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Kenya Agricultural & Livestock Research Organization

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Cassava Value Chain Manual

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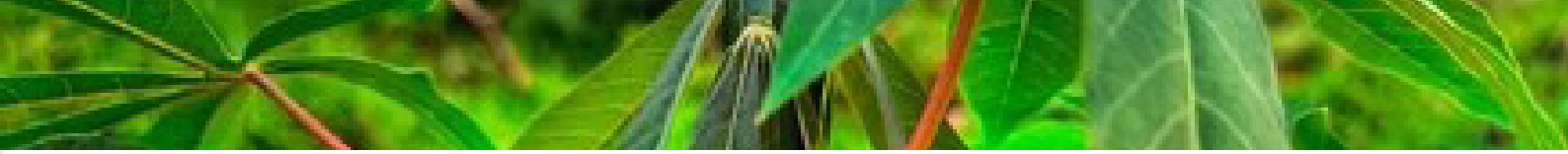
Disclaimer
This manual is for advisory use only. Users of this manual should verify details that relate to their agro-climatic zones from their area agricultural extension officers. It is also advised that this training manual should be used in conjunction with the respective value chain handbook and other relevant resource materials.



Foreword

The Micro Enterprises Support Programme Trust (MESPT) is a local development organization founded in 2002 through a partnership between the Government of Kenya (GoK), the European Union (EU), and later, the Royal Danish Government. MESPT's main goal is to eradicate poverty by supporting the growth of micro-enterprises, including agricultural production, agribusiness, and afro-processing. This support aims to foster social, economic, and environmentally sustainable growth by increasing access to financial and business development services, creating jobs, and promoting sustainable micro-enterprises. Our vision is to build a more prosperous society, and our mission is to provide sustainable business development and financial services to smallholder farmers and agri-MSMEs in Kenya.

For over two decades, our team of professionals has been at the forefront of developing cost-effective and scalable solutions that promote financial inclusion and support the growth of sustainable agribusinesses. We accomplish this by providing tailored financial solutions that meet the specific needs of various agricultural value chains, delivered through a wholesale lending model to financial service providers such as SACCOs, MFIs, and Farmer Cooperatives. These providers, in turn, extend loans to smallholder farmers and micro agricultural enterprises.

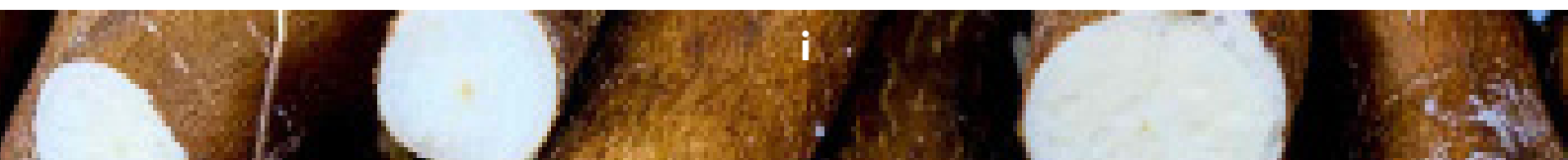
Our approach emphasizes delivering integrated financial and business development services to smallholder farmers and MSMEs in Kenya, helping them access finance, boost agricultural productivity, improve afro-processing and connect to markets. Over the years, we have worked closely with county governments, development agencies, donors, and investors to strengthen business development capacities in the agricultural sector, using a unique tripartite model that connects farmers, SMEs, and financial institutions.

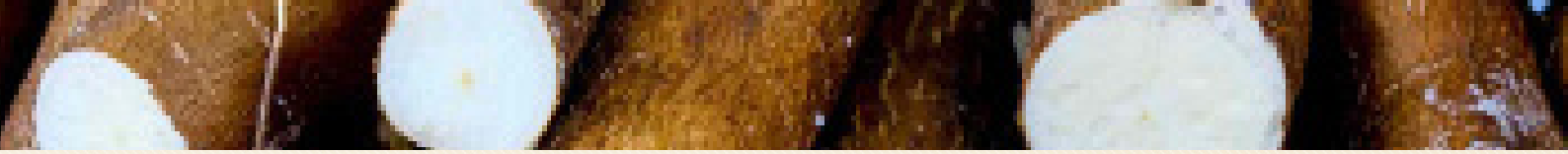
Cassava is among key value chains that have been supported by MESPT over the years through various interventions in order to enhance commercialization. MESPT appreciates the importance of documenting best practices for the value chain in facilitating effective delivery of training for farmers and Agri-preneurs. Therefore, MESPT has facilitated the development of this manual alongside the value chain trainers' guide and other resource materials through Green Employment in Agriculture Programme (GEAP) with support from DANIDA.

This guide is expected to enhance effectiveness in delivery of trainings on Good Agricultural Practices and commercialization of the value chain. I am optimistic that this manual will be helpful to partners in the value chain including county governments. I am grateful to DANIDA for the continued support to MESPT programmes. I am also thankful to the value chain experts who spearheaded compilation of this manual.

Rebecca Amukhoye,

Chief Executive Officer, Micro-Enterprises Support Programme Trust





Preface

The Green Employment in Agriculture Programme is a 5 years' programme (2021 to 2025) funded by DANIDA and implemented by Micro-Enterprises Support Programme Trust (MESPT). GEAP seeks to contribute directly to Kenya's vision 2030 and to one of Denmark-Kenya Strategic Framework on accelerated decent employment creation in MSMEs and improved competitiveness of targeted value chains in agriculture which will contribute to transforming the economy towards a greener and more inclusive growth.

GEAP programme targets 40,000 smallholder farmers and will be implemented in 12 counties namely, Kilifi, Kwale, Nakuru, Nyandarua, Siaya, Kisii, Kakamega, Bungoma, Trans Nzoia, Uasin Gishu, Makueni and Machakos. The programme facilitates increased commercialization, decent employ-ment, and green transformation through targeted interventions in selected agriculture value chains that include, Cassava, Coconut, Dairy, Export Vegetables, Pineapple, Indigenous Poultry, Moringa, Pineapple, and Aquaculture.

MESPT through GEAP tasked multidisciplinary teams to develop resource materials tailored for extension service providers and farmers. This Cassava value chain manual is one of the series of the materials that were developed. MESPT further tasked value chain experts to develop a value chain trainers' guide for Cassava. This manual is to be used as a reference material for training on implementation of good agricultural practices, value addition and marketing for the value chain. Relevance of the content is based on needs identified among value chain players, actors and aligned to GEAP project objectives.

MESPT is grateful to the value chain experts who spearheaded the development and production of this manual. It is my hope that counties and other users will adopt and optimally use this resource so as to increase productivity and profitability while ensuring a greener and more inclusive growth.

Doreen Kinoti

Programme Manager, Green Employment in Agriculture Programme

Acknowledgements

The Green Employment in Agriculture Programme (GEAP) participating counties (Kilifi, Kwale, Nakuru, Nyandarua, Siaya, Kisii, Kakamega, Bungoma, Trans Nzoia, Uasin Gishu, Makueni and Machakos) are acknowledged for providing resource persons in compilation of the document. The technical support and expertise provided by Kenya Agricultural and Livestock Research Organisation in development of the document is appreciated. Thanks to the Royal Danish Government's Danish International Development Agency (DANIDA) for facilitating the development of this re-source material. Micro Enterprises Support Programme Trust (MESPT) is appreciated for co-ordinating the process of development and production of this document.

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List of Abbreviations

AEZ	Agro-ecological zone
AFA	Agricultural Food Authority
ASAL	Arid and Semi-Arid Land
DANIDA	Danish International Development Agency
GAP	Good Agricultural Practices
GEAP	Green Employment in Agriculture Programme
Ha	Hectare
IPM	Integrated Pest Management
KALRO	Kenya Agricultural and Livestock Research Organization
Kg	Kilogram
MESPT	Micro-Enterprises Support Programme Trust

Cassava Value Chain Manual

Chapter 1: Introduction

1.1 The cassava plant

Cassava is a woody shrub that grows from 1-3 m tall. The shoot and extensive fibrous root system are developed during the first 3 months of growth. The timing for branching ranges from one genotype to another, while some do not branch. Stem colour varies from one genotype to another and the pigmentation of the stems provides stable characteristic for differentiating cultivars.

Consumers classify cassava as sweet or bitter and associate bitterness with high toxicity (Cyanide levels) and vice versa, however this is not the case. There are sweet varieties with high cyanide and bitter ones with low cyanide levels. Immature cassava has high cyanide levels, hence any consumption of cassava should be cooked or processed.

1.2 Agro - Climatic requirements

Cassava is grown between 30 degrees North and 30 degrees South of the equator at an altitude that ranges from sea level to 1500 meters above sea level (asl) in areas that receive 1000 to over 1500mm of rainfall annually but can tolerate low rainfall since it's a drought tolerant crop. Cassava grows well in warm moist climates, where mean temperatures range from 23-34 degrees centigrade. In Kenya cassava is mainly grown in three main regions coast, central and western regions.

Cassava is grown on a wide range of soil types, it does best on friable soils; which permit expansion of the storage roots. Fertile sandy soils with adequate rainfall are most suitable for cassava production.

Cassava growth and yield are reduced drastically on saline soils and on alkaline soils with a pH above 8.0. The optimum pH is between 5.5 and 6.5, but varieties are available that tolerate a pH as low as 4.6 or as high as 8.0.

1.3 Economic importance of Cassava

Cassava is the second most important food crop in Kenya. Cassava production in the country is concentrated in three main regions; Coastal, Central and Western region. Western and Coastal regions are the main cassava producing areas, producing over 80% of the recorded cassava output in the country (MoA, 1999). It is an important source of dietary energy for over 500 million people in developing countries. Kenya has an estimated hectarage 83,486 ha**,** with annual production of 1,481,518 tons.

Cassava root are used as human food as well as animal feed. The leaves are also popular vegetable. The roots are either boiled or fried before consumption. Cassava roots are the excellent source of minerals and vitamins such as manganese, calcium, phosphorus, potassium, and iron. All these are responsible for the healthy development of our body. *(Cassava Farming In Kenya: A Cassava Cultivation Guide - Farmers Trend)*

Chapter 2: Planting Materials and Propagation

2.1 Varieties

Kenya Agricultural and Livestock Research Organization (KALRO) in collaboration with Kenya Plant Health Inspectorate Services (KEPHIS) has developed clean planting materials for different Cassava growing regions in the country. The various varieties developed are outlined in the table below:

Cassava varieties for the Coastal region				
Variety	Optimal production altitude range (masl) (region)	Maturity (months)	Root yield (t/acre)	Special attributes
"Karembo" ("KME-08-05") 	15-1200 (Coast/ Eastern)	8	20-28	Tolerant to ACMD (African Cassava mosaic disease) and CBSD (Cassava Brown Streak Disease); sweet; short with open structure
"Karibuni" ("KME-08-01") 	15-1200 (Coast/ Eastern)	8-12	20-28	Tolerant to ACMD and CBSD; sweet; high branching; good for intercropping
"Nzalauka" ("KME-08-06") 	15-1200 (Coast/East-ern)	6-8	20- 28	Tolerant to ACMD and CBSD; sweet; straight stems ideal for intercropping

Cassava varieties for the Coastal region				
Tajirika	15-1200 (Coast/Eastern)	8-12	20 - 28	Root yield is 28 tons per acre. The roots are smooth with yellow cortex. Its stems are straight and do not branch
"Shibe" ("KME-08-04") 	15-1200 (Coast/ Eastern)	8-12	20-28	Tolerant to ACMD and CBSD; sweet; straight stems ideal for intercropping
"Siri"	15-1200 (Coast/ Eastern)	8-12	20	Tolerant to ACMD and CBSD; sweet; very short without branches
"Kaleso" ("46106/27")	1-1500 (Coast /Eastern)	10-12	10-12	Tolerant to ACMD and cassava brown streak disease (CBSD); sweet
"Guzo"	1-700 (Coast/ Eastern lowlands)	12-15	10-12	Resistant to (ACMD); sweet
"Kibanda - Meno"	1-500	6-8	10-12	Very susceptible to ACMD,; very sweet

Other varieties grown in other regions				
Variety	Optimal production altitude range (masl) (region)	Maturity (months)	Root yield (t/acre)	Special attributes
"KME 1"	250-1500 (Eastern)	12-14	10	Sweet
"KME 2"	250-1500 (Eastern)	8-10	16	Tolerant to ACMD; sweet
"KME 3"	250-1500 (Eastern)	8-10	16	Tolerant to ACMD; sweet
"KME 4"	250-1500 (Eastern)	8-10	16	Tolerant to ACMD; sweet
"KME 61"	250-1500 (Eastern)	14	14	Tolerant to ACMD; bitter
"Mucericeri"	250-1750 (Eastern)	12-14	10	Sweet
"5543/156"	1-500 (Coast/Eastern low-lands)	10-12	16-20	Tolerant to ACMD; bitter

2.2 Planting materials

Cassava is propagated through cuttings. The most suitable cuttings are 20-30 cm long and 20-25 mm in diameter (with 5-8 nodes), preferably from the middle browned-skinned portion of the stems of plants 8-14 months old. Cuttings from older, more mature parts of the stem give better yield than cuttings from younger parts, and long cuttings give higher yields than short cuttings. Select cuttings from healthy plants which are tolerant to diseases. Cuttings slightly infested with pests can be treated by immersion in heated water (mixing equal volumes of boiling and cold water) for 5-10 minutes just before planting. *(CM. GITHUNGURI (1995)*

2.3 Rapid multiplication of cassava

The multiplication rate of cassava is low i.e one cassava plant produces 10 cuttings compared to grain crop like maize where one seed produces on average 300 seeds. A rapid multiplication technique using mini stem cuttings has been developed to increase multiplication ratio to 1:30. This involves cutting the stem into small pieces of two or more nodes. The mini stem cuttings are prepared using

sharp tools such as shears, secateurs, panga, sharp knives or handsaw. The mini stem cuttings are then planted in a nursery either horizontal or vertical orientation and transferred to the field after three to four weeks depending on management at the onset of the rains. Ensure the seed bed is well watered.

Chapter 3: Crop Management

3.1 Land preparation

Land preparation in cassava growing plays an important role in yield. The soil should be in fine tilth form. This can be done by giving two or three normal ploughing, it is recommended ploughing be done to a minimum soil depth of 15 cm. The organic debris from the previous crop should be incorporated into the soil. The friable soil is helpful in producing more. It is recommended you carry out at least one soil test before starting cassava farming because it does not grow well in neutral soil. Cassava thrive best in soil PH range in between 5.5 to 6.5.

The best land for planting cassava is flat or gently sloping as steep slopes are easily eroded. Valleys and depression areas that usually get waterlogged are not very suitable and cassava roots do not develop well.

Soil preparation varies from practically zero tillage under shifting cultivation to ploughing, harrowing and possible ridging in more intensive cropping systems. Planting on mounds and ridges is recommended, especially for areas with rainfall of more than 1200 mm per year or in areas where soils get waterlogged (e.g valleys and depressions). Ridging may not give higher yields, but harvesting is easier and soil erosion may be reduced, especially by contoured ridges. In sandy soils, minimum tillage is appropriate for planting cassava.

3.2 Planting

The interval between cutting stems and planting should be as short as possible. There are three methods of planting cassava and all of them make use of cassava cuttings. It is recommended that planting should be done at the beginning of the rainy season.

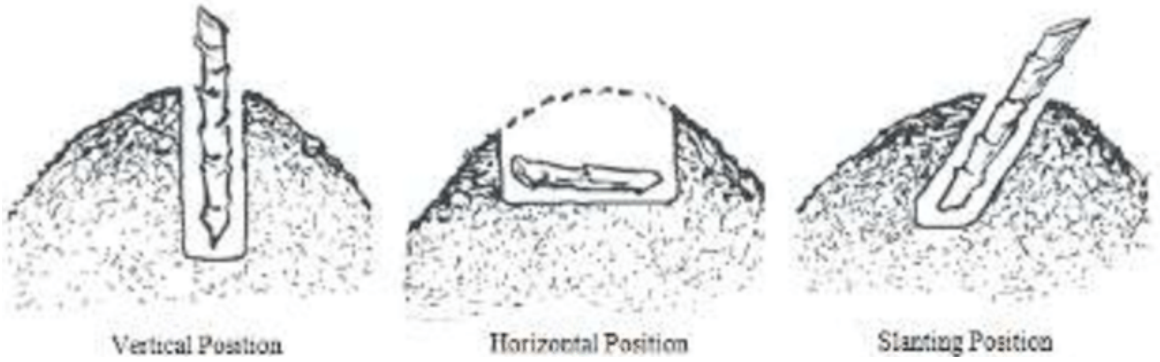
The spacing between plants will depend on whether cassava is grown as a pure stand crop or mixed with other crops (intercropping). If cassava is grown on a pure stand, cuttings should be planted one meter apart from each other. This means that 10.000 cuttings are required for 1 ha (4000 cuttings per acre). The recommended spacing for cassava seed (cutting) production is 1m between rows and 0.5m within the row giving a plant population of 20,000 plants per ha (8000 per acre). For seed production, should be grown as a pure stand. Rogue off types and infected plants in the field. *(Githunguri et.al 2017)*

3.2.1 Methods of planting

Horizontal method: Cassava cuttings can also be planted in a horizontal position in which the cuttings are completely buried in the soil to a depth of 5 cm. Horizontal planting is better in dry areas. Horizontal planting leads to a large number of thin stems, which may cause lodging. Moreover, the roots develop more closely to the surface and are more likely to be exposed and attacked by rodents and birds. This is mainly recommended for areas with low rainfall.

Slanting method: Cassava cuttings can be planted in a slanting or angular orientation of 45 degrees. Even in this case the cuttings should be buried in the ground with two-thirds in the soil. Always ensure that the buds point upwards. Do not plant cuttings upside down, as this drastically reduces yield.

Vertical method: Cassava cuttings can be planted vertically upright with two-thirds of the cutting inserted deep in the ground. Remember! Achieving increased yields of 20–45 t/ha from improved varieties starts with this critical stage of stem handling. Vertical planting is best in sandy soils, as the roots develop deeper in the soil. Do not plant cuttings upside down, as this drastically reduces yield.



3.3 Weed management

Weed control is one of the most important field operations that contributes to high cassava yields. In the first three months after sprouting the field should be kept weed free. After 3 months the farmer should control weeds as need arises. During weeding remove weeds round the plant by uprooting to avoid disturbing the roots. Weeding can be done manually, or by use of herbicides that have been recommended. Other methods of weed control include mulching with either organic and /or plastic material or use of fast-growing cover crops. Integrated weed control methods is recommended.

3.4 Fertilizer application

Cassava has the ability to grow in soils with minimal fertility that are unable to support other crops. This is due to the extensive root system that is able to utilize nutrients less accessible by other crops. It is advisable to conduct a soil test to determine the type and quantity of fertilizer to apply.

Fertilizers should be applied 8 weeks after planting at the edge of the rooting zone.

Chapter 4: Pests And Disease Management

4.1 Pests in Cassava

Larger grain borer *(Prostephanus truncatus)*.

Management measure

There are reports in Kenya, that the larger grain borer can be effectively repelled by storing cassava or grains with a fairly large amount of dried lantana or eucalyptus leaves Neem is also reported to be effective. Dried Cassava chips can also be stored in hermetic bags.

Cassava mealy bug (*Phenacoccus manihot)*

The cassava mealybug is pinkish in colour. Its body is surrounded by very short filaments, and covered with a fine coating of wax. Adults are 0.5-1.4 mm long. This mealybug does not have males. Females live for about 20 days and lay 400 eggs on average. With temperatures of about 27°C.the lifecycle from egg to adult is completed in one month. It reproduces throughout the year and it reaches peak densities during the dry season. Mealybugs are dispersed by wind and through planting material.

The cassava mealybug strongly prefers cassava and other *Manihot* species; other host crops and wild hosts are only marginally infested. It sucks sap at cassava shoot tips, on the lower surface of leaves, and on stems. During feeding the mealybug injects a toxin into the cassava plant causing deformation of terminal shoots, which become stunted, resulting in compression of terminal leaves into "bunchy tops". The length of internodes is reduced, and stems are distorted. When attack is severe plants die, starting at the plant tip, where most mealybugs are found.

Mealybug attack results in leaf loss and poor-quality planting material (stem cuttings) due to dieback and weakening of stems used for crop propagation. Cassava root losses have been estimated up to 80%. The pest-induced defoliation reduces availability of healthy leaves, which are consumed as leafy vegetables.

The most effective has been the parasitic wasp which has kept this mealybug at low levels, resulting in significant reduction of yield losses in most areas in Africa.

Management measures

Plant early in the rainy season to allow the cassava plants a good growth as strong plants are more likely to withstand pest attacks.

Use soil amendments and mulch to avoid moisture stress in sandy or poor soils. Mealybug numbers are higher on cassava grown on poor, sandy soils, and may cause damage in spite of the presence of natural enemies.

Avoid using infested plant material. Before planting, cuttings can be treated with hot water by immersing them in heated water (mixing equal volumes of boiling and cold water) for 5-10 minutes just before planting to kill all insects and to avoid transfer into the newly planted field.

Avoid using pesticides on crops surrounding cassava fields. Although no pesticides are used on cassava in Africa, insecticide drifting from neighboring fields may affect natural enemies that keep mealybugs and other pests under control.

Use of manure or other fertilizers can result in a reduction in the mealybug population. Mulch and fertilizer use also enhances the antibiotic properties of cassava against mealybug infestation.

Striped mealybug *(Ferrisia virgata)*

Management measures

Select mealybug-free planting material.

Cassava green mite *(Mononychellus tanajoa)*

This mite is green in colour at a young age turning yellowish as adult. Adult females attain a size of 0.8 mm long. They appear as yellowish green specks to the naked eye. They occur on the lower surface of young leaves, green stems and auxiliary buds of cassava. Damage initially appears as yellowish "pinpricks" on the surface of young leaves.

Symptoms vary from a few chlorotic spots to complete chlorosis. These symptoms are somehow similar to African cassava mosaic disease, and should not be confused. Heavily attacked leaves are stunted and become deformed. Severe attacks cause the terminal leaves to die and drop, and the shoot tip looks like a "candle stick". Green spider mites are major pests during the dry season. Severe mite attack results in 20-80 % loss in root yield.

Management measures

Use clean plant material for planting.

Plant at the onset of the rains to encourage vigorous growth and thereby increase tolerance to mite attack. Cassava plants aged 2-9 months are the most vulnerable to infestation.

Two-spotted spider mite *(Tetranychus urticae)*.

Management measures

Conserve natural enemies. Local natural enemies usually control these spider mites and no further control measures are needed.

Avoid planting next to infested fields.

Avoid use of broad-spectrum pesticides, in particular pyrethroids; this may lead to spider mite outbreaks.

Cassava scales *(Aonidomytilus albus)*

It is a mussel-shaped scale with an elongated silvery-white cover and about 2-2.5 mm long. This scale may cover the stem with conspicuous white secretions, and eventually the leaves. This scale sucks from the stem and dehydrates it. The leaves of attacked plants turn pale, wilt and drop off. Severely attacked plants are stunted and yield poorly. Scale attack can kill cassava plants, in particular plants weakened by previous insect attack and drought. Stem cuttings derived from infested stem portions normally do not sprout.

Management measure

Apply organic matter to improve soil fertility.

Selection of clean (scale free) planting material.

Destroy infested stems.

Avoid use of pesticides in the cassava field or in neighboring crops, which may kill natural enemies.

Cassava white flies *(Bemisia tabaci)*

Management measure

Conserve natural enemies. Parasitic wasps in particular are very important for natural control of whiteflies. For instance *Encarsia formosa*, a natural enemy of the tobacco whitefly, and *Encarsia haitiensis* a natural enemy of the spiraling whitefly

Use sticky traps

Termites *(Coptotermes formosanus)*

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Management measure

Plant early with the rains.

Avoid planting on very dry land or on termite mounds.

Other pests

Birds, rodents, monkeys, pigs and domestic animals (cattle, goat and sheep) are common vertebrate pests of cassava.

Measures that help to manage damage by these pests include:

Management measure

Fence farms and set traps in the fence.

Cover exposed roots with soil.

Weed your cassava farm to discourage rodent pests.

Harvest roots as soon as they are mature

4.2 Cassava Diseases

African Cassava Mosaic Disease

African cassava mosaic disease is one of the most serious and widespread diseases throughout cassava growing areas in Africa, causing yield reductions of up to 90%. It is spread through infected cuttings and by whiteflies (*Bemisia tabaci*).

Symptoms occur as characteristic leaf mosaic patterns that affect discrete areas and are determined at an early stage of leaf development. Symptoms vary from leaf to leaf, shoot to shoot and plant to plant, even of the same variety and virus strain in the same locality. Some leaves situated between affected ones may seem normal and give the appearance of recovery.

Cassava plant showing severe symptoms of the African Cassava Mosaic Disease (ACMD).

Management measure

Use disease-free cuttings.

Use resistant/tolerant varieties

Cassava Bacterial Blight *(Xanthomonas campestris pv. manihotis***).**

It is a major constraint to cassava cultivation in Africa. Infected leaves show localised, angular, water-soaked areas. Under severe disease attack heavy defoliation occurs, leaving bare stems, referred to as "candle sticks". Since the disease is systemic, infected stems and roots show brownish discoloration. During periods of high humidity, bacterial exudation (appears as gum) can readily be observed on the lower leaf surfaces of infected leaves and on the petioles and stems. The disease is favoured by wet conditions.

This disease is primarily spread by infected cuttings. It can also be mechanically transmitted by raindrops, use of contaminated farm tools (e.g. knives), chewing insects (e.g. grasshoppers) and movement of man and animals through plantations, especially during or after rain. Yield loss due to the disease may range from 20 to 100% depending on variety, bacterial strain and environmental conditions. *(Kidasi PC et.al 2021).*

Management measure

Use clean planting material.

Intercrop cassava with maize or melon. This has been reported to reduce cassava bacterial blight significantly.

Practice crop rotation and fallowing.

Remove and burn all infected plant debris and weeds. Alternatively plough them into the soil.

Cassava brown leaf spot *(Cercosporidium henningsii)*

Symptoms are restricted to older leaves. Brownish round spots with definite borders appear on the upper leaf surface. On the lower leaf surface, they are brownish-grey in colour. Infected leaves later become yellow and eventually drop. In wet areas the disease may cause a yield reduction of up to 20%.

Management measure

Though the disease is widespread in most cassava growing countries, it is not an economically important disease problem and it does not warrant any intervention.

Cassava Brown Streak Virus *(Potyvirus Potyviridae)*

It is particularly serious in coastal areas of Kenya, Zanzibar, Mozambique and Tanzania and lakeshore region of Malawi and in Uganda and is a threat to the whole of sub-Saharan Africa.

The virus is vectored by whiteflies (*Bemisia* spp.) and also transmitted through infected cuttings. Symptoms include yellowing (leaf chlorosis) and brown streaks in the stem bark (cortex). Infected roots have brown streaks (root necrosis) It's a stealth virus, which destroys everything in the field. The leaves may appear healthy even when the roots have rotted away.

Management measures

Use disease-free cuttings.

Use tolerant/resistant varieties (e.g. "5543/156", "TMS 30572")

Remove diseased plants from the field.

Cassava anthracnose disease *(Glomerella manihotis)*

Initial symptoms of the disease are oval lesions ("sores") on young stems. On older stems, raised fibrous lesions develop that eventually become sunken.

Management measure

It is not an economically important disease in most cassava growing countries and it does not warrant any intervention.

Chapter 5: Green Technologies And Mechanization

This is the use of renewable energy and recycling of the waste products

5.1 Green technologies that exist in cassava production

Green Technology	Product	Beneficial Use
Cover Cropping	Leguminous plants	Increase fertility
Mulching	Leaves	Weed control, soil and water conservation
Solar drying	Cassava chips	Reduce cost of drying operation, increase shelf life and transit weight
Composting	Leaves, stems	Fertility improvement
Charcoal Briquets	Waste cassava products	Alternative source of fuel
Livestock feed	Leaves, peels	Alternative livestock feed
Biogas	Cassava by products	Alternative fuel source
Recycled water	Water used for washing	Extra income from irrigated crop

5.2 Mechanization in cassava

Like every other farm product, large scale cassava farming and processing requires mechanization.

Cassava Planter

There are two types of Cassava planters.The flat type which is for a flat ground that is not waterlogged and the rigging type which is for waterlogged areas.They can dig, cut, sow and cover the soil as well..

Cassava Harvesters

Instead of uprooting with hands, cassava harvesters dig up all roots without damage. They can also be connected to regular tractors. There are manual and tractor drawn harvesters

Cassava Washing Machine

Cassava washing the first steps of cassava starch processing and cassava flour processing, it can remove the mud and sand from fresh cassava roots surface completely to make sure the final product is without impurities.

Cassava Peelers

Peeling cassava can be a tedious job. Cassava peelers make life easy for farmers and those who want to process in large scale can do that with ease. The peeling efficiency is pretty good as only about 15% of the cassava is wasted.

Cassava chipping and grating machine

These come in different shapes all aiming at reducing the roots into small sizes for faster drying. The cassava grating machine for flour processing can grate the washed cassava into a fine mash with uniform size and white colour. It can also crush the washed cassava into the slurry with uniform size and separate the residues from the cassava slurry, to improve the starch extraction ratio and starch purity.



Cassava Sieving machine:

During the production process of cassava starch, the sieving section is used to separate the fine residues (fibre) from the cassava slurry, remove the residues, reserve and convey the cassava slurry to subsequent processing equipment. There are two kinds of cassava sieving machines used for cassava starch production process: fine fibre sieve and centrifugal sieve. The fibre sieve is used in potato and cassava starch processing while the centrifugal sieve is used for starch extraction in starch processing factory.

Dewatering and Drying Machine:

This is the final step of cassava processing to produce starch. The vacuum dehydrator can remove as much moisture as possible and the flash dryer can dry the wet starch to the low moisture content of no more than 13% to achieve the starch storage standard.

Chapter 6: Harvesting, Post-Harvest and Value Addition

6.1 Harvesting

Knowing when the roots are ready for harvesting is a key first step in ensuring cassava roots with good eating and processing qualities are harvested. Therefore, cassava has to be harvested at an appropriate age, size and tenderness in order to meet the quality of its intended use. Generally, if cassava harvesting is delayed, the roots tend to become fibrous and lose good qualities for the fresh market. It is also important to harvest cassava roots at the right time so that the land where it was planted is freed up for other agricultural production activities. Generally, the time from planting, eating quality are important considerations in the determination of time of harvest. There are two types of cassava harvesting namely manual and mechanical methods.

6.2 Manual methods

Once the roots are ready for harvesting, they should be carefully removed from the soil. Manual method involves the use of hand hoe for cassava harvesting. It is a common and predominant method of harvesting for cassava that is planted on ridges, mounds or flat land among the smallholder farmers. Ridges and mounds facilitate the easiest harvesting of roots compared to the other systems of bed formation since the roots are generally confined to the ridges and mounds. When cassava is planted on flat land, it is difficult to know exactly where the roots are, therefore it is always likely to have roots damaged during harvesting operations. In manual harvesting, losses are usually higher during the dry season because of compacted soil leading to roots breaking and remaining in the soil. Therefore, care must be taken to loosen the soil first before the cassava roots are gently pulled to avoid bruises on the roots

6.3 Mechanical methods

This involves the use of specially designed tools or machines to aid in harvesting operations. These come in different forms and capacities.

6.4 Cassava up-rooter or harvester

Prior to start harvesting, cut the cassava stems about 40- 50 cm above the ground. The uprooter is pulled in cassava rows and harvests one (1) row at a time. It cuts and loosens the soil containing the cassava root cluster with minimum bruises/damage. Using the stem the roots are pulled and collected in one place for packing or loading. The harvester requires minimum human labour with minimum root wastage. It saves time and reduces drudgery and operational costs.

6.5 Post-harvest handling

Rapid deterioration of cassava roots after harvest is the biggest post-harvest challenge. Deterioration of roots begin in 24 hours after harvesting and storage life is 2-3 days. Traditionally roots are left in the ground and harvested on demand. Delayed harvesting leads to fibrous and woody roots. Post-harvest handling in cassava includes; sorting and grading, transportation, storage and value addition.

6.6 Sorting and grading

It is good practice to sort cassava roots in the field because some amount of damage is expected during harvesting operations. Therefore, damaged or roots showing visible symptoms of rotting should be removed from undamaged ones at this stage.

Post-harvest losses can be controlled by:-

Observing hygienic handling of the roots

Ensuring no damage during harvesting and transportation

Processing the roots into dry chips

6.7 Transporting cassava roots

Cassava roots deteriorate and lose quality when not utilized within 24 hours of harvest. Hence, they must be transported to the homestead, market or processing plant immediately after harvesting. The following considerations should be taken when transporting the roots:

- Use wheel barrows, sacks or any other suitable container to transport roots in small quantities and short distances, such as from the farm to road side or bulking center where they will be loaded on a vehicle for long distance transportation.
- Gently off-load the roots from the wheelbarrow, sack or container without causing bruises or damage to the roots
- Vehicles transporting cassava for long distances should be covered with tarpaulin to avoid rapid moisture loss from the roots.

- Use oxen-cart for transportation especially in the rural areas where there are no paved roads or impassable to vehicles.
- Carefully sort and arrange roots neatly in the vehicle or cart to save space.
- Do not seat or put heavy objects such as vehicle tyres on roots after loading.

6.8 Cassava storage

6.8.1 Traditional storage methods

Fresh cassava roots are traditionally stored in the following ways:

• Fresh cassava roots once mature are left in the ground and harvested when needed. This practice is called piecemeal harvesting and is common when cassava is used for daily food consumption or sale. However, it is not suited for commercial production.

• Fresh cassava roots are heaped under shade and watered daily.

• Undamaged fresh roots are stored in pits or trenches dug in well drained soils, sloppy and shaded area. The trenches (usually 1 meter long and 30-40cm wide), with the long side directed downhill are lined with straw and dried leaves before roots are arranged in them after which the roots are covered with either river-sand or sea-sand. Water-logged areas and heavy clay soils used for covering must be avoided.

• Fresh cassava roots are coated with clay or mud.

• Freshly harvested undamaged roots or peeled cassava roots are stored for 1 – 2 days by completely submerging in water. The roots are simultaneously detoxified but may ferment or spoil after 3 days.

• The storage methods described here extend the shelf life of the roots by only 2–3 days. This cannot sustain commercial operations.

Post-harvest losses can be reduced by harvesting when the soil is wet or by growing the crop in loose soil. Root damage and bruises must be avoided during harvest and transportation. Only uninjured roots must be selected for storage of more than one week. Storage could be enhanced by treating unpeeled roots with a appropriate fungicide before storage.

6.8.2 Improved storage methods

Storage time	Step wise procedure	Remarks
Pit storage	Select a well-drained area, preferably shaded, and slightly sloping. Dig trenches measuring 1 m wide and 30–40 cm deep, in such a way that the length is directed downhill. At the lower end of the trench, make a drainage ditch, at least 20 cm wide and 5 - 10 cm deeper than the storage trench Arrange mature, undamaged roots inside the trench. Cover each layer with either river- sand or sea- sand.	Do not keep cassava in a waterlogged area because roots will rot easily The length varies according to the volume of roots. A trench 1 m long can contain 70–80 kg of roots. Do not use clay-loam soil if it is too wet. Do not use heavy clay. Soil of this type could speed up root deterioration

Storage time	Step wise procedure	Remarks
Storage in saw dust	Select healthy roots that were not damaged or bruised and were harvested no later than 24 hours Put a layer of damp sawdust in wooden crates or baskets lined with plastic foils that prevent the sawdust from drying up Arrange the roots in alternate layers of damp sawdust in the wooden crate and store	Arrange the roots in alternate layers of damp sawdust in the wooden crate and store
Storage in clamps	Choose a dry spot in the farm or processing area and dig a shallow trench.	The storage period is about 1 month.
	Place a layer of straw, add a layer of selected undamaged roots to form a cone or mound	This method works best for farmers, marketers or processors to hold large stocks of non-bruised or undamaged roots for up to 4 weeks without quality loss
	Add 20cm of straw, then cover the clamp with soil, leaving openings at the bottom for ventilation, to maintain temperature below 40°C for curing wounds and for the storage	Ensure proper ventilation and that the floor remains dry

Storage time	Step wise procedure	Remarks
Storage in polythene bags	Treat non-bruised or undamaged roots with appropriate fungicide such as thiabendazole solution (0.4% w/w) to avoid microbial spoilage. Alternatively, household bleach (0.95% active chlorine) could be used.	Vacuum packing makes the polythene bag air tight and creates the atmosphere (reduced oxygen and appropriate humidity) for the storage
	Vacuum pack in polythene bags	
	Keep the package at ambient temperatures	
Storage in refrigerators	Select healthy (non-bruised or un-damaged) roots	The cassava roots can be stored for about a month but they may lose same moisture. However, their texture and taste may not be significantly affected
	Wash with cool chlorinated water	
	Pack or vacuum pack in nylon bags	
	Store in the refrigerator. at temperature between 13 – 30° C.	
Waxing	Wash non-bruised or undamaged roots in chlorinated cooled water.	Waxing slows down respiration and transpiration and prevents physiological deterioration
	Dip in melted paraffin wax at a temperature of 51.5– 52.5°C.	
	Pack in well ventilated cartons	
	Waxing is done for commercial export of roots.	
Freezing	Select healthy roots	Peeling and/or cutting into small sizes are optional.
	Wash and freeze the roots.	To reduce texture damage, apply blast freezing to quickly freeze the roots.
	Store the roots whole or cut up in frozen condition	Freezing is suitable for long term storage and long-distance marketing but the textural quality of the frozen roots may be affected

Value addition in cassava

Value addition in cassava starts by processing the fresh roots into dry cassava chips. The main steps in cassava processing include peeling, washing, slicing/chipping, grating, dewatering and drying. Other steps include boiling, fermenting, roasting, frying etc. The steps could be combined in order to have desired product. (M. GITHUNGURI (1995)

Peeling and washing

Peeling is the removal of the inedible outer skin (peel and cortex) leaving the central part of the root. It is the first and important step in processing cassava roots because it contributes to the reduction of the cyanogenic potential of cassava. Mechanical peelers exist in in the country. Cassava roots are washed to remove dirt before or after peeling on the peeling method used

Slicing/Chipping

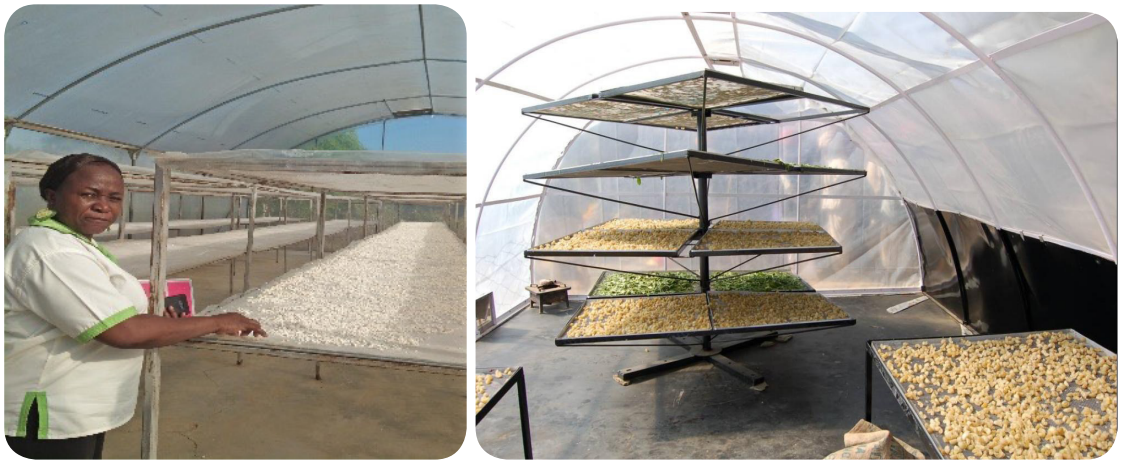
It is a process that involves cutting of cassava roots into smaller particles or sizes. This process is recommended for low-cyanide or sweet cassava varieties. However, in the traditional cassava chipping operations, it involves cutting cassava roots in smaller chunks either longitudinally or horizontally which usually results in improper drying and poor-quality products. Processing of high quality chips involves reducing cassava roots to thin slices of fresh, peeled cassava with an average diameter of 3mm to 5mm which facilitates rapid drying cassava especially under sunny conditions thus cutting out any risk of fermentation or soil and dust contamination. Unfermented Cassava chips are bright white and could be milled into flour for other uses such as cassava flour High quality cassava chips can be produced by manual or motorised chipping machines which are locally fabricated by trained local fabricators.

Grating

The process involves pressing fresh cassava roots against a swiftly moving surface provided with sharp protrusions which tear up the whole root turning it into a mash. This operation is recommended for high cyanide or bitter cassava varieties. This process facilitates reduction of toxic compounds associated with bitter cassava by more than 95% and the greater part of the remaining compounds is eliminated by pressing or dewatering the mash. This method is also used for extracting starch, flour and gari. Manual grating is laborious and predisposes processors to hand injuries. Grating machines are locally made and come with different processing capacities. The cake that is obtained after pressing requires to be broken down into granules. This can either be done manually or mechanically by passing the cake again in a grating machine. The loose granules obtained can then be further processed into the desired products such as gari, high quality cassava flour, starch etc. The most common method used for dewatering grated cassava is the use of hydraulic presses which are also locally fabricated.

Drying

Drying is the process of removing moisture from cassava roots, slices/chips or granules by placing the products in a dryer or open sun. This process significantly reduces the water and increases the shelf-life of cassava roots, chips or granules. Although sun drying is the most cost-effective method it has limitations in the rainy season due to extended cloud overcasts and also compromises the quality of chips.



Cassava solar dryers: Different types exist with varying capacity depending on capacity and level of investment

Chapter 7: Business Opportunities In the Value Chain

7.1 Business Opportunity

Business opportunities exists where and when sellers of goods and services interact in one way or another with buyers for profit gains. It may be existing or it has potential and not explored yet. Value chain business and/or market opportunities are the circumstances in which the specific value chain nodes exist and are therefore influenced by time and geographic/space variation.

7.2 Factors to consider/Types of Business Opportunities

Business opportunities are diverse. They include among others the following: -

- Low competition due to the commodity characteristics (natural superior attributes and utility diversity)
- Potential for expansion/growth
- Emerging Markets
- Potential for strategic alliance
- A growing population which translates to an increasing demand
- Changing trends in market demand (demand for processed and/or certification of goods)
- Internet/On-line marketing (enabling wider networking)
- Existence of free Knowledge hubs (including knowledge on business planning)
- Existence of financial enablers

Business Opportunity	Opportunity Drivers	Investment requirements	Challenges
Production of fresh Cassava	High demand for fresh Cassava roots	Land, farm equipment	Climate change (pro-longed drought) Limited access to adequate quality planting materials High perishability of fresh roots
Seed bulking (provision of cassava planting materials)	LLow competition availability of technology such as mmini-sets (ministems)	Secured land (properly fenced), farm equipment, registration and certification, water source	Limited sources of certified planting materials

Business Opportunity	Opportunity Drivers	Investment requirements	Challenges
Aggregation of fresh cassava roots and drying	The fresh roots market is limited and cannot absorb all the available volume High demand of dried chips by processors	Land, collection shades, sorting and grading facilities	Bulkiness of fresh cassava roots Seasonality of production
Cottage processing of fresh cassava roots to crisps and other cooked recipes Making confectionaries	The fresh roots market cannot absorb the available volume	Appropriate equipment	Bulkiness of fresh cassava roots

7.3 Collective Marketing

Establishment of producer organizations (POs) and establishment of collection centers provides an opportunity for youth and women to participate in the cassava collection from nuclear farms to the central assembly point.

7.4 Cassava Root Production Gross Margin

A simplified example of how to determine the gross margin (total revenue minus total variable costs) for an identified business opportunity – production per acre per year.

Input Variables (Cost items)	Unit Cost (KES)	Quantity	Total Amount (KES)
Ploughing	3,000	Once	3,000.00
Planting	400.00	4 man days	1,600.00
Cost of Cuttings	2.00	4,000.00	8,000.00
1st Weeding	4,000.00	once	4,000.00
2nd Weeding	4,000.00	once	4,000.00
Harvesting	20,000.00	Once**	20,000.00
Total variable Costs			40,600.00
Revenue (gross income)	5.00	28,000Kg	140,000.00
Gross margin (gross profit) = Total revenue – Total variable costs			99,400.00

Notes: *Average cost of production per Kg = Total variable cost divide by a kilogram of cassava produced: 99,400 ÷ 28,000 = Ksh 3.55.*

When determining gross margins for other products, the specific items costs and income will change depending on the product and prevailing prices.

Chapter 8: Gender equality, human rights and social inclusion

8.1 Background

Studies conducted during implementation of the various value chains identified gender and human rights related challenges to participation. Women reported that cultural issues affected their rights to own land preventing their involvement in value chain activities as they could not make decisions on what to plant since all agricultural activities are dependent on land as a factor of production.

Gender roles ,triple roles for women -Reproductive. Productive and community management for women while Men's role is productive, and community politics were also sited as a hindrance to women's involvement in value chains .

Cultural practices like wife cleansing and inheritance, especially in some counties, denied widows an opportunity to participate in the value chain activities. Decision making at the household level relating to value chain selection were mostly done by men, though in some instances, women also participated in the process. But where men had migrated to towns, women were the sole decision makers on selection of value chain(s). in some counties, men dominated in decision making concerning value addition, grading, marketing, savings, access to agricultural and marketing information, as well as access to credit and training. Women and youth could not initiate any agriculture-based Income Generating Activities (IGAs) without permission from the husbands/fathers or the elderly men in the family due to cultural beliefs and patriarchy.

High illiteracy levels and low skills especially among women left them vulnerable in terms of technical matters in the value chain activities. Several farmer groups believed both English and Kiswahili languages be adopted during training, Trainers were said to use a lot of English when training and it confused the farmers making language and methodologies used a barrier.

Lack of markets: Exploitation by intermediaries affected the prices of most of the value chain produce. It was suggested that market linkages with potential external buyers be established and strengthened.

Gender and extension services - Extension services were provided to the farmers through group training and through telephone calls by private extension officers and county government extension officers. The youth indicated that the extension training courses were done early during the day when they had reported for other activities such as attending other fishponds, harvesting excluding them from the services. Women also complained that the time at which the extension trainings are done did not favour them as they are attending to domestic chores or farm activities denying them the opportunity to gain experience.

Youth attributed their inadequate participation in value chain production activities to lack of land ownership since the parents (fathers) were not willing to give them land on a permanent basis. As a result, there was serious conflict between the young men and their fathers in counties in some counties. The fathers felt that the sons (youth) were irresponsible people who would sell the land upon being given, and the money spent on drinking alcohol. This would render the entire family landless.

Widowhood – Women in all the sampled counties were targeted because of their status as widows, and the fight for family land and other capital assets always starts immediately after the husband died. Being a widow left them vulnerable to other families or even community members who want their land and other assets. In some cases, family members secretly alter particulars of ownership documents such as title deeds to the disadvantage of widowed women.

People with disabilities often experience discrimination in their everyday life. Discrimination describes a situation where an individual is disadvantaged in some way because of a 'protected characteristic.' Discrimination takes place in different forms. It can be direct or indirect, manifest in the form of harassment, or there can be direct instructions to discriminate. Direct discrimination is based on negative attitudes, prejudice, and/or on discriminatory legislation. Indirect discrimination, for example, can be caused by physical barriers, such as stairs as the only means to get to vital locations, or using media. For example, people who are visually impaired or have difficulties hearing cannot use media without assistance.

Most of the respondents requested special training on gender mainstreaming and gender-based violence and human rights, hence this manual. The findings came from the report below and gender analysis of selected value chains conducted by the Gender Youth and Social Inclusion Advisor, MESPT in August 2024 (G.V. Masinde and C.K. Wambu, PhD November, 2021 Final draft report *A Gender Equality and Human Rights Approach for The Green Employment in Agriculture Programme (GEAP), MESPT)*

8.1.1 Definition and key concepts

Sex: It identifies the biological differences between men and women. Kenya recognized and counted intersex persons during the census in 2019.

Intersex: Intersexuality is an overarching term that refers to human bodies that fall outside the strict male and female binary. The term refers to the many variations—often present at birth—that can affect a person's reproductive or sexual anatomy, which may involve genitalia, hormones, reproductive organs, and chromosomes.

For example, these variations might include being born with "female" anatomy on the outside, such as a vaginal opening, but having "male" sexual organs on the inside.- Intersex: What It Means, How It's Identified accessed on 14/11/2024

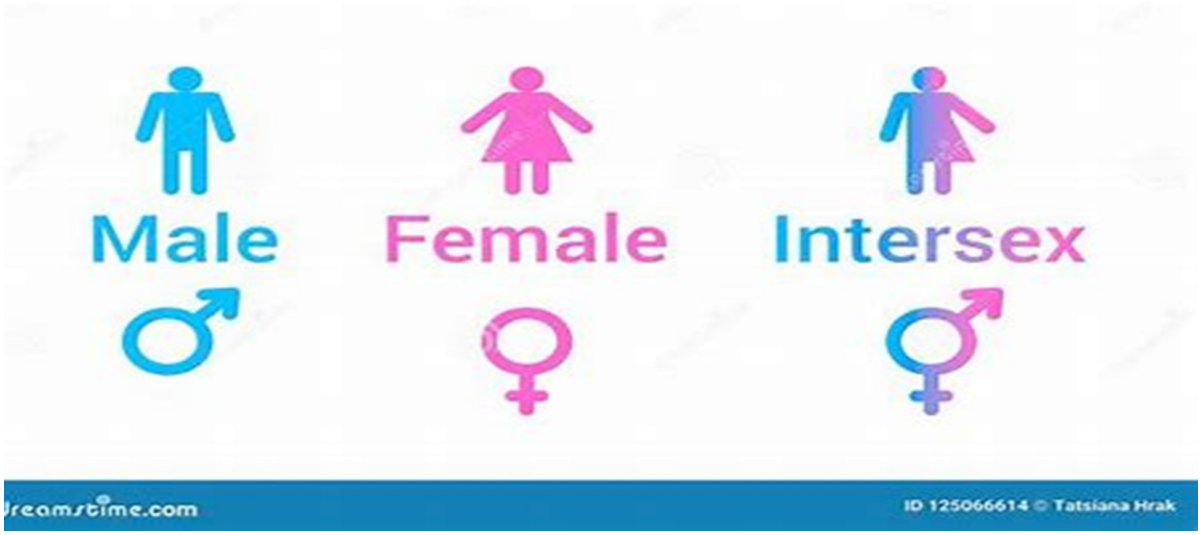


Figure 1:Kenya recognizes three genders Two genders? No, we should recognize the three in Kenya | Nation accessed on 14/11/2024.

Gender : Refers to the socio-cultural differences and relations between men and women that are learned, changeable over time, and have wide variations both within and between societies and cultures. The concept of gender also includes expectations held about the characteristics, attitudes and behavior of women and men (femininity and masculinity).

Gender equality: This is a human right that is enshrined in several declarations and conventions, including the legally binding Convention on the Elimination of All Forms of Discrimination against Women (CEDAW).

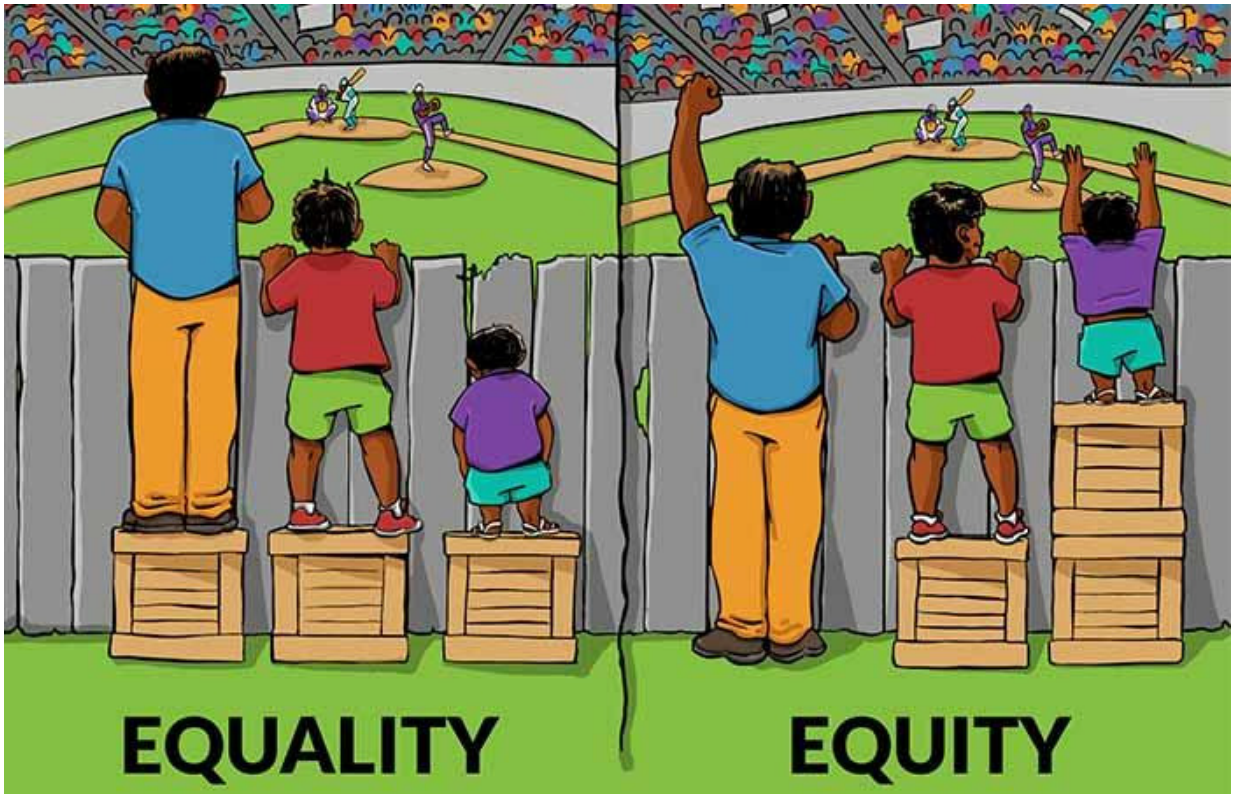


Figure 2 Equality and Equity illustrated All You Need To Know About Gender Equity Accessed on 14/11/2024

Equality does not mean that women and men are the same but that women's and men's rights, responsibilities and opportunities should not depend on whether they are born male or female. Gender equality implies that the interests, needs and priorities of both women and men are taken into consideration, recognizing the diversity of diverse groups of women and men(UN General Assembly, 1979). The centrality of **gender equality** to development is its establishment as a goal (goal 5) of the Sustainable Development Goals (SDGs) and included as a target in other SDGs.

Gender Equity: This is about fairness and being sensitive to the peculiarities of individuals, socio-economic groups, or communities. It is about equality of outcome or result of an intervention. Gender equity involves considering the different social, cultural, and economic situations of women, men, girls, and boys right from the design of an intervention through implementation to monitoring and evaluation.

Gender sensitivity: The ability to recognize the differences in terms of roles, contributions, needs and experiences of both women and men, and create a conducive environment for effective application of their specific knowledge, skills, and experiences in meeting their prioritized needs.

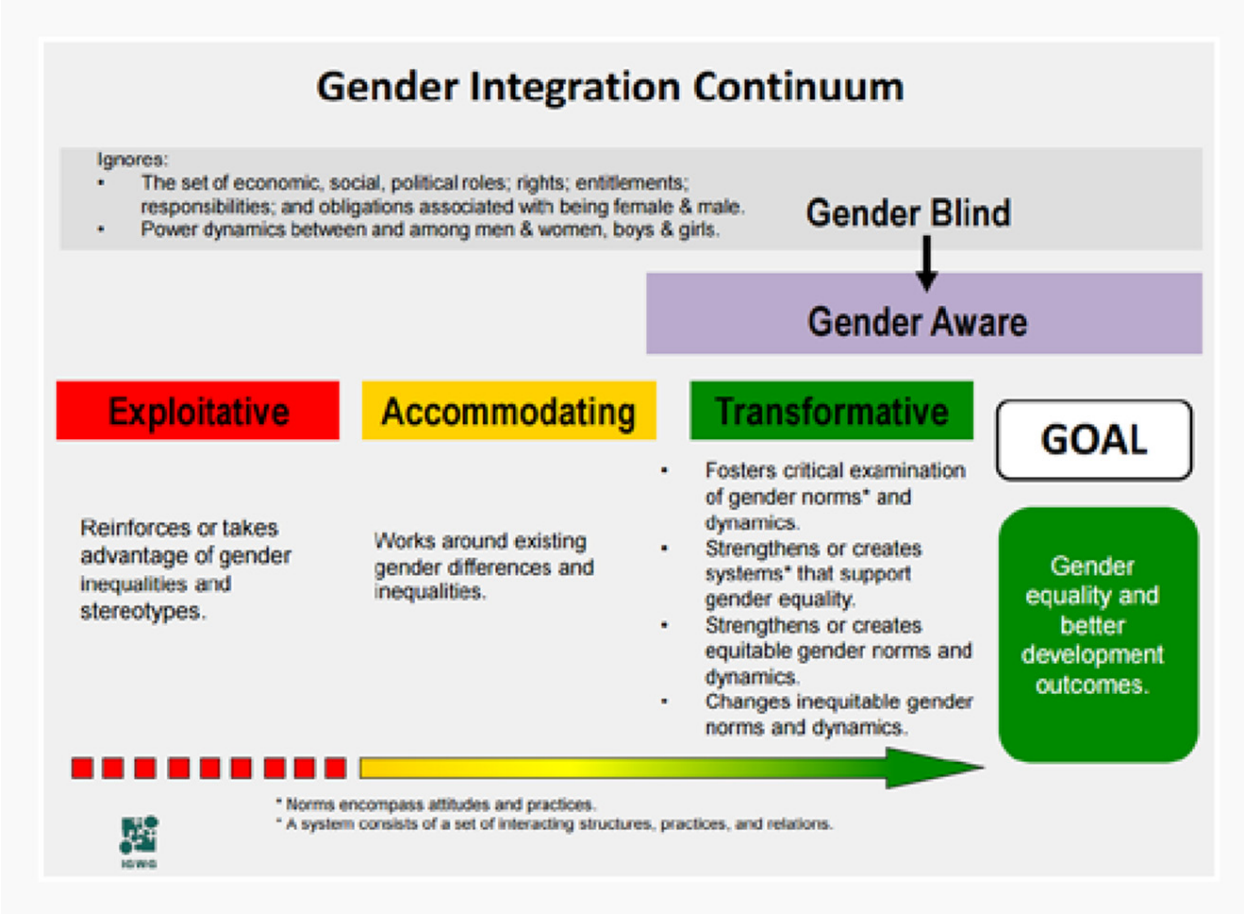


Figure 3: Gender Integration Continuum About IGWG | IGWG *accessed on 14/11/2024*

Gender aware: Recognizing or being aware of the existence of gender and gender differences in society; recognizing that men and women are positioned differently; that they have different experiences, different needs and interests, different strengths, and skills, and that these need to be considered while planning for any intervention.

Gender responsiveness: This describes the policies, programmes and projects that focus on transforming existing gender disparities to create a more balanced relationship between women and men in terms of power and decision-making as well as access to and control over productive resources. Gender responsiveness is key in meeting strategic gender needs(strategic gender needs are the needs women identify because of their subordinate position in society. These needs are long-term and relate to the empowerment of women. Strategic gender needs for women might include land rights, more decision-making power, equal pay, and greater access to credit. Addressing these needs allows people to have control over their lives beyond socially defined restrictive roles)

Practical gender needs are defined as: Needs that respond to immediate necessities such as adequate living conditions, water provision, health care, and employment. Gender-specific needs that do not challenge gender roles, such as access to healthcare, water availability, and employment opportunities.

Gender transformative

Addressing gender imbalances, changing gendered power relations, and actively building equitable social norms and structures. An organization is aware that women and men do not have equal opportunities in the household, at community level or at work. They may, for example, create equal working conditions for women and men, recognizing that special means may be required to increase the number of women in management positions or to achieve an environment free from gender-

based violence (GBV). Gender transformative approaches are characterized by explicitly centering gender norms and are thus common for interventions that have the primary goal of addressing gender issues and transforming gender relations to promote equality.

Transformative Gender Programming includes policies and programs that seek to transform gender relations to promote equality and achieve program objectives. This approach attempts to promote gender equality by:

1. fostering critical examination of inequalities and gender roles, norms, and dynamics,

2. recognizing and strengthening positive norms that support equality and an enabling environment,

3. promoting the relative position of women, girls, and marginalized groups, and transforming the underlying social structures, policies and broadly held social norms that perpetuate gender inequalities.

4. Most importantly, program/policy planners and managers should follow two gender integration principles:

    - First, under no circumstances should programs/policies adopt an exploitative approach since one of the fundamental principles of development is to "do no harm."

    - Second, the overall objective of gender integration is to move toward gender transformative programs/policies, thus gradually challenging existing gender inequities and promoting positive changes in gender roles, norms, and power dynamics.

Empowerment: Is about improving women's and men's status to enhance their decision making-capacity at all levels. It refers to the process in which women and men reflect upon their reality and question the reasons for their situation in society. It includes developing alternative options and taking opportunities to address existing inequalities. It enables them to live their lives to the fullest of their capabilities and their own choices in respect of their rights as human beings.

Gender Mainstreaming: Gender equality can be achieved by a strategy of mainstreaming which is defined by the United Nations, as '…the process of assessing the implications for women and men of any planned action, including legislation, policies, or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic, and societal spheres so that women and men benefit equally, and inequality is not perpetuated. The goal is to achieve gender equality.'

Gender mainstreaming aims to ensure that women and men, particularly those who are disadvantaged, equally participate in and benefit from the activities of a given organization, and that all implemented projects and programmes consider women's and men's concerns and experiences as an integral dimension of their cycles. This intervention ensures that existing democratic relations are protected, at the same time preventing the further perpetuation of inequalities and the creation of new ones.

8.1.2 The Business case for gender mainstreaming

Gender mainstreaming in Agri-enterprises is not only a matter of social equity but also makes strong business sense. Here are some key points that highlight the business case for gender mainstreaming in this sector:

Increased Productivity: Women make up a sizable portion of the agricultural workforce. By providing them with equal access to resources such as land, credit, and training, productivity can be significantly increased. Studies have shown that closing the gender gap in agriculture could increase yields on women's farms by 20-30%

Enhanced Innovation: Diverse teams bring varied perspectives, leading to more innovative solutions. Women often bring unique insights into agricultural practices and market needs, which can drive innovation and improve business outcomes.

Market Expansion: Women are key players in local markets and value chains. By empowering women, Agri-enterprises can tap into new markets and consumer bases, enhancing their market reach and profitability.

Improved Financial Performance: Companies that invest in gender equality tend to perform better financially. Gender-diverse companies are more likely to have higher returns on equity and better financial performance overall.

Risk Mitigation: Gender mainstreaming can help mitigate risks associated with labor shortages and community relations. Empowering women can lead to more stable and resilient communities, which in turn supports sustainable business operations.

Compliance and Reputation: Increasingly, investors and consumers are looking for companies that adhere to social responsibility standards. Gender mainstreaming can enhance a company's reputation and compliance with international standards, attracting more investment and customer loyalty.

By integrating gender mainstreaming into their operations, Agri-enterprises can not only contribute to social equity but also enhance their competitiveness and sustainability.

8.1.3 Steps to mainstream Gender

Gender mainstreaming in Agri-enterprises involves several strategic steps to ensure that gender considerations are integrated into all aspects of the business. Here are some specific strategies:

1. **Conduct Gender Analysis**: Start with a thorough gender analysis to understand the distinct roles, needs, and challenges faced by men and women in the agricultural sector. This analysis should inform all stages of project planning and implementation.
2. **Develop Gender-Responsive Policies:** Create policies that promote gender equality and address specific barriers faced by women and youth. This includes policies on equal access to resources, decision-making, and opportunities for training and development.
3. **Capacity Building:** Provide training and capacity-building programs for both men and women to enhance their skills and knowledge. This can include technical training, leadership development, and financial literacy.
4. **Gender-Responsive Budgeting:** Allocate budget specifically for gender mainstreaming activities. This ensures that there are sufficient resources to support gender equality initiatives.
5. **Participatory Planning:** Involve both men and women in the planning and decision-making

processes. This ensures that the perspectives and needs of both genders are considered and addressed.

6. **Monitoring and Evaluation:** Establish gender-sensitive indicators and regularly monitor and evaluate the impact of gender mainstreaming activities. This helps in assessing progress and making necessary adjustments.
7. **Promote Women's Leadership:** Encourage and support women to take on leadership roles within the enterprise. This can be achieved through mentorship programs, leadership training, and creating an enabling environment for women leaders.
8. **Address Social Norms:** Work on changing discriminatory social norms and practices that hinder gender equality. This can be done through community engagement, gender transformative approaches including Gender action learning systems(GALS), community conversations, model families, among others that seek to address root causes of discrimination.

8.2 HUMAN RIGHTS

Human Rights: These are rights inherent to all human beings, independent of nationality, place of residence, sex, national or ethnic origin, race, religion, language, or any other status. All human beings are equally entitled to human rights without discrimination. These include the right to life, equality before the law, the right to work, social security, education, and the right to development. These rights are all interrelated, interdependent and indivisible(Access the comprehensive text here [30 articles on the 30 Articles of the Universal Declaration of Human Rights | OHCHR]

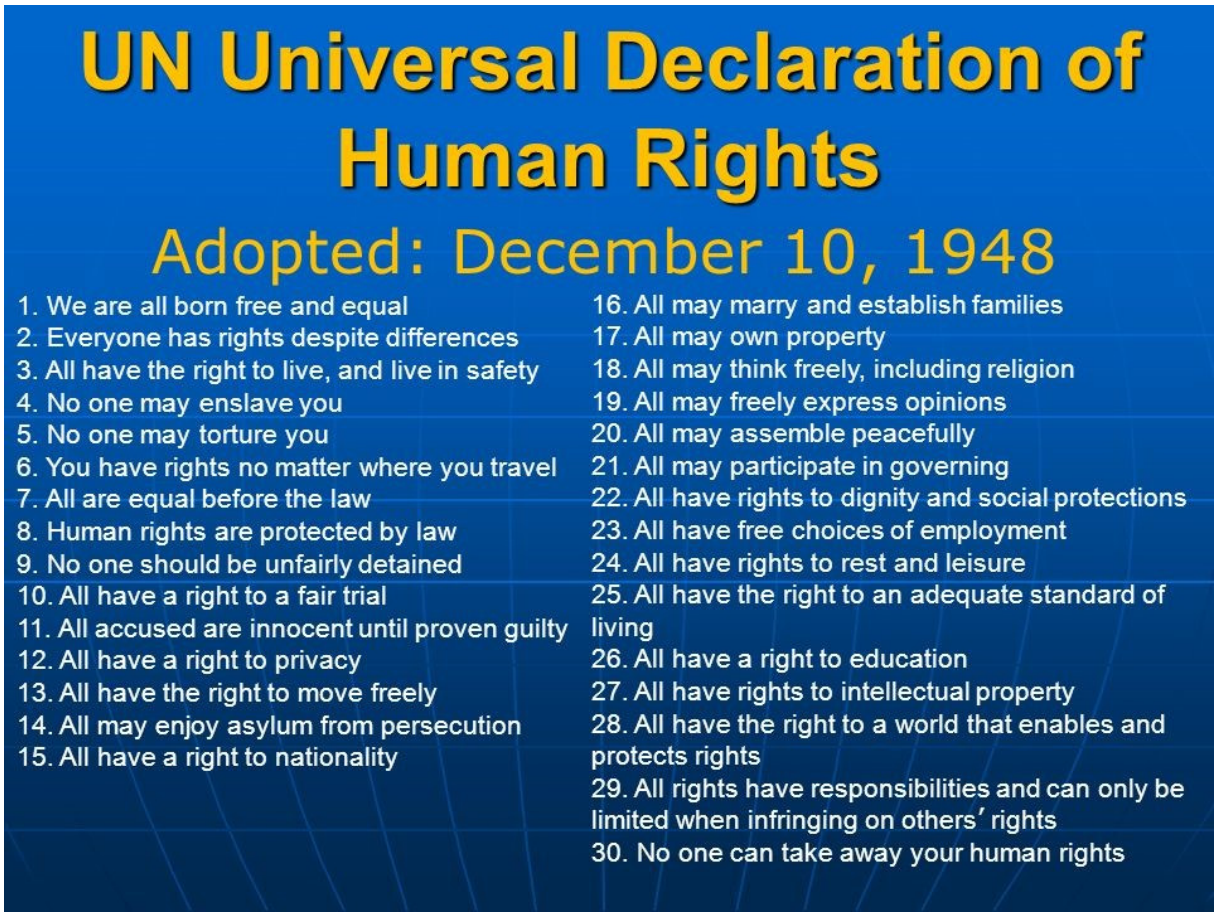


Figure 4: 30 articles of Huma rights [https://rvalibrary.org/shelf-respect/law-library/national-human-rights-month/] Accessed on 14/11/2024

Children rights are also enshrined in the convention on the rights of the child(1989). Kenya enacted this into a children's act 2022.

convention-rights-child-text-child-friendly-version.pdf accessed on 13/11/2024.

Access the full text here file

A human rights-based approach (HRBA): This is a conceptual framework based on international human rights standards and directed towards promoting and protecting human rights. HRBA seeks to analyze the inequalities which lie at the heart of development problems and redress discriminatory practices and unjust distributions of power that impede development progress.

HRBA is concerned with empowering people to know and claim their rights and increasing the ability and accountability of individuals and institutions who are responsible for respecting, protecting, and fulfilling rights. The HRBA approach aims to eliminate or at least diminish the impediments of

existing exclusion and discrimination within the implementation of any programme or project. HRBA gives equal attention to both achieving development goals and to the processes that are chosen to achieve these goals. So, within HRBA, the processes that enable the participation and inclusion of all stakeholders are important.

8.2.1 ABOUT HRBA AND PANT PRINCIPLES

The HRBA builds on the norms and principles outlined in the Universal Declaration of Human Rights, and the subsequent legally binding UN treaties, which form the basis for all development cooperation. Application of the HRBA contributes to effective development cooperation processes and sustainable development outcomes. It challenges unequal power relations and social exclusion that deny people their human rights and often keep them in poverty and oppression. Microenterprise support Programme Trust (MESPT) is committed to the HRBA in all interventions.

HRBA places people living in poverty and oppression (rights holders) at the center. It is about:

- Empowering rights-holders to enable them to take action to address their situation and to claim their rights individually and collectively.
- Developing capacities and interests of duty-bearers to fulfil their obligations to respect, protect and fulfil human rights.

PANT is a tool that guides staff on the practical application of the HRBA.

It has four elements:

Participation : Do all stakeholders engage actively, in a way which allows rights-holders to contribute meaningfully and influence processes and outcomes?

Everyone has a right to freely participate in decision making that affects them and their environment. People of power have an obligation to offer meaningful participation and consultations to people affected. Everyone has the right to organize and hold opinions without any interference, and to seek, receive and impart information and ideas through any media regardless of frontiers. Promoting participation is essential for the outcome of projects and programmes. It is stated in international treaties that women, men, girls, and boys have a right to participate in decision-making that affects them. Social and cultural roles that are prescribed women and men have impact on their possibilities of choices, economic independence, access to natural resources, access to land tenure, access to clean and safe water, and decisiveness on housing, education, and livelihood.

Guiding questions are:

- Are fair and effective platforms for public-private dialogue in place, and do they give space to representatives of women and men with less power and status?
- Are measures taken to include and enhance the capacity of those with less knowledge and power so that they can participate meaningfully in the consultative processes? For example, do all stakeholders have sufficient and accessible information on the issues being addressed? Are they invited to truly participatory processes? Are barriers removed, e.g., no expensive travelling, not during busy seasons, not inaccessible for women or persons with disabilities?
- Are stakeholders actively engaged at all stages of the programming process?
- Do initiatives make space for vulnerable people to take actions of their own choosing to manage perceived risks? This is especially important in 'transformative' efforts that encourage profound changes in livelihood systems in response to climate change or market upheavals.

- **Accountability** :Who are the duty bearers on various levels, and do they have sufficient capacity and interest to be accountable to rights holders?
- The state has an obligation to respect, fulfil and protect the rights of its population. It entails a functional regulatory system for climate and environmental issues, labour law, land systems ; concrete plans for disaster risk reduction and response; rule of law including a justice system providing legal aid to poor and marginalized people and their organisations; and functional and accessible complaints mechanisms. Emphasizing the accountability of all actors (both state and non-state), whose actions impact the environment and natural resources, is a central element of HRBA. Asserting human rights without supporting effective and precise frameworks to hold duty bearers accountable is of little practical use. Strengthening the governance of natural resource management and securing natural resources tenure while also taking rights of local people, women and men, ethnic minorities, nomadic or other marginalized groups into account, can
- minimize corruption.
- have positive effects on conflict management.
- be a key step towards alleviating tensions in society and consolidating peace in post-conflict societies.
- **Guiding questions are:**
- Are the duty bearers and other actors with power identified?
- Does the initiative contribute to ensuring that public and private sector actors have systems in place to monitor and disclose social and environmental impacts according to national and international standards?
- Do monitoring and evaluation arrangements involve civil society organisations representing the concerned population?
- Are there consequences (legal, financial, or moral) for non-compliance with human rights objectives and principles?
- Has the contribution established accessible and effective mechanisms for redress and complaints?
- Does the contribution facilitate access to networks, organisations and other sources of information that may assist duty bearers to enhance their accountability and rights holders to claim their rights?

Non-discrimination :Are rights holders and the root causes of their lack of human rights identified and considered, particularly those most subjected to discrimination, marginalization, and vulnerability?

All women, men, girls, and boys are, without any discrimination, entitled to equal access to ecosystem services , market systems and natural resources as well as resilience for a standard of living adequate for their health and well-being. Discrimination may be expressed in law (explicit discrimination) and hence be part of official policy such as lack of land rights; or it may be found in practice and behavior (implicit discrimination)such as where a remote group cannot access water services because drinking wells provided by the state are too far away.

Key questions are:

- Are vulnerable groups specifically identified and targeted?
- Is there a proper analysis of the consequences of the contribution for these women, men, girls, and boys?

- Is there a plan for their inclusion and benefit including disaggregated data and indicators?
- Are tariffs and fees also adjusted to accommodate poor and marginalized groups?
- Are land and property rights addressed to ensure that women, minorities, and poor people are protected or compensated?
- Are the livelihoods supported resilient to risks related to climate and market volatility and uncertainty, and therefore relevant for vulnerable populations that cannot afford to shoulder uncertain risks?

Transparency :What measures are put in place to ensure that all stakeholders can access relevant information and knowledge regarding the contribution?

Transparency All people have the right to obtain information in an accessible and timely manner, e.g., about pollution levels, water quality, environmental health risks, exploitation plans, land use plans and disaster preparedness plans. Granting sufficient and accessible information to affected women and men in planning and policy making processes is of key importance to their ability to influence and monitor developments. It is also important to consider local traditions, survival strategies and indigenous people's dependence on natural resources, and ensuring that separate views are documented. It is also essential to consider access to natural resources for people living in poverty and that a long-term sustainable development can be promoted, to avoid future opposition and conflicts.

Guiding questions are:

- Are the plans and goals of the contribution made public and explicit in an accessible manner to all stakeholders concerned, including the most marginalized groups so that they understand benefits and risks?
- Will affected women, men, girls, and boys receive sufficient, timely and accessible information,

including separate views on the plans, and will they be able to take meaningful part in and influence the process?

- Will access to information regarding the local risk situation be improved and will early warning systems be developed so that the ability of vulnerable groups to protect themselves and quickly recover after disasters is strengthened?
- Does the initiative contribute to capacities and commitments for greater transparency in policies and practice affecting land and natural resource tenure, particularly in new forms of land acquisitions and concessions?

8.3 SOCIAL INCLUSION

Social inclusion is the process of improving the terms on which individuals and groups take part in society—improving the ability, opportunity, and dignity of those disadvantaged based on their identity.

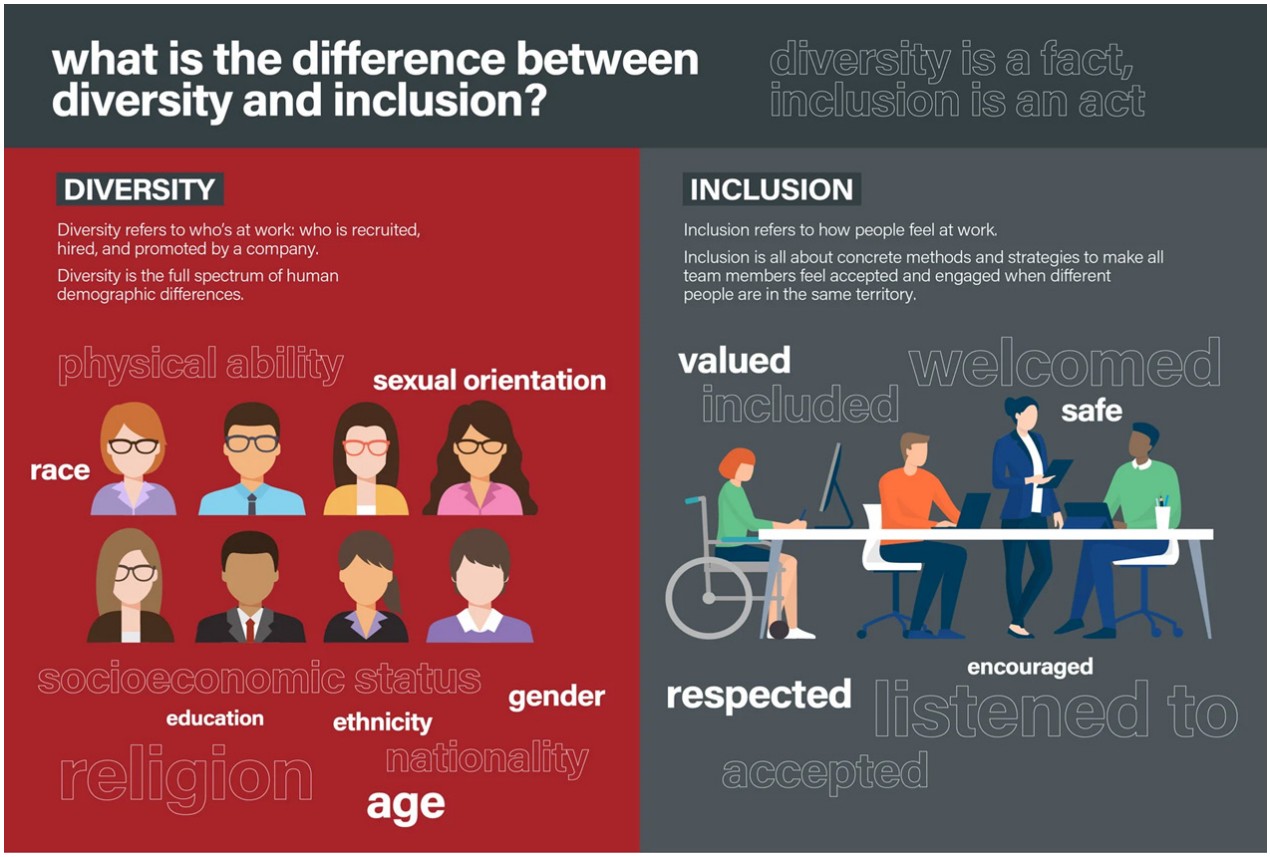


Figure 5 Diversity vs Inclusion DRP Group. (n.d.). What is the difference between diversity and inclusion? DRP Group. Retrieved November 14, 2024, from https://www.drpgroup.com/en/blog/what-is-the-difference-between-diversity-and-inclusion.

In every country, some groups confront barriers that prevent them from fully participating in political, economic, and social life. These groups may be excluded not only through legal systems, land, and labor markets, but also discriminatory or stigmatizing attitudes, beliefs, or perceptions. Disadvantages are often based on gender, age, location, occupation, race, ethnicity, religion, citizenship status, disability,

and sexual orientation and gender identity (SOGI), among other factors. This kind of social exclusion robs individuals of dignity, security, and the opportunity to lead a better life. Unless the root causes of structural exclusion and discrimination are addressed, it will be challenging to support sustainable inclusive growth and rapid poverty reduction.

Social inclusion is the right thing to do, and it also makes good economic sense. Left unaddressed, the exclusion of disadvantaged groups can be costly. At the individual level, the most measured impacts include the loss of wages, lifetime earnings, poor education, and employment outcomes. Racism and discrimination also have physical and mental health costs. At the national level, the economic cost of social exclusion can be captured by foregone gross domestic product (GDP) and human capital wealth. Exclusion, or the perception of exclusion, may cause certain groups to opt out of markets, services, and spaces, with costs to both individuals and the economy.

Ensuring inclusivity means no one is left behind(leave no one behind-LNOB). The following steps make this possible.

8.3.1 Leave no one Behind

STEP 1:Who is being left behind? Gather data.

Identify who is being left behind and in what ways, and who among them is the furthest behind.

- Gather and analyze all data and information on who in the community is left behind in group activities and project interventions-sub populations and geographic localities among others with due attention to the human rights-based approach and gender considerations.
- Include and analyze data and information from a range of sources, including from national statistical offices, national human rights institutions, international human rights mechanisms, ILO supervisory bodies, civil society organizations, particularly organizations of marginalized communities as well as women's organizations, and/or community-level data, citizen science initiatives and scientific journals.
- Seek feedback and input from diverse stakeholders, including groups and populations left behind, throughout the process, from initial gathering of data to review and analysis.
- Identify data gaps.
- Complement existing data where needed, to further understand which subpopulations may be left behind, and which ones are furthest behind, using participatory approaches to gathering data.
- Combine relevant national and UN development, human rights, conflict, inequalities, political, risk and humanitarian analysis for more joined up assessment of who is left behind and why – with a view to identifying the furthest behind.
- Triangulate the data from the above sources through a consultative analytical process to develop a mutual understanding across all interventions that consider the voices and experiences of communities together with other data sources.

STEP 2:Why? Prioritization and analysis

- Frame as problems the LNOB assessment's main findings are about the ways in which people are left behind. Identify the relevant human rights and international labour standards.
- Conduct a root cause analysis to identify why people are being left behind and to enable responses to the root and underlying causes of inequalities, including gender inequalities, vulnerability, deprivation, discrimination, displacement, and exclusion.

- Conduct a role pattern analysis.
- Conduct a capacity gap analysis.
- Questions to be asked at each step: Causal analysis WHY? Which rights are implicated that explain why there is a problem? Role pattern analysis WHO? Who is the duty-bearers? Who are the rights holders? Who must do something about it? Capacity gap analysis WHAT? What capacity gaps are preventing duty-bearers from fulfilling their duties? What capacity gaps are preventing rights holders from claiming their rights? What do they (each) need to act?

STEP 3: What? What should be done?

Identifying what should be done and by whom.

- Identify actions and interventions to address challenges, barriers, and capacity gaps. Areas include advocacy, enabling the environment, capacity development ,community empowerment, quality and accessibility of services, partnerships including civil society.
- Prioritize, considering the commitment to address the furthest behind first.

STEP 4: How? How to measure and monitor progress

- Help identify and contextualize LNOB indicators and targets – having a clear overview of data and data gaps and a plan for monitoring progress is an important precondition for effective follow-up and review.
- Quantitative and qualitative indicators will be necessary – measuring commitments, processes, and outcomes.
- Support innovative ways of tracking, visualizing, and sharing information.
- Develop the stakeholder capacity to monitor inequalities, including gender inequality and discrimination, including that of governments (national, subnational) and communities.

STEP 5: Advancing accountability for LNOB.

- Ensure accountability for LNOB within the in the organization and the interventions.
- Support the integration of LNOB in interventions follow-up and review processes, including in narrative reports.
- Support national accountability to people left behind.

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ANNEX I

MESPT
MICRO ENTERPRISES SUPPORT PROGRAMME TRUST

BANANA VALUE CHAIN TRAINING WORKSHOP FOR XXXX

TRAINING VENUE: XXX **DATES: XXX**

SAMPLE PROGRAMME

Date and Time	Activity	Duration	Responsible

ANNEX 11.: List of participants who validated this value chain manual

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1	Joseph Kairu	County Government of Siaya
2	Winston Motanya	County Government of KISII
3	Nicholas Manyinsa	County Government of KISII
4	Cecilia Mutuku	County Government of MACHAKOS
5	Paul Busienei	County Government of NAKURU
6	David Kimera	Youth Agri-Preneur
7	Lawrence Swanya	County Government of MACHAKOS
8	Kenneth Kagai	County Government of TRANS-Nzoia
9	Benedict Khanyifu	County Government of TRANS-Nzoia
10	Mwalimu Menza	Kenya Agricultural and Livestock Research Organization
11	George Kamami	County Government of MAKUENI
12	Moses Munialo	County Government of BUGOMA
13	Agesa Eric	County Government of KAKAMEGA
14	Benard Mainga	County Government of KWALE
15	Jane M Kamamu	County Government of KILIFI
16	Teresia Ndungu	County Government of NYANDARUA
17	Wilbur Mutai	County Government of UASIN-GISHU
18	Stephen Odipo	Kenya Agricultural and Livestock Research Organization
19	Solomon Mbivya	PAPA FARMERS Limited
20	William Mwangi	County Government of MAKUENI
21	Doreen Kinoti	Micro-Enterprises Support Programme Trust
22	Serah Nzau	Micro-Enterprises Support Programme Trust
23	Margaret Kikuvi	Micro-Enterprises Support Programme Trust

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