity as compared to other varieties eg the conventional cotton variety.
- ③ Creation of employment at different levels of production eg farm workers, loaders, transport etc.



- ④ Other related business activities such as sale of animal feeds will be improved.
- ⑤ Income earned from sale of cotton can be used to fend for families and meet family needs.
- ⑥ More people are likely to embrace cotton farming due to the benefits associated with the BT cotton variety.
- ⑦ Economic growth to be experienced in the areas and communities where BT cotton will be grown.
- ⑧ The cooperative society will benefit from more funds obtained from commissions gotten from sale of cotton.

The meeting also established the following to be the possible negative impacts of commercialization of BT cotton:

1. Loss of family ties arising from family funds due to misappropriation of funds (obtained from sale of large volumes of cotton) by family heads.
2. Over-reliance on cotton farming due to benefits accrued from BT cotton may pose a threat to food security. This is due to the fact that some farmers may completely abandon food crop farming to embrace cotton farming.
3. There is uncertainty on the likelihood of the crop to produce byproducts such as oil and animal feeds.
4. Increase in the number of unregistered buyers of cotton.

Mitigation measures on the above negative impacts were arrived at as follows:

- \* a) Farmers should be sensitized on the importance of incorporating food crop farming alongside cotton



farming. This is in a bid to mitigate the threat posed on food security.

b) Society members found selling cotton to the unregistered traders should be fined so as to avert losses associated with this.

c) A lot of research should be carried out by governmental and Non-governmental organisations to provide more information on BT cotton.

d) A member of the society suggested that farmers and farmer groups should be given enough funding to boost their operations.

e) It was suggested by a member that cotton societies should be provided with tractors to aid in their operations.

f) Another member suggested on the need of having a revolving fund to help in early and timely payment of cotton.

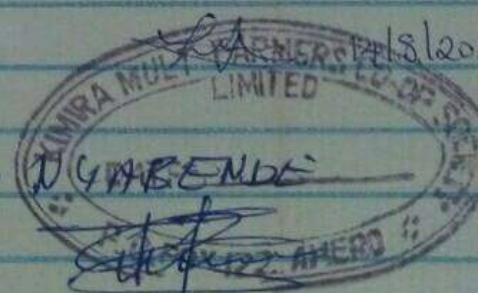
g) It was suggested by a member that the cotton sector should have a better pricing policy and the need to have a ginery close by.

It was unanimously agreed that the project should be implemented.

There being no any other business the meeting ended at 1620 hrs.

Compile by: Tonny Agutu

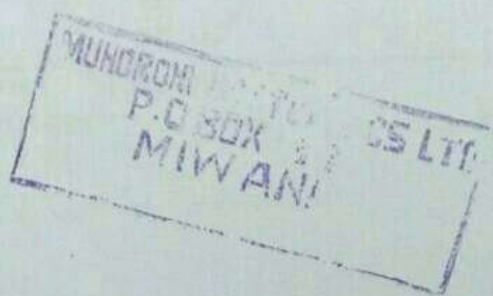
Confirmed by: FRANCIS O. N. G. N. U. P.  
CHAIRPERSON



14/08/2020



# MINUTES OF THE PUBLIC CONSULTATION MEETING, HELD IN MASOGO BN CENTE ON 14/08/2020.



## Present

1. Baypal Consultancy firm Team.
2. Zulkayo Ogondo - Secretary (Masogo Nyangoma ward)
3. Susan Odawa - Treasurer (Miwani ward)
4. Albert Pala - Member - Ombeyi ward
5. Josephat Okelo - Committee Member - Ombeyi Ward
6. William Ochilo - Farmer - Miwani Ward
7. Caroline Kepha - Member - (Masogo - Nyangoma ward)
8. Kepha Ogola - Chairman

## Min1: Introduction

Mr. Opiyo from Baypal Consultancy firm called the meeting to order and introduced the Baypal team. Called on the chairman of the Cooperative Society to introduce the Committee members and other farmers. Mr. Opiyo then briefed the meeting on the main object of the meeting - to seek the views of the Committee members, farmers on the Commercialization of BT Cotton.

Chairman of the Cooperative informed the meeting that the Group was formed with the aim of improving the lives of the locals by improving Cotton Production. He also described the roles and mandate of the Cooperative Society.

## Min2: Deliberations

Members of the community were aware of the plan to introduce BT Cotton in the area having been trained by ASDSP, Ministry of Agriculture and Food Authority (AFA).

The meeting identified the following as the possible positive impacts from the BT Cotton Commercialization:

- ① Less chemicals (Pesticides, fertilizers) Since the plant is resistant to most Pesticides so farmers will spend less.
- ② Grows and matures faster than conventional Cotton
- ③ High quality Cotton unlike the " (AR grade only).
- ④ Improved Cotton yield (1 acre about 300kg) - BT has
- ⑤ Will encourage the youth to venture into Cotton farming since does not involve alot of labour.
- ⑥ The BT Cotton to be planted as Pure stand thus its possible to estimate Production of Cotton.



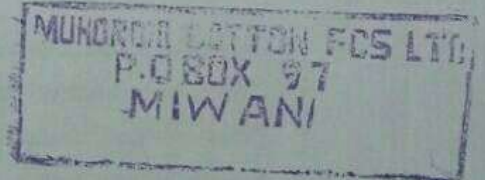
on the trials, ~~the~~ BT Cotton can be intercropped with other crops.  
anticipated

A member expressed fears if all these benefits will be realized since the venture will require some finance, equipments which may not be available to the farmers.

7. From the trials, few (about 2) seeds are planted per hole unlike the conventional Cotton.
8. Economic development will be improved - Ginneries, textiles will be established.

### Negative Impacts anticipated

- ① Uncertainties Concerning the impacts of BT Cotton in the long run, whether BT's cotton can perform as conventional cotton.
- ② The chemicals that are used can be detrimental to health, environment.
- ③ In case the BT cotton can not be intercropped with other crops - this can decrease the food security in the region.
- ④ Possibility of increased moral decadence in the due to increased income - Eg prostitution, - leading to increased HIV/AIDS
- ⑤ Exploitation of farmers in securing seeds, equipments etc - by charging exorbitantly for it.
- ⑥ There will be improved economic development - Ginneries and textile indus
- ⑦ Uncertainties on the effects on animals - the conventional cotton are used as animal feed without negative effects.



### Suggested Mitigation to negative Impacts

- ✓ Do research to find the impacts on the health of animals and environment
- ✓ Establish cottage industries (Ginneries) to ensure maximum benefit from the by products from cotton by the locals in the area
- ✓ Create or Sensitize the farmers on the wise use of money - Deposit the money to the Banks to reduce money being stolen
- ✓ To ensure food crop security, do not abandon food crop farming.
- ✓ Use PPEs while handling chemicals.
- ✓ Ensure all used containers be collected in special boxes and disposed by the supplying companies. Supplying the chemicals.
- ✓ Sensitize the farmers/locals not to use the used chemical containers.



Discourage burning of the chemical waste since the fumes from the waste can be a health hazard.

- A member suggested that to ensure sustainability of BT cotton farming, if approved, Gineries and industries must be set-up locally, and seeds sold cheaply, soft loans provided to farmers, laws be enacted to remove bottlenecks in agriculture eg youth who have not attained the age of 18 should not be barred from accessing agricultural facilities.

~~All the~~  
It was unanimously agreed that the project be implemented.

There being no other business the meeting ended at 1305hrs by a prayer from one of the members.

Compiled by:

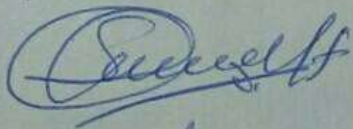
Caleb Obonyo

~~James J.~~

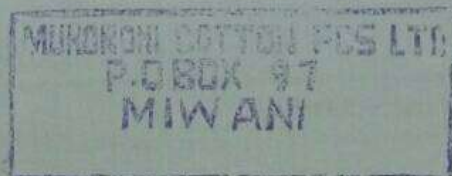
14/08/2020.

Confirmed by:

KEPHA OGOLA — CHAIRMAN  
MUKORONI COTTON COOP S. L. R.



14/8/2020.





KANYADA COTTON FARMERS  
COOPERATIVE SOCIETY  
HOMA-BAY SUB-COUNTY.  
HOMA BAY COUNTY.



### FGD INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name, Designation and contacts.	Institution/Organization	Signature & Stamp
21-8-2020	RICHARD OPILYO OLUO	KANYADA COTTON CO-OP. SECRETARY	0725267819 [Signature]
21/08/2020	SERFINE GWAYO 0746424411	KANYADA COTTON CO-OP	[Signature]
21/08/2020	SILILA DUMA	KANYADA CO-OP	0792403959 S.A.
21/08/2020	Elisba Opiyo	Kanyada	0729658394 [Signature]
21/08/2020	Josephine Afirene	Kanyada CO-OP	0702558716 [Signature]
21/08/2020	Denise O. Obuya	0716002146 Kanyada Co.op	[Signature]



Republic of Kenya  
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# PALA FARMERS CO-OPERATIVE K HOMABAT COUNTY



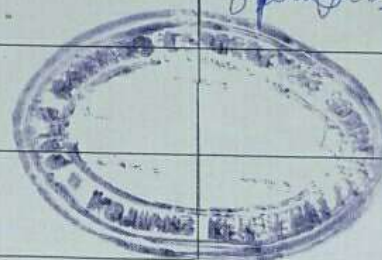
## FGD INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name, Designation and Contacts.	Institution/Organization	Signature & Stamp
21/8/2020	JOHN K. AKOYO Chairman ID 1570026 0712360639	PALA FARMERS GROWERS COTTON CO-OPERATIVE SOCIETY.	
21/8/2020	ERICK OUMA AJAJA 0707293795 FARMER	PALA FARMERS GROWERS COTTON - CO-OPERATIVE SOCIETY	
21/08/2020	JOHN OBOYA ODEMBU 0717314694 FARMER	PALA FARMERS GR. COTTON - CO-OPERATIVE	
21/08/2020	DAVID M. MAGAK 0717510305 FARMER	PALA FARMERS COTTON FARMERS	
21/8/2020	SARAH A. KUNGA 0710719332 TREASURER	PALA COTTON GROWERS CO-OPERATIVE SOCIETY.	
21/8/2020	GERSHON O. ODIDI 0715168762 0727123769 MEMBER	PALA COTTON GROWERS SOCIETY	
21/8/2020	LOICE A. OSOME 0723731935 MEMBER	PALA COTTON GROWERS CO-OPERATIVE SOCIETY.	
21/08/2020	PETER L. AGUNDO 0700-288784 MEMBER	PALA COTTON GROWERS CO-OPERATIVE SOCIETY.	
1)	TOM M. AKECH 0721523579 FARMER	1)	



Republic of Kenya  
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# MUHORONI SUB-COUNTY KISUMU COUNTY



## FGD INTERVIEW ATTENDANTS' LIST MUHORONI COTTON FARMERS COOPERATIVE SOCIETY

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name	Institution/Organization	Signature & Stamp
14/8/2020	0706464601 ZAKATO OSOMBA OGONDA ✓	MUHORONI COTTON F.C.S LTD (HON. SEC)	
14/8/2020	SUSAN AWUOR JUNIA TEL. 0727242594 ✓	MUHORONI COTTON F.C.S LTD (TREASURER)	
14/8/2020	SILVAN KEPHA OGOLLA 0724669561 ✓	MUHORONI COTTON F.C.S LTD - CHAIRMAN	
14/8/2020	ALBERT BALA KISEGE 0716483709 (VICE CHAIR) ✓	MUHORONI COTTON F.C.S LTD	
14/8/2020	JOSEPHAT OKELLO BWAKA 0723497786 ✓	MUHORONI COTTON F.C.S LTD - COMMITTEE	
14/8/2020	WILLIAM OCHINDO ✓ MIDIRA - FARMER 0724669561	MUHORONI COTTON F.C.S LTD	W. midira
14/8/2020	0724607162 CAROLINE ANYANGO ✓ AKERLO - FARMER	MUHORONI COTTON F.C.S LTD	

MUHORONI COTTON FCS LTD  
P.O BOX 97  
MIWANI



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





MUHORONI & NYANDO SUB-COUNTIES  
KISUMU COUNTY



FGD INTERVIEW ATTENDANTS' LIST **KIMIRA MULTIPURPOSE FARMERS COOPERATIVE**

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name	Institution/Organization	Signature & Stamp
14/8/20	CARILUS SUMA OMENYA ASST. CHAIRMAN 0713424089 ✓	KIMIRA FARMERS COOPERATIVE SOCIETY MUHORONI-AHERO	CJW
14/8/20	JOSEPH OKELLO OKELLO MEMBER 0727993817 ✓	KIMIRA FARMERS COOPERATIVE SOCIETY	ng
14/8/2020	RISPER AUMA ODUNGO MEMBER 0727041439 ✓	KIMIRA FARMERS COOPERATIVE SOCIETY	RE
14/8/2020	David Okieno ✓ 0787164214	Cooperative Kimira 0792693698	DL
14/8/2020	BRYAN OUMA ODHIAMBO MEMBER 0724446456 ✓	KIMIRA - COP. SOCIETY	B+
14/08/2020	FRANCIS ONG'ENDO CHAIRPERSON 0725842970 ✓	KIMIRA F.C.S.LD	[Signature]



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







# NAMBALE FARMERS CO-OPERATIVE FGD INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

17/08/2020

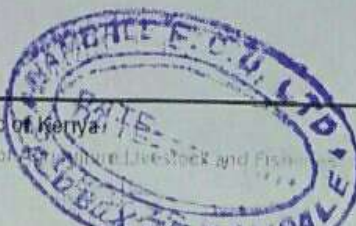
CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name, Designation and Contacts.	Institution/Organization	Signature & Stamp
1-	SECRETARY EPHREM LUBAKHA	Nambale T.C. 4/ Bulwani Society	0725532802 0725532802
2-	GODFREY OKUKUK	MEMBER	0712901317 0727355720
3	MAKOKHA WASIKE MA	MEMBER	0714595776 010448
* 4	SPENCY OKUNA	MEMBER	0719293763 0714285768
5	JENICO IMAMAT AMUKURU	MEMBER	0711207340 0726525795
6	FRANCIS WAFULA	MEMBER	0727-1672 0727-167200
7	FRANCIS OMUKU NAMBALE		07180041853 0700041853
8	BISANGLO OKURA OBERAI		0701476603 0712924409
9	LEDNILSANAMOKURU AMUKURU		0791382779
10	GREGORY WADENYA	MATHCO KENYA	
11	MARTIN ODEMBE	NAMBALE	



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







# GD ATTENDANCE LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD; CONSULTANT: BAYPAL CONSULTANCY FIRM

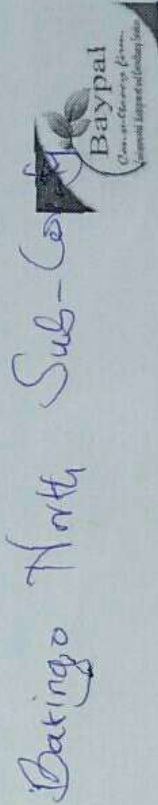
Name of the Group: SALAWA FARMERS GROUP Venue: SALAWA Date: 19/08/2020

No	NAME	DESIGNATION	CONTACT	SIGNATURE
1	SHABIR KIPITOK	Chair Salawa F Group	0728453911	
2	DAVID K. KIPKOSIOM	MEMBER SALAWA F GROUP	0724980611	
3	SAMUEL LUGER	MEMBER SALAWA F GROUP	0723225035	
4	VICTOR KIBET	FARMER	0716969343	
5	William Wanjohi	FARMER	0779931150	
6	David Wanjohi	FARMER	0719702684	
7	Henry K. Kipkotto	FARMER	0728 645 857	



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





# FGD ATTENDANCE LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the Group: KETURWO FARMERS GROUP Date: 19/08/2020

Venue:

No	NAME	DESIGNATION	CONTACT	SIGNATURE
1.	DANIEL K. CHEPTIONY.		0713884412.	
2.	Michie K Kikochi		454354	
3.	Richard K Cherop		0706439195	
4.	Isaiah B Nyangoli	Farmer	0722687912	
5.	Benjamin gator	Farmer	0709404699	
6.	Diana T chumoiwo	Farmer	0704602573	
7.	Thomas K. Chelam		0717571555	
8.	Paul Nicholas	Consultant	07209948398	
9.	Joel Cherumono	Farmer	0725129703	



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







NYANDO SUBCOUNTY  
KISUMU COUNTY



# FGD INTERVIEW ATTENDANTS' LIST

Kobura Multipurpose  
Cooperative Society

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name	Institution/Organization	Signature & Stamp
13/8/2020	07111 55783 JAMES E. RIAGA ✓	KOBURA	JR
13/8/2020	0726531685 GEOFFREY O. KUNGU ✓	OBUSO BORDER	
13/8/2020	0723-107701 Omondi Chere ✓	KOBURA	
13/8/2020	0782377539 MICHAEL ONYURO	KOBURA	Onyuro
13/8	PAMELA OGERE	KOBURA	Pnel-



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







MATAYOS SUB-COUNTY, BUSIA COUNTY


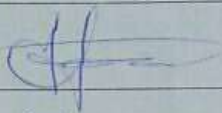
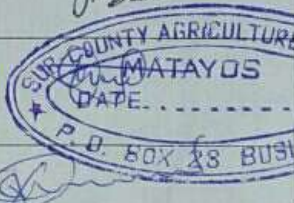

Baypal  
Consultancy Firm  
Corporate Services and Training

MATAYOS FARMERS CORPORATIVE SOCIETY  
FGD INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name, Designation & Contacts	Institution/Organization	Signature & Stamp
17/8/2020	VINCENT L EGESA- 0727681104 ✓	MATAYOS COTTON F.C SOCIETY LTD - CHAIRMAN	
17/8/2020	WILBROD S. NABWIRE 0724099023 ✓	MATAYOS COTTON F.C	Willy
17/8/2020	LIVINGSTONE NYONGESA 0707950636 ✓	MATAYOS COTTON SOCIETY LTD	
17/8/2020	SAUBA IMELDA JUMA 0711841011 ✓	MATAYOS COTTON SOCIETY LTD	Sty
17/8/2020	ROBERT O. ODWOM 0713951356 ✓	MATAYOS COTTON SOCIETY LTD	Rob
17/8/2020	FRANCIS OKUKEN - 0727638318 ✓	MATAYOS cotton F.C Vice chair.	Francis
17/8/2020	DONAT DJIAMBLO EGESA 0720329429 ✓	MATAYOS COTTON SOCIETY LTD	Donat
17/8/2020	SAMUEL DWIND 0723211899 ✓	MOA MATAYOS	
18/08/2020	Amund Chrispine 0722625912 ✓	AFA - FCD BUSIA	



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







SIAYA COUNTY, RARIEDA  
SUB-COUNTY

UYOMA FARMERS SOCIETY  
CO-OPERATIVE SOCIETY LIMITED



### FGD INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name, Designation and Contacts.	Institution/Organization	Signature & Stamp
19/8/2020	HON. SECRETARY 0719355454 ✓ ZEDEKIA ADUL AJWANG	UYOMA FARMERS CO-OPERATIVE SOCIETY	
19/8/2020	Ambassador 0706104292 ✓ PATRICK OMWONO AGEM	UYOMA FARMERS CO-OPERATIVE SOCIETY	
19/8/2020	0705236638 ✓ HENRY OUKO OTIENO	VICHAIR - U.F.C.S.	
19/08/2020	0725585015 ✓ JOAB RINGIRO OMBECH	TREASURER (U.F.C.S)	
19/08/2020	0708317153 ✓ NICOLAS SAGYA ADIHAHWA	CLERK Secretary	
19/08/2020	MATHEW SOTIENO OCHUNDO ✓ 0715353189	CHAIRMAN U.F.C.S.	
19/08/2020	Mathew Onduru Misiari ✓ 0715097232	CM. U.F.C.S.	

UYOMA FARMERS  
CO-OPERATIVE SOCIETY LTD  
P. O. BOX.....MADIANY  
DATE.....



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries





# SEME SUBCOUNTY, KISUMU COUNTY



## FGD INTERVIEW ATTENDANTS' LIST SEME-KISUMU CO-OPERATIVE SOCIETY

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name	Institution/Organization	Signature & Stamp
13/08/2020	Joseph Odinga ✓ (0706824286)	SEME-KISUMU CO-OPERATIVE SOCIETY	
11	Rebecca Dinya Otieno (0708910106) ✓	SEME-KISUMU CO-OPERATIVE SOCIETY	
11	(0706912969) ✓ ANASTACIA A. DBIERO	SEME-KISUMU CO-OP. SOCIETY	
11	AFLINE ODEGA ✓ (0719573254)	SEME-KISUMU CO-OP. SOCIETY	
13/8/2020	0723677194 ✓ Margaret Ogembo	CO-OP. SOCIETY	
11	Joseph Pande	SEME-KISUMU CO-OPERATIVE SOCIETY	



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







1 SAKWA-YIMBO F.C.S.L,  
BONDO SUB-COUNTY,  
SIAYA COUNTY



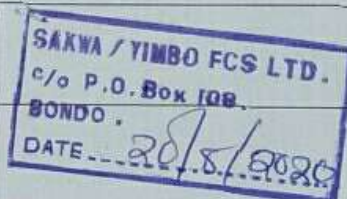
### FGD INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
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RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name, Designation and Contact.	Institution/Organization	Signature & Stamp
20/08/2020	MOSES OKWALITO HON SECRETARY 0740941021 ✓	SAKWA/YIMBO FCS	
20/08/2020	VITALIS KANGA ✓ CHAIRMAN 0727290642 0712975498 A FARMER ✓	SAKWA/YIMBO FCS	
20/08/2020	NICHOLAS OGISU OGANGA ✓ MICHAEL OPIYO - 0705933620 ✓ SXI FIELD OFFICER ✓	SAKWA/YIMBO FCS SXI	
20/8/20	RITA ATIEND OKWA FARMER 0713859237 ✓	SAKWA/YIMBO FCS	
20/8/20	MILLICENT ATIEND ABOUTI 0713819128 ✓ FARMER ✓	SAKWA/YIMBO FCS	



Republic of Kenya  
Ministry of Agriculture, Livestock and Fisheries







# FGD ATTENDANCE LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the Group: KIMWANGA COTTON FARMER CO-OP SOCIETY Venue: MALAKA Date: 25/08/2020

No	NAME	DESIGNATION	CONTACT	SIGNATURE
01	WILLIE W. OPILI	CEO - MALAKA MALAKA	0720002356	
2	Jabun Wakoli Mang'emu	FARMER	-	
3	MARTIN S.O. MUMILO	Secretary-Malaka Malaka	0710388412	
4	FRED OKALELE	FARMER	0718416302	
5	SELIMA WENIGONIA	FARMER	0714812526	
6	PETER NABAHISI	FARMER	0759471223	
7	PROJIA SUSIFUNA MANGOLI	FARMER	0710300970	
8	TIMOTH WANYONYI	FARMER	0798142724	
9	Amubno Chispine	APA - FCD	0782625912	



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# TESO NORTH SUB-COUNTY NORTH MALABA WARD



## FGD INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

JAIROS COOP

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name, Designation and Contact.	Institution/Organization	Signature & Stamp
18/08/2020	JOSEPH KIPITALANG SHOT Treasurer Jairos 0714 0714178665 ✓	JAIROS Farmers	Jkeptolan
18/08/2020	Edward Okebe Society manager 0714 185 670 ✓ 0710430464 ✓	Jairos Cotton Growers Co-operative Society Ltd. Box 74 - 50408 Malabek (K)	
18/08/2020	ELIWA A. ODEKE FARMER 07284 0282 ✓	JAIROS SOCIETY 0728460826	Elideke
18/8/2020	OMOTI ODERAN	Jairos S/Manager	
18/8/2020	OKWARE VINCENT 0718721991 FARMER. ✓	JAIROS SOCIETY	
18/08/2020	ALGARET EMOJONKI DIRASDA 0704607432 ✓ CHAIRMAN	JAIROS FC SOCIETY	
18/8/2020	JOHN ESKUT 0714583029 FARMER ✓	JAIROS SOCIETY	
18/8/2020	PETER OPUKO Cluster Chairman 0721314963	Jairos Society	
18/8/2020	ELIUD EMASE O. Member ✓ 0768340637	Jairos Society	



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PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name	Institution/Organization	Signature & Stamp
18/8/2020	ELVANA JA ECHAKARA MEMBER 0726435598 ✓	JAIROS	[Signature]
18/8/2020	JOSHUA OKASIDA ✓ member - 0712124571		[Signature]

**JAJOSI COTTON GROWERS CO-OP SOCIETY LTD**  
P.O. Box 74 KAMUKUJI  
DATE.....



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# FGD ATTENDANCE LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Name of the Group: CHEMILET PRODUCE MARKETING SOCIETY Venue: CHEMILET Date: 21/08/2020

No	NAME	DESIGNATION	CONTACT	SIGNATURE
1	HARPER K. Komen	Field facilitator	0707089655	Harper
2	Anthony Otieno	Farmer	07273742473	Anthony
3	Peter K. Bangehung	Farmer	0724710977	Peter
4	ABRAHAM K. Kamen	Farmer	0704777653	Abraham
5	Emily J. Kiptum	Farmer	0726540555	Emily
6	BETHAKINE J. OTHERO	Farmer	0713613587	Bethakine
7	Paul Njiriga	Consultant	0724243338	Paul
8	JENNIFER J. RUTO	ATA-FOC staff	0720324122	Jennifer



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## KII INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name of the staff	Institution/Organization	Signature & Stamp
1	CHAIRPERSON		
14/8/2020	FRANCIS ONG'ENDO	KIMIRA FCS	
17/8/2020	CHAIRMAN VINCENT L. FEESA	MATAYOS F.C. SOCIETY	
17/08/2020	SAMUEL OWING 0723211899	MOA	
17/8/20	(VICE CHAIR) MADY ODEMBE	NAMBALE F.U.	
18/8/20	KENNEDY OTIENO	MOA	
19/8/20	MATHEWS OTHENO OGONDE CHAIR PERSON	U.F.C.S.	



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PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name of the staff & Designation.	Institution/Organization	Signature & Stamp
11/08/2020	Amuono Christine ZCC 0722625917	AFA - FCD	 AGRICULTURE & FOOD AUTHORITY (K) - FIBRE CROPS DIRECTORATE-BUSIA P.O. Box 28-50400, BUSIA (K) Date: .....
11/08/2020	GREGORY WADENYA FIELD OFFICER 072924409	MAHICO - KENYA	
12/08/2020	NIXON CHEBUCHIE F.D.A. 0725896187	AFA - FCD - KSM	 FIBRE CROPS DIRECTORATE 254 202684424 12 AUG 2020 P.O. BOX 3837 - 40100, NAKURU KISUMU OFFICE
13/8/2020	JAMES E RIANA	KOBURA CO-OPERATIVE	 KOBURA MULT CO-OPS. LTD P.O. BOX 12487 KSM DATE: .....
13/8/2020	ANASTACIA A. DBIERO VICE-CHAIRPERSON (0706912969)	SEME/Kisumu CO-OP. SOCIETY	
14/8/2020	SILVAN ILEPHA OGOLLA - 0724669561 CHAIRMAN.	MUHORONI COTTON F.C.S LTD	 MUHORONI COTTON FCS P.O. BOX 97 MIWANI



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PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name of the staff	Institution/Organization	Signature & Stamp
17/8/2020	Lwangat C. Sheila 0710413550	National Government Administration	
18/08/2020	CHAIRMAN ABUDU ERGASHI OWASIDA 0704807432	JAIROS F.C SOCIETY	 
18/8/2020	Ruthene Nausi	Nuria County Dept of Water & Natural Resources	 
19/8/2020	Melky O. Wafuka	Agriculture Siaya county	 
19/8/2020	Vincent Othok	County Dept. of Agriculture Siaya	 
20/8/2020	VITANS OWOOR KANIA	CHAIRMAN SAKWA/YIMBO FCS LTD	 



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PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name of the staff	Institution/Organization	Signature & Stamp
24/8/2020	Hallerine A. Okeno	MOA - MINISTRY OF AGRICULTURE	COUNTY DIRECTOR OF AGRICULTURE HOMERU COUNTY BOX 711/BAY DA:
25/08/2020	JANE W. GITAU 0722384151 janegitau83@yahoo.com	MINISTRY OF AGRICULTURE	COUNTY DIRECTOR IRRIGATION & DRAINAGE BUNGOMA COUNTY P. O. Box 634 BUNGOMA
25/08/2020	BRIAN WAMALWA	MINISTRY OF ENVIRONMENT	MINISTRY OF TOURISM, ENVIRONMENT, WATER & NATURAL RESOURCES. 25 AUG 2020
25/08/2020	CAROL SOITA MFA-HCD 0724166802	MFA-HCD	AGRICULTURE, FISHERIES & FOOD AUTHORITY BUNGOMA COUNTY P.O. Box 437-50200, BUNGOMA
			TEL: 020-2392872 / FAX: 020-20011 P. O. Box 2654-50200, BUNGO





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PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name of the staff	Institution/Organization	Signature & Stamp
24/08/2020	Eng. Vincent Oyien 0725052526.	MW & I	COUNTY DIRECTOR OF IRRIGATION AND WATER STORAGE 24 AUG 2020 P.O. BOX 4 - 40300, NOMABAY
24/08/2020	MR. FRANCIS OBWANA 0728342756	NEN	DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES COUNTY GOVERNMENT OF NOMABAY DATE: 24/08/2020 SIGN: [Signature]
27/08/2020	SYLVESTER SHETCHI 0728649627	DALF - Kisumu Chile	COUNTY DIRECTOR OF AGRICULTURE P.O. BOX 1700-40700 KISUMU



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CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name of the staff, Designation and Contact.	Institution/Organization	Signature & Stamp
18/08/2020	JOHN KWANYA AHGBO Chairman Pala 0712360634	PALA F.S.C	
18.			
21-8-2020	RICHARD OPIYO OLOO HOK SECRETARY KANYAD COTTON F. 0729658374	KANYAD COTTON FARMERS CO-OP. SOCIETY	
21-8-2020	Elisheg Opiyo 0729658374	Retired Chief Kothielg-Kanyadg	



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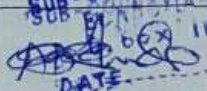


### FGD INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name	Institution/Organization	Signature & Stamp
24/08/2020	Alphonse Ogado ofinik	Agriculture Department Boda	 SUB-COUNTY AGRIC. OFFICE SUB-COUNTY AGRIC. OFFICE 113/114/115 DATE



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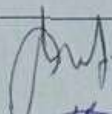
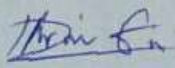


## KII INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON  
COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND  
RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name of the staff	Institution/Organization	Signature & Stamp
24.08.2020	CHARLES LAGAT	RIVATEX E.A LTD	
25.8.2020	DAVID KIREMBU	KVDA	



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## KII INTERVIEW ATTENDANTS' LIST

PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR PROPOSED BT COTTON COMMERCIALIZATION IN WESTERN, COASTAL, NORTH EASTERN, EASTERN AND RIFT VALLEY REGIONS OF KENYA.

CLIENT: BAYER EAST AFRICA LTD;

CONSULTANT: BAYPAL CONSULTANCY FIRM

Date of Interview	Name of the staff	Institution/Organization	Signature & Stamp
19/8/2020	Alpha K. Ruttoh	Baringo county Department of Agriculture	 COUNTY DIRECTOR OF AGRICULTURE P.O. Box 4-30400, KABARNET
20/8/2020	John C. Kidogo	BCC Dept of Water	 OFFICER MINISTRY OF WATER AND IRRIGATION 20 AUG 2020
23/8/20	Gilbert Magut	CDE-NEMA BARINGO.	 BARINGO COUNTY GOVERNMENT COUNTY DIRECTOR OF ENVIRONMENT 20/8/20 P.O. Box 54-30400, KABARNET
20/8/2020	JENNIFER J. RUTTO	AFA - FCD KABARNET OFFICE	 AGRICULTURE & FOOD AUTHORITY CROPS DIRECTORATE 20 AUG 2020 P.O. Box 498-30400, KABARNET
20/8/2020	CHARITY KOSHEI	ELGEYO MARMKET. DEPARTMENT OF AGRICULTURE & IRRIGATION	



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