# The United Republic of Tanzania

## Tanzania Investment Centre

## *Investment Opportunities in the Oil Palm Value Chain, Tanzania*

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# 1 Overview of the Oil Palm Producing Regions in Tanzania

During this study, the team visited oil palm (*Elaeis guineensis*) farmers and processors in various parts of the Kigoma region, and a deskwork/literature review enabled us to draw data and information for Mbeya and Pwani regions.

Kigoma, Mbeya and Pwani are the main oil palm producing regions in Tanzania – with Kigoma producing about 61.4%, Mbeya 35.7% and Pwani 0.9% as per 2017/18 agricultural season data[1]. In Kigoma there are over 30,000 smallholder subsistence palm oil farmers[2]. Meanwhile, the country imports over 500,000 MT of palm oil per annum. Thus, palm oil value chain development offers great potential for both import substitution and poverty alleviation. At the same time, other goals such as environmental conservation, improved nutrition, and gender equality and women's empowerment may be achieved through sustainable palm oil value chain development. Figure 1 shows the map of Kigoma region.


**Figure 1-1 Map of Kigoma region**

## 1.1 Data Collection

This study was conducted in partnership between the Tanzania Investment Centre (TIC) and East Africa Trade & Investment Hub (EATIH) during June 2019. The Kigoma Regional Authority took the lead to guide the team throughout the exercise.

The team visited small-scale and large-scale oil palm producers and processors in the entire region of Kigoma. Table 1 shows our schedule.

1 Annual Agriculture Sample Survey (AASS) for Crop and Livestock report of 2017/18

2 3ADI+. The palm oil value chain in Tanzania - Diagnostics, investment models and action plan for development and innovation (2019)

**Table 1-1 Palm Oil Value Chain Study Schedule**

| Location | | Name of Oil Palm Producer or Processor | Date |
|---|---|---|---|
| 1 | Kigoma | Kwitanga Prison – Oil Palm Plantation and Palm Oil producer | June 10, 2019 |
| 2 | Kigoma | Jumapili Mpoki Mwakalikamo – Oil Palm seeds breeder | June 10, 2019 |
| 3 | Kigoma | Tanzania Agricultural Research Institute (TARI) – Oil Palm seeds breeder | June 11, 2019 |
| 4 | Kigoma | Community Groups and a Uvinza District Council's Facility for Palm Oil processing – both at the Ilagala village | June 11, 2019 |
| 5 | Kigoma | FELISA Company Ltd (Dr. Hamimu Hongo; Managing Director and Founder) – Oil Palm seed producers | June 12, 2019 |
| 6 | Kigoma | SIDO Kigoma – Palm Oil & processors and soap manufacturers | June 12, 2019 |

The following methods were used to generate required data or information: -

i. Desk work/Literature review
ii. Physical site visits - observation
iii. One-to-one or group interviews
iv. Questionnaires
v. Focus Group Discussions

## 2 Edible Oils: The Untapped Sub-sector in Tanzania

Tanzania`s edible oil sub-sector stands at Tshs 676.2 billion (US$294 million) with players like Bidco Oil and Soap Ltd, Murzah Oil Mills and Alaska Tanzania[3].

The sub-sector is highly in need of investors to fill the supply gap that currently stands at 320,000 tons so as to slash the import bill that amounted to Tshs.191.3 billion (US$83.19 million) in 2018. The country`s annual demand for edible oil is 570,000 Tons (50,000 $m^3$ per year) and annual supply is 180,000 Tons (or 40,000 $m^3$ per year) leaving the country with no choice but to import the remaining 320,000 Tons.

The demand forecast shows an increase from 570,000 tons to 700,000 tons of edible oil by 2030; and, Tanzania guarantees the market growth for investors in the foreseeable future.

The major sources of edible oil in Tanzania include sunflower, oil palm, groundnuts, sesame, soya beans and cotton. Experts[4] report that oil palm, coconut and avocado as the leading edible oil producing value chains per unit area, worldwide. Hence, an investment opportunity avails itself in tapping oil palm, coconut and avocado's potential in filling the edible oils' gap in Tanzania.

Oilseeds are produced in almost all regions in Tanzania. The major crop for edible oil production in Tanzania is the sunflower because it can be grown in most parts of the country as it is drought resistant, less susceptible to diseases and cheaper to cultivate compared to other oilseeds crops. However, production of sunflower remains low and benefits from its value chain have not been adequately realized.

[3] Ministry of Agriculture and Food Security of Tanzania (2019)

[4] Dr Hamimu Hongo, FELISA Company Ltd Managing Director & Founder (2019)

Overall, there is a huge potential for producing edible oilseeds in Tanzania. This includes high demand of vegetable oil, large suitable land, availability of market/demand, presence of water bodies, favorable policies and regulations, availability of power in the rural areas through the Rural Electrification Program through the Rural Electrification Authority (REA) program, and possibility of a wide range of products that can be produced in these oilseeds value chain.

Various studies have indicated that the performance of this subsector does not mirror the underlying opportunities. Production is characterized by small area of cultivation and low yield. For example, on average, sunflower cultivation is on small-scale, with an average farmer cultivating 4.0 acres only, producing 0.6 tons of sunflower seeds per acre[5]. This level is far below productivity of 2.0 - 3.0 Tons of sunflower seed per acre. Similar low productivity levels have been reported for oil palm in Kigoma and Mbeya, whereby under current farming conditions one *Dura* plant yields 7-8 litres of palm oil/year; and, a plant of *Tenera* yields 28 litres/year.

As for avocados, there is no single company in Tanzania which processes avocados to produce edible oils. This is an opportunity for investment in the country.

While the role of farmers in the sunflower value chain is only confined at production level and selling sunflower seeds, processing is characterized by small and medium scale processors and is only limited to sunflower oil and animal cake. It has been reported that the low performance in this subsector is driven by a few constraints. These include; poor farming practices, inadequate extension services, poor access to finance, depressed farm gate prices of sunflower products, inadequate processing facilities, threat from imported edible oil and inadequate technology.

To address these challenges, the Ministry of Agriculture and Food Security recommends the following measures: -

a) Capacity building to farmers
b) Improving extension and processing services
c) Addressing financing needs to the sunflower value chain especially farmers
d) Meeting input needs to the farmers
e) Encouraging public private partnership in the subsector and strengthening marketing infrastructure for sunflower products.

However, Tanzania believes it has the capacity to produce enough of the required edible oil and so undertook measures to boost production. In the 2018/19 financial year, the country increased the tariffs on crude palm oil to 25% to promote local production of oil seeds. The country also increased duty on semi-refined and refined/double refined edible oil including sunflower oil, palm oil, groundnuts oil, olive oil, maize corn oil to 35% from 25%.

This report analyses the potential of Oil Palm production in curbing the huge edible oils' deficiency in Tanzania.

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[5] Bank of Tanzania. Working Paper Series (Potentiality of Sunflower Subsector in Tanzania) – WP No. 10, March 2017

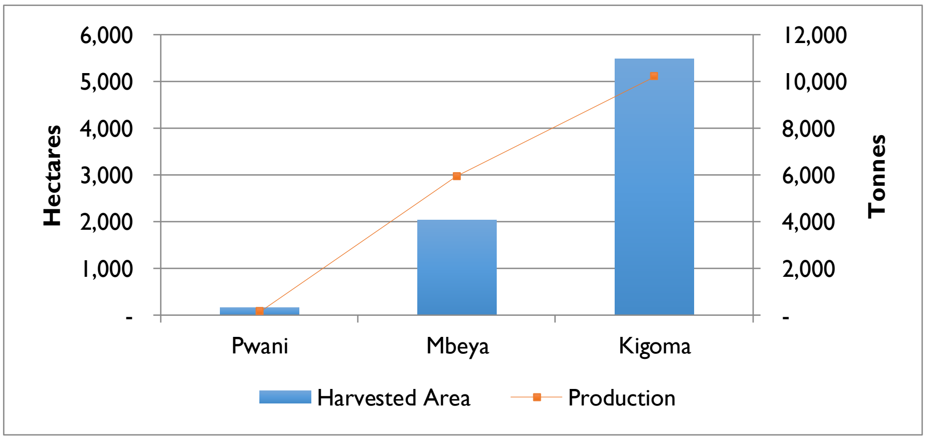
# 3 Oil Palm Production

## 3.1 Oil Palm Production in Tanzania

The main source of palm oil in Tanzania is Kigoma – where palm trees date back to 1920s[6]. Kigoma region accounts for over 65% of palm oil produced in the country, the remaining 35% comes from Kyela district, Mbeya region[7].

During 2018/19 agricultural season, oil palm production was mainly recorded from five regions of mainland Tanzania. A total of 25,773 operators were engaged in oil palm production. The total area planted with oil palm was 9,742 ha of which 7,717 ha were harvested (79.2 percent of planted area)[8].

**Table 3-1 Harvested Area (Hectares) and Production (Tons) of Palm Oil by Region**




Kigoma Region with 6,819 ha (70.0 percent) had the largest planted area, followed by Mbeya with 2,102 ha (21.6 percent). The other palm oil producing region was Pwani (444 ha: 4.6 percent). The total production was 16,593 Tons from 7,717 ha harvested with an average yield of 2.2 Tons/ha. Kigoma Region with 10,192 Tons (61.4 percent) had the highest production from 5,487 ha harvested, followed by Mbeya 5,918 Tons (35.7 percent) from 2,031 ha harvested and Pwani Region with 156 Tons (0.9 percent) from 126 ha harvested as shown in Figure 3 40.

Palm oil production in Kigoma region has faced several challenges for the last 100 years -- hence its demise. The problems include low productivity, lack of stable investment and weak market functions with private investors abandoning their farms due to unpredictable returns.

There are many (other than Kigoma, Mbeya and Pwani) suitable for oil plam production in Tanzania. Areas that have the potential to grow oil palm include: Tabora (Urambo & Kaliua), Katavi, Morogoro, Tanga, Lindi, Mtwara, Kagera and Mbeya (Kyela)[9].

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6 Tanzania Edible Oils Actors Association (TEOSA), 2012.

7 Dr Hamimu Hongo, FELISA Company Ltd Managing Director & Founder (June 2019)

8 2017/18 Agriculture Survey, Ministry of Agriculture, Tanzania

9 Dr Hamimu Hongo, FELISA Company Ltd Managing Director & Founder (June 2019)

Tanzania, boasts itself for having the best environment and hence, the high potential for palm oil production in the world, because:

a) We have the best oil palm parent stock (*Dura* and *Pisifera*) - which was taken by Malaysia and Indonesia during the 1930s, and hybridized with those from DRC Congo, Cameroon and Ivory Coast
b) A vast arable land enabling us to feed the whole of Africa

### 3.1.1 Historical and Current Global Production of Palm Oil

In 2016, the global production of palm oil was estimated at 62.6 million Tons, 2.7 million Tons more than in 2015. The palm oil production value was estimated at US$39.3 billion in 2016, an increase of US$2.4 billion (or +7%) against the production figure recorded in the previous year[10].

Between 1962 and 1982 global exports of palm oil increased from around half a million to 2.4 million Tons annually and in 2008 world production of palm oil and palm kernel oil amounted to 48 million Tons.

The global production of palm oil is expected to grow to around 73.5 million metric tons in the marketing year 2018/2019, up from approximately 70.5 million metric tons in 2017/2018[11]. In that period, Indonesia and Malaysia were the leading exporters of palm oil worldwide.

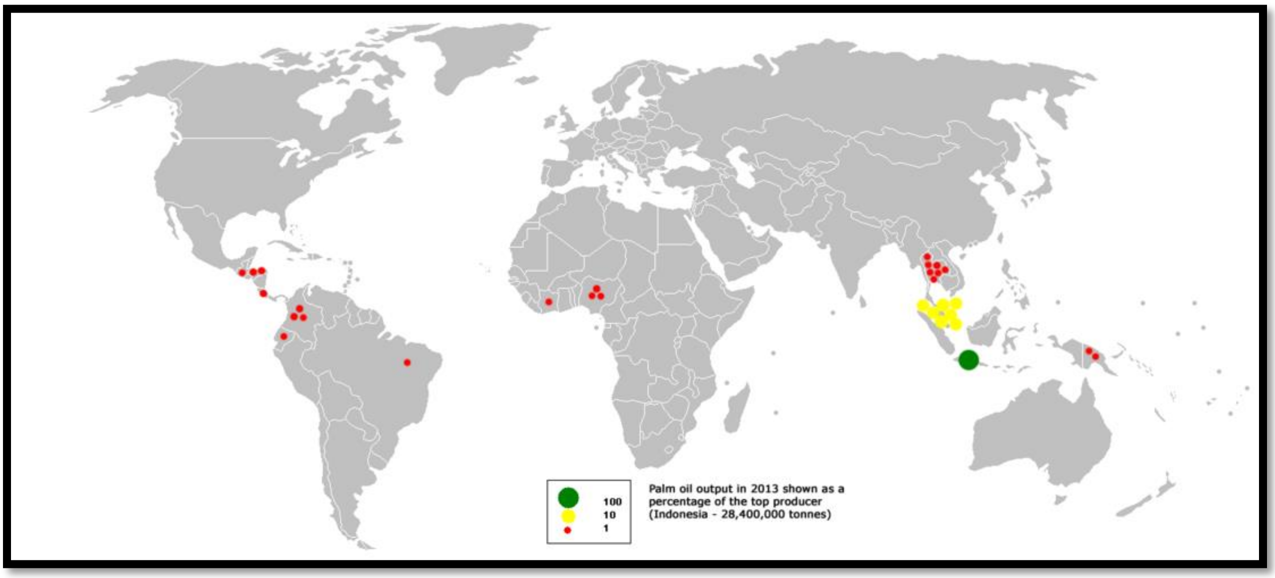


**Figure 3-1 A Map of world palm oil output, 2013**

[10] "Global Palm Oil Market Overview - 2018 - IndexBox". www.indexbox.io. Retrieved 17 August 2018.

[11] https://www.statista.com/statistics/613471/palm-oil-production-volume-worldwide/

According to FAO forecasts by 2020 the global demand for palm oil will double, and triple by 2050[12].

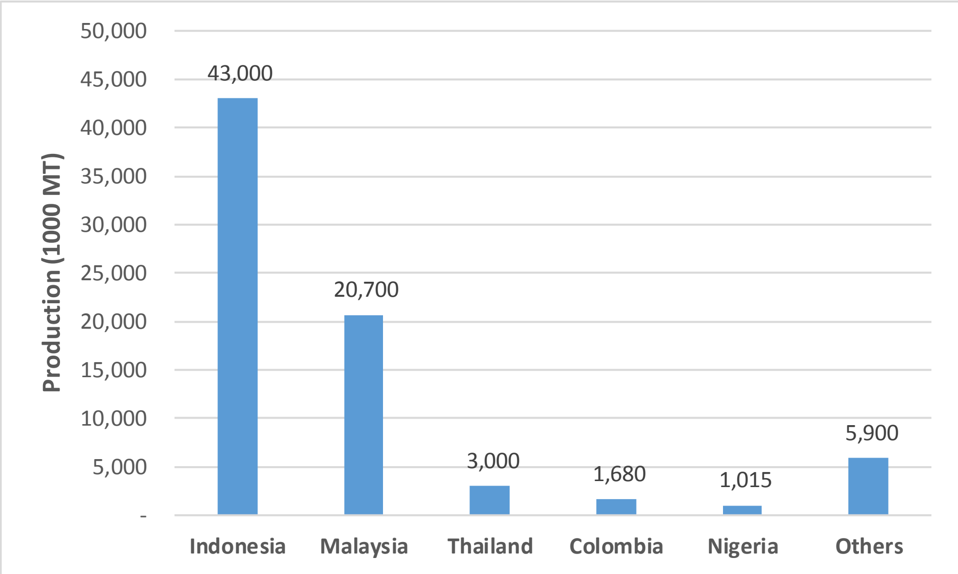


**Figure 3-2 Leading Producers of Palm Oil Worldwide from 2018/19**

Figure 2-3 shows the African countries which produce palm oil.

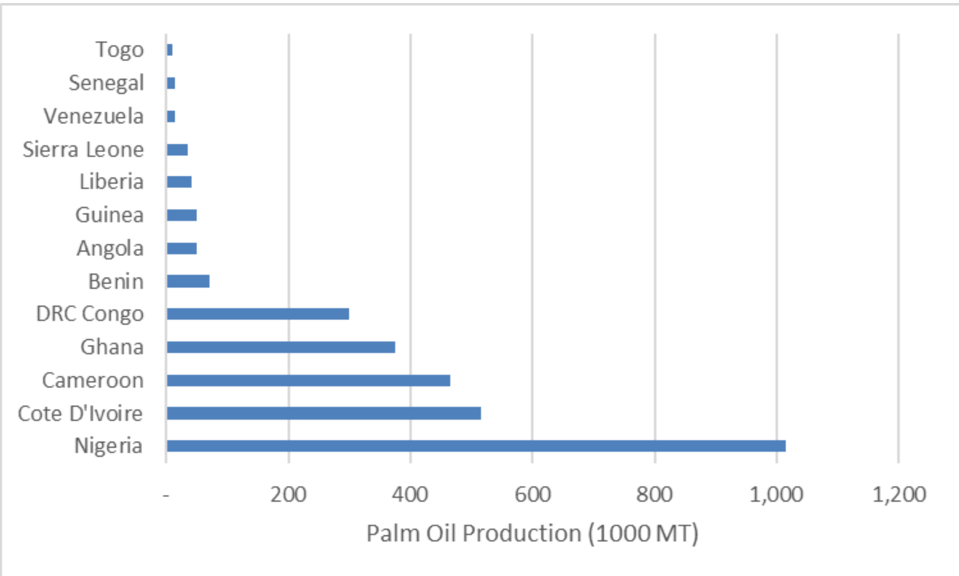


**Figure 3-3 Palm oil production in Africa**

[12] Prokurat, Sergiusz (2013). "Palm oil - strategic source of renewable energy in Indonesia and Malaysia" (PDF). Journal of Modern Science: 425–443. Archived from the original (PDF) on 4 March 2016.

The African oil palm, which originated in West Africa and grows extensively in this region, but largely as low-yield multi-crop stands in and around villages, where it has been traditionally grown as a subsistence crop in small-scale farming systems for thousands of years. Africa (and West Africa in particular) is a new frontier region for large-scale palm oil production. Many companies that already have existing plantations and other investors are now looking to expand their operations into this region to meet the growing demand for palm oil. Depending on the country, smallholders account for between 70–90% of African oil palm growers.

Yield is much lower in Africa than in Southeast Asia for various reasons, including climate and infrastructural limitations and a predominantly smallholder approach to production. It is debatable whether comparative yields are achievable even with investment and improved growing techniques.


**Figure 3-4 Palm oil in Africa**

While Africa remains a net importer of palm oil, African governments see oil palm development as a potential source of tax and export revenue. A growing number of investors, including some of the world's largest plantation companies, are finding concession areas easier to secure in Africa than in other parts of the world such as Asia.

Developments for sustainable palm oil are at the very early stage and are likely to be determined by the pace of agro-industrial project developments. The Africa Palm Oil Initiative (APOI), the first Signature Initiative of the TFA 2020, recognizes the ambitious development plans of countries in Africa and aims to help transition the palm oil sector to a sustainable driver of long-term, low-carbon development in the region, through the development and implementation of a set of regional principles for responsible palm oil development.

# 4 Botany and Farming of Oil Palm

## 4.1 Oil Palm Farming

Oil palm is a tropical tree crop which is mainly grown for its industrial production of vegetative oil. It is a typical crop of the rainy tropical lowlands. The tree requires a deep soil, a relatively stable high temperature and continuous moisture throughout the year. Soil fertility is less important than physical soil properties. Dry periods of more than 2-3 months do not specifically damage vegetative growth but affect seriously the production and quality of the fruit bunches[13]. Oil palm yield is not only determined by vegetative growth and production, but also by the way and pests and diseases can be controlled or eradicated.

For optimal growth and production, the crop requires a high and year-round rainfall with little or no dry season and stable high temperatures; soils should be deep and well drained. The crop grows mainly in tropical lowlands below 400 m altitude, originally covered by a dense rainforest. Dry spells or temperatures below 18°C do not affect vegetative growth but reduce yield. Fertilizer demands are moderate compared to other industrial crops and are mainly for compensating the nutrients harvested in the fruit bunches. The crop is sensitive to many pests and diseases.

**Figure 4-1 African oil palm (*Elaeis guineensis*) at the Kwitanga Prison Plantation, Kigoma region**

Oil palm is now the most important supplier of vegetable oil in the world. There are 3 oil palm varieties: *Dura, Pisifera* and *Tenera*, with the latter being mainly selected for economic production – whereby, in most plantations in Tanzania[14], the *Dura* variety occupies 85% of oil palm trees, *Tenera* (14%) and *Pisifera* (1%).

The oil palm seed is such that, the oil is concentrated in the fruit bunches, composed of a fresh fruit pulp, and in the fruit kernels. Oil content in the fruit pulp is about 50-60% or 20-22% of bunch weight; oil content in the fruit kernels is 48-52% or 2-3% of bunch weight[15]. Fresh fruit bunches once harvested must be treated in an oil mill within 24 hours to avoid that oil quality decreases.

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[13] Willy Verheye (2017). Soils, Plant Growth and Crop Production – Vol. II – Growth and Production of Oil Palm

[14] Dominic Kazimili, Head of the Kwitanga Government Prison in Kigoma (June 2019)

[15] Willy Verheye (2017). Soils, Plant Growth and Crop Production – Vol. II – Growth and Production of Oil Palm

## 4.2 Origin and Distribution

The origin of oil palm points to Africa - West Africa. Fossil pollen, like the oil palm as it grows today, have been found in Miocene and more recent strata in the Niger delta. Portuguese explorers of the Guinea coast mention the existence of trees appearing to be oil palms as early as 1434. In 1508 already reference has been made to palm groves in Liberia, and to palm oil trade near the Forcados River in Nigeria. The palm spreads from 16° North in Senegal to 15° South in Angola, and eastwards to Zanzibar and Madagascar. The best production levels are attended in the high rainfall areas between 7° North and South from the Equator.

In the Far East palms were initially only grown as ornamental plants. Seed selection in the Botanic Gardens of Singapore and Bogor (Java, Indonesia) and at the Deli Research Center in Sumatra (Indonesia) gave origin to an important development and extension of the crop since the 1930s in Malaysia and Indonesia. These are now the main production areas in the world, both in terms of palm oil and palm kernel production. The yield and quality of palm oil produced in these areas is still superior to the oil produced in other parts of the world.

## 4.3 Botany

The oil palm tree (*Elaeïs guineensis*) is a member of the family *Palmae*, subfamily *Cocoideae* (which also includes the coconut), genus *Elaeis*. The genus contains two main species: *E. guineensis* or African oil palm, and *E. melanococca* or American oil palm; the latter is only valuable for hybridization. Male and female inflorescences occur on the same tree in alternated cycles of the same sex and are only differentiated after approximately two years. This process is influenced by moisture and temperature conditions, fertilization and other secondary ecological factors.

The development of the inflorescence to the fruit regime takes 42 months, including 10 months from establishment to initial sexual differentiation, 24-26 months between sex development and flowering, and 5-6 months from flowering to yield. Hence, ecological conditions which affect earlier phases of inflorescence and flowering appear only in the yields 18 to 24 months afterwards. This situation opens good perspectives for good yield forecasting[16].

### 4.3.1 Cultivars and Classification

Cultivars in the strict sense do not occur. As the oil palm is monoecious and crosspollinated, individual palms are usually very heterozygous; and vegetatively propagated clonal material cannot be made. The current practice of oil palm production in Tanzania is such that, classification of cultivars is mainly based on fruit structure and yield, or commercial value:

a) *Dura*: shell 2-8mm thick, comprising 25-55% of weight of fruit, medium mesocarp content of 35-55% by weight, but up to 65% in Deli palms; less productive but hardy variety, well adapted to village gardens. Locally referred to as a 'female' plam or in Swahili, 'mchikichi mama';

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[16] Blaak, G. (1998). Crop Forecasting in Oil Palm: Elaeis guineensis. FAO, Internal Document, Plant Protection Division, Rome, 6p. [Analysis and critical evaluation of yield forecasting methods for oil palm production].

b) *Pisifera*: shell-less, with small pea-like kernels in fertile fruits; of little commercial value, because of its high abortion ratio, but important for crossbreeding commercial palms. Locally referred to as a 'male' oil plam or in Swahili, 'mchikichi bubu, also 'baba'; and
c) *Tenera*: shell 0.5-3 mm thick; comprising 1-32% of weight of fruit; medium to high mesocarp content of 60-95%, but occasionally as low as 55%; this variety is the result of a hybridization of *Dura* and *Pisifera,* and has a high commercial value. The *Tenera* variety dominates about 75% of the plantations (such as the Kwitanga Prison's) in Kigoma.

As mentioned earlier, smallholder farms and commercial plantations in Tanzania are established based on *Tenera* palms. Oil palms may live up to 200 years, but their commercial yield rapidly decreases after 30 years of age.

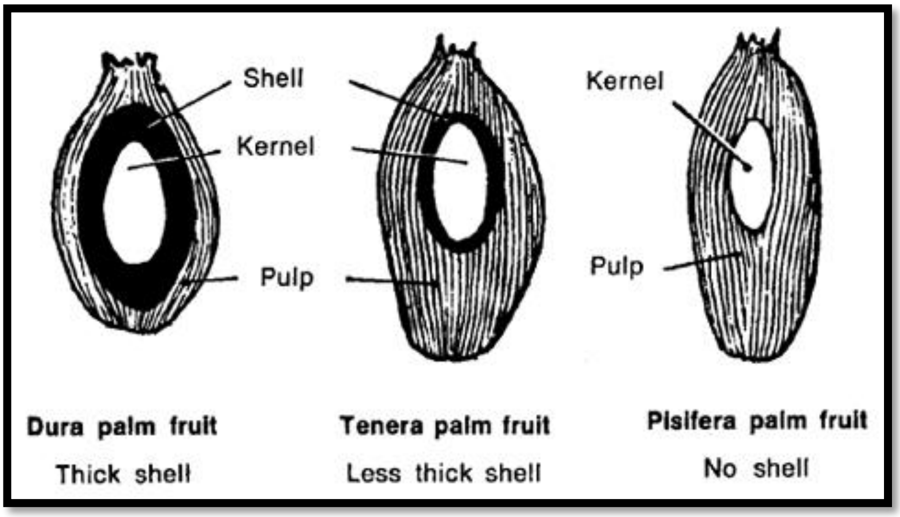


**Figure 4-2 Oil Palm Fruits:** ***Dura, Tenera and Pisifera***

### 4.3.2 Planting

In Kigoma, oil palm is planted at a spacing of 9 x 9 m – hence making about 50 oil palm plants per acre (143 trees per hectare – using the triangular planting style). For each acre of oil palm, which is harvested year-round, the annual production averages 7-8 litres of palm oil/year for one *Dura* plant, and 28 litres/year for one *Tenera* plant.

**Figure 4-3 The Kwitanga Prison's Oil Palm Plantation in Kigoma, Tanzania**

In other countries such as Malaysia and Thailand, for each hectare of oil palm, about 20 Tons of fruit yielding 4,000 kg of palm oil and 750 kg of seed kernels yielding 500 kg of high-quality palm kernel oil, as well as 600 kg of kernel meal. Kernel meal is processed for use as livestock feed.

All modern, commercial planting material consists of *tenera* palms (or D x P hybrids), which are obtained by crossing thick-shelled *dura* with shell-less *pisifera*. Although common commercial germinated seed is as thick-shelled as the *dura* mother palm, the resulting palm will produce thin-shelled *tenera* fruit. An alternative to germinated seed, once constraints to mass production are overcome, are tissue-cultured or "clonal" palms, which provide "true copies" of high-yielding 'D x P' palms.

An oil palm nursery must have an uninterrupted supply of clean water and topsoil which is both well-structured and sufficiently deep to accommodate three rounds of on-site bag-filling. About 35 ha can grow enough seedlings over a three-year period to plant a 5,000-ha plantation. Prenursery seedlings must be watered daily. Whenever rainfall is less than 10 mm per day, irrigation is required, and the system must be capable of uniformly applying 6.5 mm water per day.

Prenursery seedlings in the four-leaf stage of development (10 to 14 weeks after planting) are usually transplanted to the main nursery after their gradual adjustment to full sunlight and a rigid selection process. During culling, seedlings that have grassy, crinkled, twisted, or rolled leaves are discarded.

Weeds growing in the polybags must be carefully pulled out. Herbicides should not be used. Numerous insects (ants, armyworms, bagworms, aphids, thrips, mites, grasshoppers, and mealybugs) and vertebrates (rats, squirrels, porcupines, and monkeys) are pests in oil-palm nurseries and must be carefully identified before control measures are implemented.

After eight months in the nursery, normal healthy plants should be 0.8 – 1 m in height and display five to eight functional leaves.

### 4.3.3 Key Steps in Oil Palm Seedlings Production

In Tanzania, it takes around 18 months from pollination to distribution of seedlings to farmers, with the availability of *Dura* flowers being the main challenge. The key steps are as illustrated on Fig. 4.4:

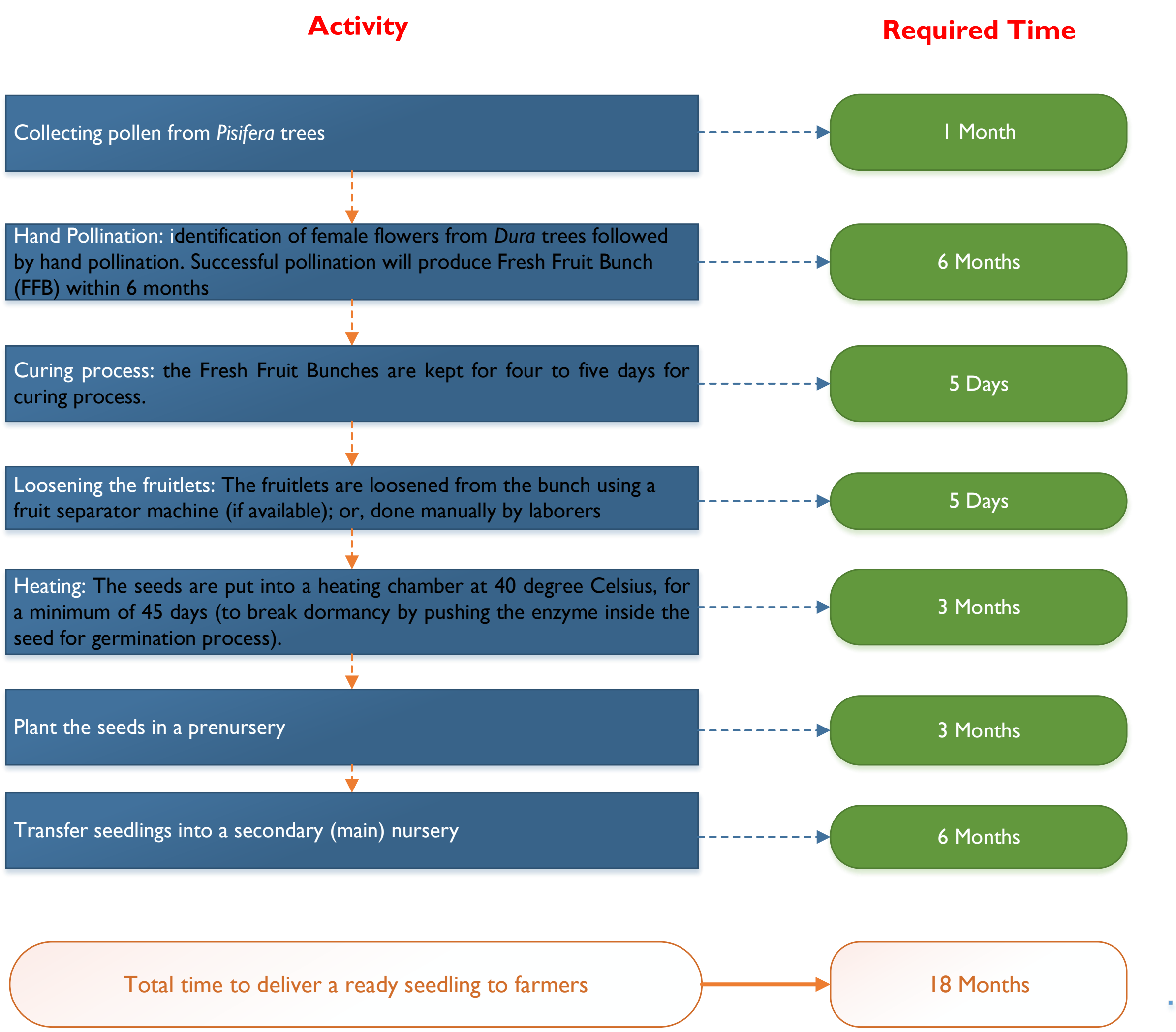


**Figure 4-4 The 18-Months Process to Produce Oil Palm Seedlings**

#### 4.3.3.1 Step 1: Identification of female (*Dura*) and male (*Pisifera*) palm trees

This process is done through observation, and finally confirmed through laboratory testing.

Figure 4-5 *Dura* and *Pisifera* oil palm trees, Kigoma, Tanzania

#### 4.3.3.2 Step 2: Collection of pollen from *Pisifera* trees

Pollen is collected from *Pisifera* trees and stored in a refrigerator.


Figure 4-6 Collected pollen from *Pisifera* trees

#### 4.3.3.3 Step 3: Hand Pollination

Identification of female flowers from *Dura* trees followed by hand pollination. Successful pollination will produce Fresh Fruit Bunch (FFB) within 6 months.


Figure 4-7 Demonstration of the hand pollination process at Tanzania Agricultural Research Institute (TARI), Kigoma

#### 4.3.3.4 Step 4: Curing Process

The Fresh Fruit Bunches are kept for four to five days for curing process.

Figure 4-8 Oil Palm seeds curing process at TARI, Kigoma

#### 4.3.3.5 Step 5: Loosening the Fruitlets

The fruitlets are loosened from the bunch using a fruit separator machine (if available); or, done manually by laborers.

#### 4.3.3.6 Step 6: Removal of the Mesocarp from the Seeds

Use of a scraper machine is made or done manually; then the seeds are treated using clorex and soap in a treatment machine to discard the debris.

#### 4.3.3.7 Step 7: Air Drying of Seeds

The seeds are air-dried for one to two weeks.

#### 4.3.3.8 Step 8: Sorting of Seeds

The seeds are sorted according to size.

#### 4.3.3.9 Step 9: Grading of Seeds

The seeds are graded using the seeds grader machine to grade the seeds into different sizes: tiny, small, medium and large.

#### 4.3.3.10Step 11: Heating

The seeds are put into a heating chamber at 40 degree Celsius, for a minimum of 45 days (to break dormancy by pushing the enzyme inside the seed for germination process).

#### 4.3.3.11Step 12: Soaking the seeds

The seeds are soaked until they reach 22% moisture content for 5 days.

#### 4.3.3.12Step 13: Moisture Testing and Viability Testing

In developed countries, tetrazolium test is used to determine seed viability. In Tanzania, observation is used to assess seed viability

### 4.3.3.13Step 14: Planting the seeds in a Pre-nursery

Plant seeds in a prenursery for and provide management for three (3) months.

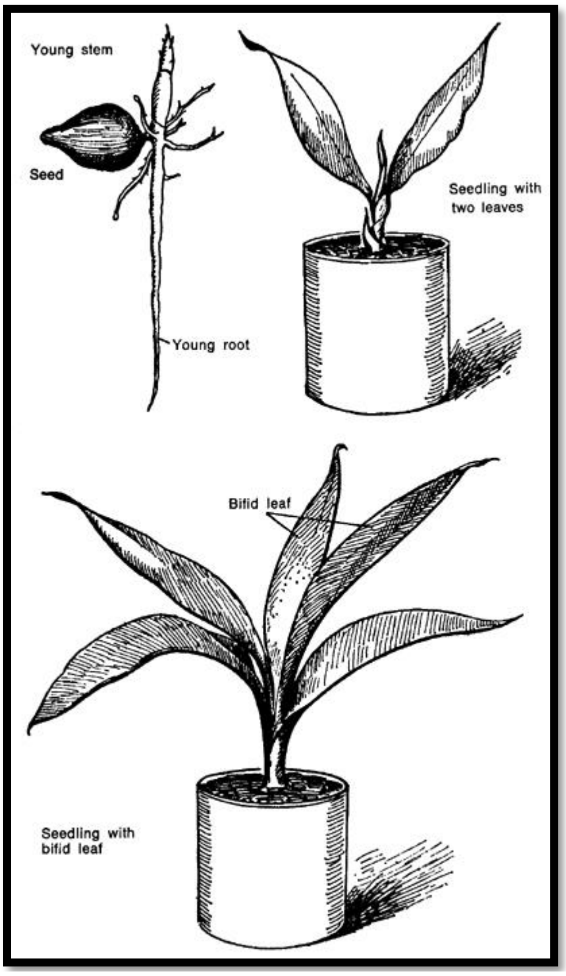


**Figure 4-9 Oil palm seedlings at different stages**

### 4.3.3.14Step 15: Moving Seedlings into Main Nursery

Move the seedlings into bigger polythene bags provide the requisite husbandry for a period of six (6) months.

Figure 4-10 Mr Jumapili Mpoki working on oil palm seedlings in a prenursery, Kigoma

### 4.3.3.15Step 16: Delivering the Seedlings to Farmers

In Tanzania, seedlings are ready to be delivered to the farmer after approximately 18 months, at the earliest.

## 4.4 Palm Oil

Palm oil is derived from the mesocarp (reddish pulp) of the fruit of the oil palms, primarily the oil palm. It is naturally reddish in color because of a high beta-carotene content – and not to be confused with palm kernel oil (or in Swahili 'Misse') derived from the kernel of the same fruit.

**Figure 4-11 Left: palm oil: reddish pulp from mesocarp ('Mawese') and; Right: palm kernel oil ('Misse')**

The differences are in color (raw palm kernel oil lacks carotenoids and is not red), and in saturated fat content: palm mesocarp oil is 49% saturated, while palm kernel oil is 81% saturated fats[17].

However, crude red palm oil that has been refined, bleached and deodorized, a common commodity called RBD palm oil, does not contain carotenoids. Many industrial food applications of palm oil use fractionated components of palm oil (often listed as 'modified palm oil') whose saturation levels can reach 90%; these 'modified' palm oils can become highly saturated but are not necessarily hydrogenated[18].

The oil palm produces bunches containing many fruits with the fleshy mesocarp enclosing a kernel that is covered by a very hard shell. FAO considers palm oil (coming from the pulp) and palm kernels to be primary products[19]. The oil extraction rate from a bunch varies from 17 to 27% for palm oil, and from 4 to 10% for palm kernels or 'Misse'.

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[17] Palm Oil and Palm Kernel Oil Refining and Fractionation Technology". doi:10.1016/B978-0-9818936-9-3.50015-0. This super stearin contains ~90% of saturated fatty acids, predominantly palmitic

[18] Nagendran, B.; Unnithan, U. R.; Choo, Y. M.; Sundram, Kalyana (2000). "Characteristics of red palm oil, a carotene- and vitamin E–rich refined oil for food uses". Food and Nutrition Bulletin. 21 (2): 77–82

[19] FAO data - dimension-member - Oil, palm fruit". ref.data.fao.org. Retrieved 17 August 2018

### 4.4.1 Composition

#### 4.4.1.1 Fatty Acids

Palm oil, like all fats, is composed of fatty acids, esterified with glycerol. Palm oil has an especially high concentration of saturated fat, specifically the 16-carbon saturated fatty acid, palmitic acid, to which it gives its name. Monounsaturated oleic acid is also a major constituent of palm oil. Unrefined palm oil is a significant source of tocotrienol, part of the vitamin E family[20].

The approximate concentration of esterified fatty acids in palm oil is[21]:

**Table 4-1 Fatty acids content of Palm Oil (present as triglyceride esters)**

| Type of Fatty Acid | Triglyceride Esters Content (%age) |
|---|---|
| Myristic saturated C14 | 1.0 |
| Palmitic Saturated C16 | 43.5 |
| Stearic Saturated C18 | 4.3 |
| Oleic Monounsaturated C18:1 | 36.6 |
| Linoleic polyunsaturated C18:2 | 9.1 |
| Other/Unknown | 5.5 |

Red palm oil is rich in carotenes, such as alpha-carotene, beta-carotene and lycopene, which give it a characteristic dark red color[22]. However, palm oil that has been refined, bleached and deodorized from crude palm oil (called 'RBD palm oil') does not contain carotenes.

#### 4.4.1.2 Refining

After milling, various palm oil products are made using refining processes. First is fractionation, with crystallization and separation processes to obtain solid (palm stearin), and liquid (olein) fractions. Then melting and degumming removes impurities. Then the oil is filtered and bleached. Physical refining removes smells and coloration to produce refined, bleached and deodorized palm oil (RBDPO) and free fatty acids, which are used in the manufacture of soaps, washing powder and other products. RBDPO is the basic palm oil product sold on the world's commodity markets. Many companies fractionate it further to produce palm oil for cooking oil or process it into other products.

## 5 Tanzania's Efforts to Develop the Oil Palm Value Chain as Edible Oils or Biofuels

Tanzania is not yet in the list of palm oil producing countries in the world. However, experts have documented that Tanzania has the best oil palm parent stock, and such famous countries like Malaysia and Indonesia, sourced their first seeds from Kigoma, typically - the government

[20] Oi-Ming Lai, Chin-Ping Tan, Casimir C. Akoh (Editors) (2015). Palm Oil: Production, Processing, Characterization, and Uses. Elsevier. pp. 471, Chap. 16. ISBN 978-0128043462.

[21] "Oil, vegetable, palm per 100 g; Fats and fatty acids". Conde Nast for the USDA National Nutrient Database, Release SR-21. 2014. Archived from the original on 28 October 2016. Retrieved 28 October 2016

[22] Behrman, E. J.; Gopalan, Venkat (2005). William M. Scovell (ed.). "Cholesterol and Plants" (PDF). Journal of Chemical Education. 82 (12): 1791. Bibcode:2005JChEd..82.1791B. doi:10.1021/ed082p1791. Archived (PDF) from the original on 21 October 2012

is preparing conditions for entering the agrofuel business, mostly involving sugarcane, jatropha and oil palm.

In 2006, the Government of Tanzania created the National Biofuels Task Force to promote development of the sector. The goals of the taskforce include:

a) Designing biofuels policies and regulations suitable for Tanzanian conditions (e.g. mandate, obligation, tax breaks, enabling fuel standards)
b) Ensuring co-operation between Ministries involved in the development of biofuels policies
c) Acting as an information channel between Government and biofuels stakeholders
d) Designing financing options (e.g. capital allowances, tax breaks) and set-up incentives for (local and foreign) investors
e) Securing international funding for biofuel development, such as the EU Partnership Dialogue Facility, the FAO International Bioenergy Programme, and the G8 Global Bioenergy Partnership.

By 2009, over 4 million hectares of land had been requested for biofuel investments, particularly for jatropha, sugar cane and oil palm, of which 640,000 ha had already been allocated and of these, some 100,000 ha had been granted formal rights of occupancy[23].

Oil palm is most popular to the west of the country, particularly in Kigoma District, where local farmers have cultivated this palm to produce edible oil since the early 1920s. More recently, additional uses for this crop have developed, such as local soap production using palm oil. Oil palm production in Tanzania is carried out primarily by smallholder farmers living in Kigoma Region (Kigoma Rural District), as well as in Mbeya Region (mostly Kyela District) and some parts of Tanga and Pwani regions. In the case of Kigoma, the local cooperative collects about 150,000 litres of palm oil annually and sells this to local refineries and soap producers in Dar es Salaam. At the local level, women are in charge of boiling and milling of palm oil as well as in selling palm oil products (oil, soap).

Things began to change in Kigoma in 2005, when FELISA Ltd planted its first hybrid palm seedlings in the region. The company had 24 (majority Belgian) shareholders and started operations at a 100 hectare oil palm plantation 75-km from Kigoma town. They later obtained another 4,258 hectares of land 150 km from Kigoma, where they planned to plant oil palm. FELISA also aims to purchase fruits from local small-scale farmers as part of a proposed outgrower scheme. The company was targeting production of 10,000 ha of oil palm in the region; roughly half of this is expected to come from local smallholder out-growers and half from its nearly 5,000 ha plantation.

More recently, the company African Green Oil Limited applied for a land-lease to the Tanzania Investment Center (TIC) for more than 10,000 hectares of land in the Rufiji river delta in south-east Tanzania for oil-palm plantation. African Green Oil (AGO) Limited was granted a land lease for 250 hectares as a trial investment and the area was to be increased depending on their performance. The company aimed at producing palm-oil for selling to different buyers including biofuel producers. According to the company's web page its aim is to establish 'a 20,000 ha oil palm plantation by 2020'. AGO current annual planting is 800 ha which had the

[23] IIED Report (2011)

aim of reaching 2,500 ha by 2013. AGO had already acquired 5,000 ha and planted 435ha by 31st May 2009.

Two other oil palm projects identified by IIED's report are Tanzania Biodiesel Plant Ltd, with 16,000 hectares acquired in Bagamoyo and InfEnergy Co. Ltd, with 5,818 hectares located in Kilombero. Additionally, a report commissioned by Oxfam (2008) mentioned further projects: TM Plantations Ltd, a Malaysian company planning plantations in Kigoma; Sithe Global Power, LLC (US), with plans to develop 50,000 hectare of oil palm plantations and refineries in Tanzania; InfEnergy (UK) which has optioned a 10,000 hectare site for an irrigated oil palm plantation; an unknown "palm oil group" from Malaysia, planning to plant 40,000 ha in the Kigoma area.

In Kigoma, the Kwitanga Government Prison oil palm plantation is 8,028 acres. The government has plans to plant additional 6,000 acres by 2022[24].

According to a paper presented in 2009 in Nairobi by the Ministry of Agriculture, Food Security and Cooperatives (Tanzania Government Perspective on Biofuels), the 'Areas Earmarked for Biofuels Crops Production' include oil palm in Kigoma and in Ruvuma, near the border with Mozambique. However, the above-mentioned projects appear to show that oil palm plantations will be established in many locations throughout the country.

## 6 Investment Opportunities in the Oil Palm Value Chain in Tanzania

The following opportunities have been identified:

a) Firstly, the **production of oil palm seeds** by hybridizing *Pisifera* with *Dura* (which we both have in Tanzania), to produce *Tenera*. Oil palm experts advise that, Tanzania doesn't need to import seeds from abroad as we have the best parent stock. In total, **Tanzania requires some 20,377,500 *Tenera* plants in order to produce the required 570,000 MT of edible oil** through palm oil value chain. This is a huge number of oil palm trees needed in the country. Research centres (such as TARI), individual graduates and individual farmers, foreign companies etc can seize this business opportunity and flood the seeds' market.

<u>Assumptions:</u>

i. One *Tenera* tree produces 28 litres of palm oil/year
ii. There are 143 oil palm trees per hectare
iii. Tanzania's edible oils needs per annum are 570,000 MT
iv. Some 1,000 liters of palm oil are equal to 1 MT

Therefore,

i. There will be **4,004 liters of palm oil/hectare**. This is derived from: ({28 litres/tree/year} x {143 trees/hectare}) – which is equivalent to 4 MT of palm oil/hectare per year;

[24] Dominic Kazimili (Head of the Kwitanga Prison, Kigoma, Tanzania) – June 2019

ii. Tanzania requires some **142,500 hectares** of *Tenera* to produce the required 570,000 MT of palm oil per year. This is derived from diving 570,000 MT/year by 4 MT/hectare per year (or 570,000 MT/year ÷ 4 MT/hectare/year = 142,400 hectares);
iii. Some **20,377,500 oil palm trees** will be required to make Tanzania self sufficient in edible oils' needs

b) Secondly, there is a vast opportunity in **opening new oil palm farms/plantations** – to reach a **minimum of 142,500 hectares** to meet Tanzania's annual edible oil needs. This is a combination of both small-scale oil palm farming and large-scale plantations. Potential regions in Tanzania include Kigoma, Tabora (Urambo and Kaliua), Katavi, Morogoro, Pwani, Tanga, Lindi, Mtwara, Kagera and Mbeya (Kyela).

c) Thirdly, m**anufacture and/or supply of machinery and spare parts for the entire palm oil value chain** – from seed production to refinery. There is an opportunity for local and foreign companies to tap this opportunity through partnerships. Machines requires include:
   i. **Laboratory tools/machinery during the seed production stage.** These are mostly smaller laboratory tools/equipment. They include pollen collection & storage bags, refrigerators, lab fruit separator machines, mesocarp scraper machines, fruit driers, seeds grader machines, tetrazolium test machines for seed viability etc. These are generally small machines/equipment.
   ii. **Field machinery during the oil palm farming stage**. This includes machinery for field ploughing (such as tractors), irrigation, fertilizer and pesticides application, harvesting/lifting machines, trailers etc. These are big machines.
   iii. **Palm oil processing and refinery machinery.** They include both oil palm fruit and kernel oil extraction mills, fruit boilers, refineries etc. These are big machines.

d) Fourthly, **establishing processing factories (including efficient refinery of palm oil).** This is an opportunity for high efficiency palm oil processing factories and refineries

e) Fifthly, **embarking on skills development in the entire palm oil value chain.** Tanzania's skills & experience in the palm oil value chain is very limited. There is an opportunity for investment into vocational skills development to bridge the knowledge gap in the palm oil value chain. This can be done by opening training centres, laboratories, consultancy firms etc in targeted regions.