The Oil Palm Value Capture Opportunity in Africa
Pathways to Transformation

The Oil Palm Value Capture Opportunity in Africa

acet African Center for Economic Transformation
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Executive Summary

Despite its natural endowment for producing palm oil, the productivity, processing, and manufacturing of palm oil in Africa is largely inefficient and limited. Low yield, limited finance, low oil extraction rates, high energy cost, and simple neglect are responsible for this. For example, with the discovery of petroleum oil in Nigeria, 2 million hectares of oil palm was left to grow in the wild with minimum to no inputs and an average yield of 2 metric tons per hectare. This neglect is highlighted when compared to Indonesia and Malaysia’s productivity of almost 20 metric tons per hectare.

The oil palm industry has multiple untapped value adding opportunities that can be captured by:

- Closing the yield gap
- Improving the oil extraction rate (OER)
- Improving crude palm oil (CPO) quality of small millers
- Promoting outgrower schemes
- Producing energy to supplement national power grids, and
- Producing biodiesel for domestic and export markets

Investing in efforts to close the yield gap alone can fully address the continent’s dependence on foreign palm oil. However, this would require concerted efforts from governments, research institutions, private financiers, and extension officers to insure the proper understanding and utilization of improved seeds and agronomic practices.

There are large opportunities for small-scale millers to invest in improved oil extraction machineries. For example, a $12,500 to $13,500 investment in efficient oil extraction machineries could increase OER efficiency by a range of 15-46%.

A strategy to promote oil palm cultivation would have to promote outgrower schemes whereby small farmers have a stronger association with processing units. Considering the high liquidity constraint that saddles most oil palm farmers, these schemes are an effective mechanism to stimulate palm oil production, particularly as difficulties in the access of land constitute an obstacle to substantial expansion of oil palm plantations.

Capturing downstream value addition opportunities (specialty fat, oleochemical, biodiesel, etc.) will necessitate strong participation of private sector actors given the high financial commitment that most African governments have failed to meet. African governments need to explicitly provide avenues for facilitating the participation of private investors in this industry by making more land available for large-scale plantations. This can be done by:
• establishing and advertising a market-based land bank with information on available land for oil palm cultivation

• Harmonizing land policies and the legislative framework with customary law for sustainable land administration

• Developing adequate environmental standards

Some of the stringent quality control requirements imposed by European markets can be addressed by introducing a palm oil marketing board. A highly interventionist approach to regulation and support of the palm oil sector can reduce risk and volatility for players, especially palm oil farmers, and can be an effective means for improving and maintaining quality. As an example, the Ghana Cocoa Board is considered successful in ensuring the generally higher quality of Ghanaian cocoa beans versus other major producers such as Côte d'Ivoire. However, this needs to be offset against the challenge and cost of developing and maintaining an effective and transparent sector bureaucracy.
Introduction

The oil palm tree is indigenous to Western Africa. It grows in a belt from Angola to Senegal. Its consumption dates back 5000 years to ancient Egypt. Today, palm oil, which comes from oil palm trees, feeds more than three billion people worldwide in more than 150 countries. Its increased consumption is attributed to its high versatility. In fact, palm oil can be found in more than 40% of the packaged products in an average supermarket, including edible items such as cooking oils, margarine, mayonnaise, ice cream, cookies, and chocolates; and non-edible items such as soaps, detergents, and cosmetics. Palm oil is also used as an emollient in both the metal and leather industries (Teoh, 2010). And palm kernel meal is used as fertilizer and livestock feed. More recently, in response to growing global demand for renewable energy, biodiesel manufacturing now also uses palm oil.

Oil palm trees are cultivated year-round, with five to seven hours of daytime sunlight in humid tropical climates, with temperatures of 24-32°C, and an annual rainfall of 2,000 mm. Figure 1 below presents a map of palm oil-producing countries according to land allocation. The countries that have allocated more than 1 million hectares of land to oil palm trees are Indonesia, Malaysia, and Nigeria, with respective allocations of 5 million hectares, 4 million hectares, and 3 million hectares out of the total 14.4 million hectares of land allocated to oil palm trees worldwide.

![Figure 1: Oil Palm Cultivation in 43 Countries](image)


Oil palm trees are a perennial *monoecious* crop, as they bear both male and female flowers on the same tree to produce fruit bunches every year. Each tree produces compact fresh fruit

---

1 In the leather industry, palm oil is used for softening leather and enhancing its pliability. In the metal industry, it is used to treat waters contaminated with heavy metals waste.
bunches (FFB) weighing between 10 and 25 kilograms with 1000 to 3000 oval-shaped fruitlets per bunch. Generally, the fruitlet is dark purple, almost black when unripe, and orange red when ripe. Each fruitlet contains a hard kernel seed enclosed in an endocarp shell, surrounded by a fleshy mesocarp and exocarp exterior, as illustrated below in figure 2.

FIGURE 2 PALM FRUITLET

Oil palm trees may grow up to sixty feet. Young and mature tree trunks are wrapped in fronds, which give them a rough appearance. Older trees have smoother trunks, apart from the scars left by the fronds, which have withered and fallen off. Oil palm trees begin bearing fruit 30 months after planting and continue to be productive for 20-30 years; thus ensuring a consistent supply of oil. After the tree reaches an 18 year threshold, it loses its optimal productivity and gradually decreases its output.

While more than 30% of oil palm agricultural land is located in Africa, less than 10% of total oil production comes from Africa. This significant yield gap is the largest value capture opportunity that oil palm offers Africa. Processing oil palm into other products also presents sizable opportunities to the sector. More efficient processing can help substitute the palm oil imports, which amount to more than 70% of the total consumption. At the manufacturing level, palm oil has large opportunities as well. From the production of lightly manufactured products such as soaps and shortenings, to that of heavily manufactured ones such as electricity and biodiesel, Africa has the potential to earn billions of dollars if it were to develop the right policies to capture the available opportunities along the value chain.

This report discusses the sector and the value capture opportunities available to African countries that produce palm oil. After identifying the palm oil value added opportunities, we will conclude the report by eliciting the necessary steps for developing effective policies for stimulating a viable palm oil industry in Africa. This includes discussing the ways oil palm yields can be improved, a cost-benefit analysis of investing in better oil extraction machineries, and a policy discussion regarding the necessary actions and anticipated bottlenecks to support an effective palm oil manufacturing sector in Africa.
Palm oil production

The total world production of FFBs has been growing by an average rate of 6% over the past 10 years. Current production stands at 234 million metric tons. This growth rate is largely attributed to harvested area increases, which have grown by an average of 5% to its current size of 16.2 million hectares (1.2% of total harvested agricultural land worldwide). More than 80% of production is done in Indonesia and Malaysia, while Nigeria and Ghana are responsible for 3.5% and 0.8% respectively of the total world FFB production from Africa. On its own, Nigeria controls more than 19% of total FFB harvested area worldwide, and therefore has great potential.

Integrated palm oil production and manufacturing model

Palm oil processing can be broken down into four stages. First, FFBs are produced from agricultural activities. Second, crude palm oil (CPO) and crude kernel oil (CKO) are extracted from the FFB fruitlets. Third, CPO and CKO are further processed using a refining, bleaching, and deodorising (RBD) technique. Last, the RBD products are manufactured into high-value products such as speciality fats, oleochemicals, and biodiesel.

FFB production

Oil palms generally begin to produce fruits 30 months after being planted, and commercial harvesting commences 6 months later. The yield of an oil palm is relatively low at this stage, but increases as the oil palm continues to mature, and peaks between the 7th and 18th year. Yields gradually decrease thereafter. The typical commercial lifespan of an oil palm is 25 years, after which it is no longer viable for commercial harvesting.

Fully mature oil palms produce 18 to 30 metric tons of FFBs per hectare, depending on a variety of factors, including age, seed quality, soil and climatic conditions, quality of plantation management, and timely harvesting and processing.

The ripeness of harvested FFBs is critical in maximising the quality and volume of extracted palm oil. Harvested fruits must be processed within 24 hours to minimise the build-up of free fatty acids (FFA) that reduce CPO quality and increase manufacturing expense.

CPO/CKO extraction

FFBs are transferred to the palm oil mills for sterilisation within 24 hours of harvesting. They are sterilized with high-pressure steam, whereupon the palm fruits are enzyme-deactivated and separated from the palm bunches.

After the steaming process, the palm fruitlets and kernels are crushed separately to extract CPO and CKO. A centrifuge clears and separates waste and water. The cleared CPO is then sent for refining, and the crushed fruit bunches and liquid waste are both used as fertiliser. Palm oil is predominantly consumed as CPO, with little secondary processing. Once the palm kernel is crushed the remaining palm kernel meal is used as animal feed.

RBD processing

To produce refined oil, CPO and CKO is processed through three refining stages. In the degumming stage, the gum, fatty acid, and other impurities such as trace minerals, copper, and
Iron are separated using phosphoric acid. In bleaching, the oils are mixed with bleaching earth (bentonite calcium) in a vacuum room to remove impurities and color pigments. To deodorise, the odor and taste of the oil are removed by steaming at temperatures between 240°C and 260°C.

**RBD palm stearin and RBD palm olein**

The oils are then fractioned into searin and olein, before being crystalized. The crystalized oil is then filtered through a membrane to separate the liquid fraction. RBD palm olein is usually sold as cooking oil and may go through further fractioning depending on the quality required.

**Palm oil manufacturing**

Finally, the stearins and oleins can be further manufactured to satisfy a number of edible and industrial applications for the food, cosmetics, and pharmaceutical industries as well as the energy sector.
Palm oil comparative advantages

Palm, soybean, and rapeseed are the most consumed oil crops worldwide. Palm oil’s high consumption is mostly attributed to its versatility. Soybean oil consumption is substantial as a by-product of soybean meal’s high usage as animal feed in livestock industries, whereby the high volume of residual oil is then exploited. Rapeseed oil consumption is attributed to its health benefits. The remaining agriculture-based oils are not as widely consumed because of their relatively higher prices.

<table>
<thead>
<tr>
<th>Source</th>
<th>World consumption (million metric tons)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm</td>
<td>41.31</td>
<td>The most widely produced tropical oil, also used to make biofuel</td>
</tr>
<tr>
<td>Soybean</td>
<td>41.28</td>
<td>Accounts for half of worldwide edible oil production</td>
</tr>
<tr>
<td>Rapeseed</td>
<td>18.24</td>
<td>One of the most widely used cooking oils. Canola is a trademarked variety of rapeseed.</td>
</tr>
<tr>
<td>Sunflower seed</td>
<td>9.91</td>
<td>A common cooking oil, also used to make biodiesel</td>
</tr>
<tr>
<td>Peanut</td>
<td>4.82</td>
<td>Mild-flavored cooking oil</td>
</tr>
<tr>
<td>Cottonseed</td>
<td>4.99</td>
<td>A major food oil, often used in industrial food processing</td>
</tr>
<tr>
<td>Palm kernel</td>
<td>4.85</td>
<td>From the seed of the African palm tree</td>
</tr>
<tr>
<td>Coconut</td>
<td>3.48</td>
<td>Used in soaps and cooking</td>
</tr>
<tr>
<td>Olive</td>
<td>2.84</td>
<td>Used in cooking, cosmetics, soaps and as a fuel for traditional oil lamps</td>
</tr>
</tbody>
</table>

Source: Palmoil.com; ACET Analysis

In addition to price, palm oil has many advantages including productivity, low hydrogenation\(^2\), natural origin, and employment generation:

- **Productivity**: As presented in table 2, palm oil is eleven times more productive than soybean, five times more productive than rapeseed, and eight times more productive than sunflower.

<table>
<thead>
<tr>
<th>Oil</th>
<th>Metric tonnage per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean</td>
<td>0.37</td>
</tr>
<tr>
<td>Palm</td>
<td>4.09</td>
</tr>
<tr>
<td>Rapeseed</td>
<td>0.75</td>
</tr>
<tr>
<td>Sunflower</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Source: Oil World (2010), ACET Analysis

\(^2\) Hydrogenation is a process that transforms unsaturated fat into saturated fat. In general, this extra process in oil manufacturing adds to the manufacturing cost. However, this processing necessary to transform palm oil into saturated fat does not require too much processing, hence low hydrogenation.
However, as presented in figure 4, total metric tonnage of CPO is not statistically different from soybean oil because of the larger acreage allocation to soybean cultivation in countries such as Argentina, Brazil, and the United States, where soybean meal is used as animal feed.

**FIGURE 4: CRUDE VEGETABLE OIL PRODUCTION**

![Chart showing vegetable oil production breakdown](chart)

Source: RSPO Secretariat, www.rspo.org, ACET Analysis

- **Low hydrogenation:** Unlike vegetable oil, palm oil requires little or no hydrogenation to solidify CPO for making products such as margarine, bakery shortenings, and confectionery fats. This further reduces the processing cost associated with moving palm oil up the supply chain.

- **Not derived from genetically modified organism (GMO):** Palm nuts are not genetically modified like other oil crops such as soybean. This feature makes palm oil easily tradable to regions that have banned the import of GMOs, providing a natural marketing niche for palm oil exporting countries.

- **Employment generation:** Due to low mechanization possibilities, large oil palm plantations are labor intensive and generate up to 30 times more employment per unit area than other large-scale farming, including rubber, sorghum, and soybeans.

**Overview of palm oil production cost**

Indonesia is the largest producer of palm oil. Their CPO production process is highly efficient due to high yield and perennial harvesting. These factors, combined with low labor costs, an abundance of undeveloped land, and favorable climate and soil conditions in Sumatra, lower production costs. Thus Indonesia is one of the most cost effective countries in the world for oil palm plantations. In table 3 we compare Indonesia’s CPO production cost with other FFB producing countries.
Table 3 illustrates CPO production costs. The establishment cost pertains to a FFB plantation that yields 1 metric ton of CPO. This figure includes land rental and other start-up costs. The cultivation cost includes variables such as: fertilizers, pesticides, weeding and pruning, and the like. Harvesting and transportation costs mostly include the costs of labor and fuel used for harvesting and logistics. The milling cost is the cost of extracting CPO, excluding additional refining. The cultivation cost is the highest of CPO production. Milling could have been the highest cost, but kernel oil/meal credits substantially reduces it.

Based on Rahman et al (2009), fertilizer costs constitute 65% of total cultivation costs in Malaysia. If implemented in a market-smart and sustainable way that does not burden governments, or crowd out private investments, programs such as subsidized fertilizer can help boost FFP productivity in Sub-Saharan Africa (SSA) and make the continent more competitive. Adopting agriculture conservation practices is also a cost effective way to reduce dependence on fertilizers, cutting costs even more. Using leguminous nitrogen fixing plants as cover crops, for example, can increase yield by 5% because they replenish the soil’s nutrients.

### TABLE 3 COMPARATIVE CPO PRODUCTION COST

<table>
<thead>
<tr>
<th>US$ per metric ton</th>
<th>Colombia</th>
<th>Cote d’Ivoire</th>
<th>Indonesia</th>
<th>Malaysia</th>
<th>Nigeria</th>
<th>World Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment</td>
<td>71.2</td>
<td>69.5</td>
<td>64.3</td>
<td>60.7</td>
<td>224.5</td>
<td>72.1</td>
</tr>
<tr>
<td>Cultivation</td>
<td>91.2</td>
<td>136.1</td>
<td>72.5</td>
<td>75.7</td>
<td>113.7</td>
<td>79.3</td>
</tr>
<tr>
<td>Harvesting/transport</td>
<td>78.9</td>
<td>33.8</td>
<td>40.2</td>
<td>45.1</td>
<td>90.7</td>
<td>47.3</td>
</tr>
<tr>
<td>Milling costs</td>
<td>106.1</td>
<td>105.3</td>
<td>82.6</td>
<td>98.3</td>
<td>130.7</td>
<td>96.6</td>
</tr>
<tr>
<td>Kernel milling costs</td>
<td>6.9</td>
<td>7.7</td>
<td>7.2</td>
<td>7.6</td>
<td>8.2</td>
<td>7.5</td>
</tr>
<tr>
<td>Kernel oil and meal credit</td>
<td>-58.2</td>
<td>-54</td>
<td>-60</td>
<td>-61.9</td>
<td>-65.6</td>
<td>-61.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>296.1</strong></td>
<td><strong>298.4</strong></td>
<td><strong>206.8</strong></td>
<td><strong>225.5</strong></td>
<td><strong>502.2</strong></td>
<td><strong>241.3</strong></td>
</tr>
</tbody>
</table>

Source: Casson, 1999
International context of palm oil

Global trends

Global CPO export volumes have increased almost 10 fold from 3.8 million metric tons in 1980 to 36.2 million metric tons in 2009, with Indonesia and Malaysia being the largest exporters. The largest importers of CPO are India, China, and the EU, accounting for 17% (6.8 million metric tons), 17% (6.6 million metric tons), and 16% (5.8 million metric tons) of global imports respectively (see figure 5). Dependence on imported vegetable oils has continued to surge in China, the EU, India, Russia, and Ukraine over the last 10 years.

![Figure 5: Asia and EU are the world's major importers of palm oil, 2009](image)

Source: RSPO Secretariat, www.rspo.org. ACET Analysis

Price

The rising price of palm oil since 2000 reflects the stronger demand for vegetable oils. Palm oil has become the staple food oil in Malaysia and Indonesia, joining much of West Africa in this respect. Partly due to the higher price of fuel and increasing demand for alternative sources of energy in the Western world, CPO prices rebounded from $600 per metric ton in 2008 to slightly over $1,200 per metric ton in 2010.

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3 In addition, financial speculation, low stocks, and other factors could also be associated with the rebound in commodity prices.
CPO’s price has remained competitive compared to other oil crops. As presented in figure 6, CPO is cheaper than oil extracted from peanuts, soybeans, rapeseeds, and sunflower.

Over the past six years alone, the nominal price of CPO increased by 17% per year, while peanut, sunflower, rapeseed, and soybean oils increased during the same period by only 6%, 11%, 5%, and 12% respectively. The growing demand for vegetable oil is one explanation for this increase. In fact, this justification is supported by the rapid increase in palm oil imports. Figure 8 shows that imports of palm oil to SSA has dramatically increased, while exports have only
slightly increased. This spike in import is driven by increases in population and per capita consumption.

**FIGURE 8 SSA PALM OIL IMPORTS AND EXPORTS**

![Graph showing SSA palm oil imports and exports from 1970 to 2010.](image)

Source: FAOSTAT, ACET Analysis

**Demand outlook**

Worldwide demand for vegetable oils is expected to increase by 36% between 2007—2017, with biofuels accounting for one-third of the increase (World Bank, 2011). Demand for palm oil for edible use is expected to continue to rise due to population growth, increased per capita consumption, and movement of the developed world away from saturated animal fats. While the per capita consumption of oils and fats during 2008–2009 in the EU and the United States was 59.3 kg and 51.7 kg, respectively, the per capita consumption in developing countries such as India, Pakistan, and Nigeria was 13.4 kg, 19.9 kg, and 12.5 kg. As income levels increase in the developing world, a further leap in production of vegetable oil will be required to meet the anticipated higher demand. Palm oil is the most efficient oilseed to meet the demand because of its relative high productivity.
Indonesia is the largest consumer of palm oil, followed by SSA, Europe, and China as illustrated in figure 9. Demand is expected to increase in the EU as a result of its mandate to cut greenhouse gas emissions 20% by 2020.

We recognize the moral debate over whether or not food crops should be diverted toward biofuel production. However, substantial increases in crop yields due to investments in new technology, or increased efficiency in ethanol production (including usage of alternatives such as non-food crops residues, grasses and forest products when they become commercially viable) might help to dilute the debate to some degree. Alternative biofuel sources like switchgrass might help to increase the efficiency of biofuel production, as well as ease the pressure on food crop biofuels. Land use for biofuel production will nevertheless also have an impact on food production because in certain areas, one might consider the opportunity cost of the other, and switch.

**Supply outlook**

As presented in figure 10, average FFB productivity in SSA is very low compared to Malaysia and Indonesia. Insufficient rainfall contributes to West Africa’s lower yields. And in Nigeria in particular, where a large percentage of oil palm trees exist in semi-wild conditions, low yield is mostly due to tree age and poor fertilization.
Figure 11 below ranks the major producers of CPO. Indonesia and Malaysia are the world’s largest producers, accounting for nearly 85% of global CPO production. Smaller producers are: Cameroon, Colombia, Cote d’Ivoire, Ghana, Nigeria, Thailand, and Papua New Guinea. Indonesia is expected to continue to lead, as its government has announced plans to produce 40 million metric tons of palm oil by 2020, designating 50% for food and 50% for energy production (World Bank, 2010). This anticipated increase can interfere with SSA efforts to gain global market share. Therefore, SSA should focus its production primarily on regional consumption, where 14% of its total CPO production is consumed.
Planted areas in Africa and Latin America are also expected to expand production to meet rising local and global demand. Considering that Africa’s average per capita consumption of oils and fats is only 11 kg per year compared to the world average of 24 kg, and the wide discrepancy in production and consumption between palm oil and vegetable oils, Africa presents a significant opportunity for future expansion of global palm oil production for regional and EU supply, assuming cost-effective techniques.

In pursuit of economic growth and reduced dependence on imported edible oils, several African and Latin American countries are attracting Asian and European companies such as Wilmar and Siat Group to invest in their sector. These include Liberia, Cameroon, Ghana, Democratic Republic of Congo, Ivory Coast, and Brazil. The increasing demand for biofuel is furthering interest in expanding palm oil cultivation in African countries. This is evidenced by Chinese companies recently negotiating for large tracts of land in DR Congo, where they’ve signed a deal for 2.8 million hectare; and in Zambia, where they’ve requested 2 million hectare for producing biodiesel from palm oil (Economist, 2009).

**Trends in ACET countries**

Among the African Center for Economic Transformation (ACET) countries, Nigeria, Cameroon, and Ghana are the top three palm oil producers, where palm oil production annually grew by 0.7%, 1.5%, and 8.5% respectively. Ghana experienced the largest production growth because it recently allocated more land to palm oil production and adopted high yield varieties.

Source: FAOSTAT, ACET Analysis
Palm oil exports grew in Cameroon, Ghana, Kenya, Nigeria, Tanzania, and Uganda, while exports decreased in Liberia due to civil wars, as well as in Senegal due to internal conflicts in the Cassamance region, where most of the palm oil is produced.

**TABLE 4 PALM OIL PRODUCTION IN ACET COUNTRIES (1,000 METRIC TONS)**

<table>
<thead>
<tr>
<th>Country</th>
<th>1999</th>
<th>2004</th>
<th>2008</th>
<th>5 yr CAGR</th>
<th>10 yr CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>8,000</td>
<td>8,700</td>
<td>8,500</td>
<td>-0.3%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Ghana</td>
<td>1,031</td>
<td>1,955</td>
<td>1,897</td>
<td>-1.0%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Cameroon</td>
<td>1,100</td>
<td>1,200</td>
<td>1,250</td>
<td>0.9%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Liberia</td>
<td>174</td>
<td>174</td>
<td>183</td>
<td>0.0%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Senegal</td>
<td>64</td>
<td>70</td>
<td>71</td>
<td>0.3%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>62</td>
<td>65</td>
<td>65</td>
<td>1.0%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Source: FAOSTAT, ACET Analysis

Except Burkina Faso, all of the ACET countries experienced increases in CPO imports over the past 10 years, with Cameroon, Ghana, and Senegal experiencing the most growth (see table 6). In addition, all but Kenya and Rwanda witnessed double digit import growth, showing that there is ample room for promoting palm oil production for import substitution alone.

**TABLE 5 ACET COUNTRIES CPO EXPORTS (1,000 METRIC TONS)**

<table>
<thead>
<tr>
<th>Country</th>
<th>1999</th>
<th>2004</th>
<th>2008</th>
<th>5 yr CAGR</th>
<th>10 yr CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>0</td>
<td>194</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cameroon</td>
<td>11433</td>
<td>7623</td>
<td>30000</td>
<td>41%</td>
<td>11%</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>0</td>
<td>114</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ghana</td>
<td>11164</td>
<td>65000</td>
<td>100000</td>
<td>11%</td>
<td>28%</td>
</tr>
<tr>
<td>Kenya</td>
<td>12259</td>
<td>32791</td>
<td>35877</td>
<td>2%</td>
<td>13%</td>
</tr>
<tr>
<td>Liberia</td>
<td>5500</td>
<td>157</td>
<td>301</td>
<td>18%</td>
<td>-28%</td>
</tr>
<tr>
<td>Mauritius</td>
<td>0</td>
<td>0</td>
<td>80</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nigeria</td>
<td>6000</td>
<td>5000</td>
<td>25000</td>
<td>50%</td>
<td>17%</td>
</tr>
<tr>
<td>Senegal</td>
<td>2068</td>
<td>778</td>
<td>265</td>
<td>-24%</td>
<td>-20%</td>
</tr>
<tr>
<td>Uganda</td>
<td>1835</td>
<td>3468</td>
<td>12411</td>
<td>38%</td>
<td>24%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>1540</td>
<td>2318</td>
<td>19612</td>
<td>71%</td>
<td>33%</td>
</tr>
<tr>
<td>Zambia</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: FAOSTAT, ACET Analysis
Most of the CPO imports, especially for the case of FFB producing countries, are imported by large manufacturers as RBD palm olein. These refined products are mostly used to manufacture high-valued products such as speciality fats and oleochemicals.
Manufacturing palm oil

Beyond cooking oil, palm oil can also be manufactured into shortening, oleochemicals, and biodiesel. Palm oil combined with palm stearin, and often blended with liquid oils, makes an excellent fat blend for manufacturing shortenings. Palm oil volumes in shortenings generally vary from 30-40% of total weight. In many formulations, up to 80% of palm oil and its fractions can be accommodated. Used extensively in the baking industry, palm shortenings make excellent bakery fats.

Further, 20% of palm oil and 70% of palm kernel oil are used in non-food applications. This is a sector fast gaining importance due to the suitability of the oils and the higher value addition to their derived products. The oils can be used directly in soap manufacture for example, or processed into oleochemicals, such as fatty acids and alkyl esters before being made into final products. Oleochemicals are widely used to produce washing and cleaning agents, cosmetics, pharmaceuticals, lubricants, and plastics. They are also used in a number of other industries such as paper, leather, rubber, and textile.

The palm oil industry is also embarking on producing palm methyl esters as biodiesel for export and as a substitute for diesel in taxis, buses, trucks, tractors, and stationary engines. Studies indicate that the performance of engines using palm biodiesel is good; engines start easily and run smoothly with less smoke and reduced content of hydrocarbon, nitric oxides, carbon monoxides, and sulphur dioxide in the exhaust fumes; therefore it is more environmentally friendly.

Speciality fats

Manufacturers of margarine and speciality fats modify and combine various kinds of refined edible oils to achieve an oil- or fat-mixture with the desired texture, consistency, and other physical and chemical properties. These modifications are done using various techniques, including:

- **Fractionation**: Cooling the palm oil under controlled conditions, separating the high melting point triglycerides from the low melting point triglycerides.

- **Hydrogenation**: Adding hydrogen to unsaturated fatty acids to create saturated fats with a higher melting point. This process is often called hardening.

- **Rearrangement**: Combining two different oils to produce a fat with different melting characteristics.

Specific oil or fat blends are created with these techniques, and can be mixed with oil-soluble ingredients such as vitamins, colors, flavor, and emulsifiers. Some such blends are used as ingredients in various food industries.

Other oil or fat blends are mixed with water, in which whey, brine, milk proteins, and starches are dissolved at temperatures of 50-60°C. After pasteurisation, the blend is carefully chilled under constant agitation to form a water-in-oil emulsion. This process generates various types of margarines and spreads, sold both to consumers and to other food industry products.
Oleochemicals

Edible oils are used to produce oleochemicals such as fatty acids, fatty alcohols, glycerine, and methylesters. Oleochemicals are then used to manufacture products such as foods and specialty fats, soaps and detergents, cosmetics and personal care products, lubricants and greases, drying oil, surface coatings and polymers, and biofuels (see table 7).

Similar chemicals may be synthesized from crude oil, but are then classified as petrochemicals. The advantages of using oleochemicals over petrochemicals are:

- Oleochemicals are derived from renewable resources, so the continued availability of raw materials is assured.
- Oleochemicals are fully biodegradable and non-toxic, therefore they are easily disposable and contribute to a healthier environment.
- Oleochemical production requires less energy and causes less pollution.

<table>
<thead>
<tr>
<th>Industry/Product</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leather</td>
<td>Softening dressing, polishing and treating agents</td>
</tr>
<tr>
<td>Metal work and foundry</td>
<td>Cutting oils, coolants, buffing and polishing compounds</td>
</tr>
<tr>
<td>Mining</td>
<td>Surface-active agents for forth floating of ore and oil-well drilling</td>
</tr>
<tr>
<td>Rubber</td>
<td>Vulcanising agent, softening and mould-release agents</td>
</tr>
<tr>
<td>Electronics</td>
<td>Insulation and special-purpose plastic components</td>
</tr>
<tr>
<td>Lubricants and hydraulic fluids</td>
<td>General and speciality industry lubricants and biodegradable base oils, hydraulic fluids</td>
</tr>
<tr>
<td>Paints and coatings</td>
<td>Alkyd and other resins, dying oils, varnishes and other protective coatings</td>
</tr>
<tr>
<td>Printing and paper recycling</td>
<td>Printing ink, paper coatings, photographic printing</td>
</tr>
<tr>
<td>Plastics</td>
<td>Stabilizers, plasticizers</td>
</tr>
<tr>
<td>Biofuels</td>
<td>Methyl esters</td>
</tr>
<tr>
<td>Waxes</td>
<td>Ingredients in waxes and polishes</td>
</tr>
<tr>
<td>Soaps and detergents</td>
<td>Industrial and domestic products, specialty surfactants</td>
</tr>
<tr>
<td>Health and personal care</td>
<td>Culture media, shampoos, creams, lotions</td>
</tr>
<tr>
<td>Animal feeds</td>
<td>Nutritional supplements</td>
</tr>
</tbody>
</table>


Additional uses for oleochemicals include:

- **Glycerine**: used in pharmaceuticals, perfumery, food emulsifiers, cigarettes, alkyd resins, cellophane, dynamite, ester gums, toothpaste, and polyurethane
• **Fatty acids**: used in the cosmetics industry on a large-scale. Fatty acids derived from palm kernel oil are often used in hair cosmetics, while fatty acids derived from palm oil are often used in skin cosmetics.

• **Fatty alcohols**: used on a large-scale to produce surfactants—a material that can greatly reduce the surface tension of water when used in very low concentrations. Because of this property, surfactants are used as detergents in laundry and household cleaning products, as foaming agents in plastics production, or as emulsifier in cosmetics, margarine, and other food products.

### Biodiesel

There are many crops that can be used for producing biodiesel, but the choice normally depends on local availability, affordability, and government incentives. For example, rapeseed oil is preferred in Western Europe, while the United States favors refined soybean oil. And although Brazil is the world’s second-largest producer of soybeans, its government is fostering a castor oil–based biodiesel industry.

In terms of market size, the biodiesel industry reached 11,000 million litres in 2010 (Hunt, 2006), with Western Europe having the largest share. Although it is still the largest producer, market fragmentation has decreased Western Europe’s monopoly. Its share, 95% of the market in 2000 (Gubler 2006), had been reduced to approximately 80% by 2005. This is attributed to new players, such as Asia, entering into the market. The forecasted growth for the biodiesel market is 24,000 million litres by 2020.

One of the main arguments in the biodiesel industry is about its competitiveness over petroleum-based diesel. To shed light onto this debate, we discuss the cost of producing biodiesel in Africa, using the case of Ghana. We must initially note that biodiesel can be used in compression ignition diesel systems, either in its 100% “neat” form, or more commonly as a 5%, 10% or 20% blend with petroleum diesel. Below is our cost breakdown of “neat” and 5% blend biodiesels.

**TABLE 8 ESTIMATED (100% BLEND) PRODUCTION COSTS**

<table>
<thead>
<tr>
<th>Cost components</th>
<th>US$/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedstock cost - small farmers</td>
<td>$0.2361</td>
</tr>
<tr>
<td>Cost of oil extraction</td>
<td>$0.1822</td>
</tr>
<tr>
<td>Biodiesel production cost</td>
<td>$0.3928</td>
</tr>
<tr>
<td>Biodiesel ex-production plant price</td>
<td>$0.8111</td>
</tr>
<tr>
<td>Government taxes and distribution margins</td>
<td>$0.3179</td>
</tr>
<tr>
<td>Estimated maximum pump price</td>
<td>$1.1290</td>
</tr>
</tbody>
</table>

*Source: Technoserve*

The price of palm oil per litre in Ghana is $0.4183, and reflects the international price of $470 per metric ton. This price has built-in margins for oil extraction, allowing a third-party to extract the oil instead of the biodiesel producer. Although production costs for palm oil are lower than $470, it is unlikely that the oil extractor would sell it for a lower price in order to
produce biodiesel competitively. What is more likely is that the oil extractor and biodiesel producers would maximize their profits by selling the oil to the food industry for $470. Therefore, the price of the oil for biodiesel production is tied to the price of palm oil in the food market.

### TABLE 9 ESTIMATED (5% BLEND) PRODUCTION COSTS

<table>
<thead>
<tr>
<th>Cost components</th>
<th>US$/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiesel ex-production plant price</td>
<td>0.8111</td>
</tr>
<tr>
<td>Distribution margin</td>
<td>0.0056</td>
</tr>
<tr>
<td>Blending</td>
<td>0.0017</td>
</tr>
<tr>
<td>Biodiesel ex-refinery cost</td>
<td>0.8183</td>
</tr>
<tr>
<td>Diesel ex-refinery cost</td>
<td>0.5022</td>
</tr>
<tr>
<td>Blended (5% blend) ex-refinery cost</td>
<td>0.5180</td>
</tr>
<tr>
<td>Taxes and levies</td>
<td>0.2250</td>
</tr>
<tr>
<td>Government subsidies</td>
<td>-0.0300</td>
</tr>
<tr>
<td>Distribution margin (from refinery to distributor)</td>
<td>0.0056</td>
</tr>
<tr>
<td>Retail distributor margin</td>
<td>0.0111</td>
</tr>
<tr>
<td>Transport margin</td>
<td>0.0340</td>
</tr>
<tr>
<td>Gross margin</td>
<td>0.0722</td>
</tr>
<tr>
<td>Estimated maximum 5% pump price</td>
<td>0.8360</td>
</tr>
</tbody>
</table>

Source: Technoserve

If biodiesel was made from palm oil at its current price, the estimated price at the pump per litre of “neat” B100 would be $1.1290. Biofuel production would therefore not be competitive with the current price of diesel. However, the price difference decreases when utilizing a B5 blend, since only five percent of the cost is attributed to biodiesel. The biodiesel ex-refinery cost is calculated by adding transportation and blending costs to the biodiesel ex-production plant cost. Because the cost of biodiesel is higher than that of diesel, the blended B5 cost will be slightly higher than diesel alone by $0.0166—$0.0452 per litre. This implies that with current costs of production and local prices for vegetable oil, biodiesel cannot be competitive with fossil fuels without some form of subsidy (less than five US cents per litre). However, this scenario could change if vegetable oil costs were reduced, or if diesel prices were to increase significantly.
Country case studies

This section presents country case studies of the palm oil industry in Nigeria and Ghana, the two largest CPO producers in SSA. Although they are major CPO producers, the two countries differ in efficiency. Therefore, we present an overview of the sector in each country, the production cost structure, and how the sector can become more competitive.

Nigeria

Overview of the sector.

Oil palm trees are found predominantly in southern Nigeria, especially in the wet rain forests and savannah belt. They also exist in the wet parts of north central Nigeria, in areas like southern Kaduna, Kogi, Kwara, Benue, Niger, Plateau, Taraba and Nasarawa States as well as the Federal Capital Territory. There are three categories of palm plantations in Nigeria:

i. Smallholding
ii. Medium size, and
iii. Large-scale (estate)

More than 80% of palm oil farms in Nigeria are controlled by smallholder farmers, of which 40% exist in a wild or semi-wild state. Farm sizes average between one and five hectares, sometimes characterized by mixed cropping to maximize land usage.

Nigeria’s once-thriving palm oil industry is one of the most failed economic opportunities in Africa, as it is the third largest palm oil producer in the world, accounting for 20.8% of total land allocated to oil palm trees worldwide. Only 4% of total FFB are produced in Nigeria because yields, as presented in figure 13, average only 2.5 metric tons per hectare, while Malaysia and Indonesia reached average yields of 19 metric tons per hectare in 2009. The Nigerian sector’s performance is slow because many oil palm trees grow old in the wild and have minimum to no fertilizer inputs (IPPA, 2010).
Presco PLC, a subsidiary of Siat Group, is the largest CPO producer in Nigeria. It has three concessions totalling more than 20,000 hectares, of which 10,000 hectares are palm oil plantations. The company’s mills have the capacity to process 48 metric tons of FFBs per hour, however much of Nigeria’s CPO is processed by small-scale village level millers who use inefficient machines prone to low OER.

Source: FAOSTAT, ACET Analysis

FIGURE 14 PALM AND KERNEL OIL PRODUCTION IN NIGERIA (METRIC TONS)

Source: FAOSTAT, ACET Analysis
Due to improvements in machinery technology used for extraction over the past 30 years, CPO and CKO volumes produced in Nigeria have increased annually by three and seven percent respectively. Using total FFB and CPO, we approximate OER in Nigeria has improved from 11% in 1980 to 16% in 2012, still below Malaysia and Indonesia’s OER of more than 20% in 2012. Two reasons account for this: first, Malaysia and Indonesia use the Tenera variety of oil palm seeds, which has a higher ratio of mesocarp to kernel compared to the traditional breed used in Nigeria. Second, Malaysia and Indonesia use more efficient oil extraction technology. In fact, their oil extraction machinery has a maximum OER of 22%, while in Nigeria’s CPO is mostly extracted using artisanal tools.

Cost of producing CPO.
Nigeria’s CPO production faces many efficiency bottlenecks. Without the credits from kernel oil and meal sales, producing CPO in Nigeria would not be profitable due to the high costs of farm establishment and cultivation.

When comparing Nigeria’s CPO production costs to Indonesia, Beveridge (2009) argues that the Nigerian palm oil industry cannot be internationally competitive without government intervention. This is illustrated in table 10, where in every production stage, Nigeria is less efficient than Indonesia. The semi-wild growing conditions, combined with inefficient oil extraction machinery make the cost of producing one metric ton of CPO more expensive in Nigeria.

**TABLE 10 COMPARING NIGERIA AND INDONESIA CPO PRODUCTION COST**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Nigeria</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input cost ($/seed)</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Seeding cost ($/seeding)</td>
<td>0.33</td>
<td>2</td>
</tr>
<tr>
<td>Smallholder yield (FFB/hectare)</td>
<td>3-7</td>
<td>10-20</td>
</tr>
<tr>
<td>Farm labor rate ($/day)</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Harvesting productivity (metric tons of fruit/day)</td>
<td>0.5</td>
<td>1.2</td>
</tr>
<tr>
<td>Mill size (metric tons of fruitlets/hour)</td>
<td>1.5</td>
<td>40</td>
</tr>
<tr>
<td>Age of process technology</td>
<td>50 years</td>
<td>Current</td>
</tr>
<tr>
<td>Mill cost of production ($/metric ton of oil)</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>Quality of oil produced (FFA content)</td>
<td>10-30%</td>
<td>3-5%</td>
</tr>
</tbody>
</table>

Source: Beveridge (2009)

**Sector competitiveness strategy.**
Improving Nigeria’s palm oil industry’s competitiveness would require major actions to reduce its production cost, including:

- **Gradually replacing old trees with high yield Tenera varieties.** This process would require re-training agronomists to optimise FFB production.

- **Encouraging usage of nitrogen fixing cover-crops.** These natural fertilisers increase soil nitrogen inputs, soil moisture, and reduce weed invasion.
- **Updating processing technology.** Average OER in Nigeria is 16%, far below the 22% that available technologies could allow. Later, we present a simple cost benefit analysis of investing in improved CPO processing technology.

**Ghana**

**Overview of the sector.**

FFB sources in Ghana are located in a 240 km belt extending west from Asesewa to Aiyinasi, and northwards beyond Biso in the Brong Ahafo region. Some additional farms are also located in the Volta region. FFBS are produced by four leading palm oil plantations, outgrower farmers and, independent smallholder farmers.

FFB production has increased from 1.1 million metric tons to 2 million metric tons per year between 2001-2007 due to expansion of palm oil cultivation areas. Ghana averages 6 t/hectare, whereas yields in Indonesia and Malaysia average 19 t/hectare. However with anticipated new plantations using high yield Tenera, yields in Ghana are expected to increase.

CPO is produced by four large-scale mills, eight medium-scale mills, and numerous small-scale village mills and household units. The four major processors use 20% of Ghana’s FFB, with Unilever Ghana Ltd accounting for a major share because they manage two of the major processing mills (see table 13).

Ghana’s CPO production has increased to more than 120,000 metric tons annually, but far below Nigeria’s 1.4 million. However, Ghana’s FFB yield is both higher and more stable than in Nigeria. Over the past 30 years, yields have been 6 t/hectare in Ghana while it has varied between 2.5 and 2.7 t/hectare in Nigeria (see figure 15).

**FIGURE 15 PALM AND KERNEL OIL PRODUCTION IN GHANA (METRIC TONS)**

[Graph showing palm and kernel oil production in Ghana from 1975 to 2015]

Source: FOAStAT, ACET Analysis

Extracted palm oil has been on the rise due to increased FFB production (see figure 18). However, the production of kernel oil in Ghana has not kept up with palm oil production. This
is possibly because the newer Tenera varieties have traded off kernel size for larger mesocarp in order to maximize CPO extraction.

The main palm oil companies operating in Ghana are mostly foreign owned. They include:

1. Ghana Oil Palm Development Co. (GOPDC). Privatized in 1995, it is the largest CPO producer in Ghana. It is currently owned by three shareholders: Siat of Belgium, Social Security and National Insurance Trust (SSNIT) of Ghana, and the government of Ghana (GoG), with Siat holding the majority share.

2. Twifo Oil Palm Plantation Limited (TOPP), with locations in Ntafrewaso and Mampong, is the second largest producers of palm oil in Ghana, with Unilever and the government of Ghana being its major shareholders.

3. Benso Oil Palm Plantation Limited (BOPP) used to be a subsidiary of Unilever Ghana Limited and was recently sold to Singapore-based Wilmar International.

4. Norwegian Palm Ghana Limited (NORPALM) took over from the former National Oil Palm Limited in 2000, and is based at Prestea in the Ahanta West District of the Western Region.

<table>
<thead>
<tr>
<th>Company</th>
<th>Annual Output (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghana Oil Palm Development Company</td>
<td>30,500</td>
</tr>
<tr>
<td>Twifo Oil Palm Plantation (Unilever managed)</td>
<td>21,000</td>
</tr>
<tr>
<td>Benso Oil Palm project (Wilmar managed)</td>
<td>18,000</td>
</tr>
<tr>
<td>Norpalm Ghana Ltd</td>
<td>8,500</td>
</tr>
</tbody>
</table>

Source: Ecorys and CDC Consult (2010)

These companies export limited volumes of CPO. Most of them have put up storage tanks at the Tema port to facilitate exports. Ghana exports 40,500 metric tons of CPO per year, although the country is a net importer of refined oil. However, Ghana has the potential to export more palm oil to other countries and the sub-region, especially to Nigeria.

**Cost of producing CPO.**

In Ghana, the ex-farm price per metric ton of FFB depends on the type of palm fruit offered for sale. The two main types are Dura and Tenera. The current ex-farm price for fruit bunches is GH¢72 (US$50) per metric ton for Tenera, and GH¢50 (US$35) per metric ton for Dura.

After FFB harvesting, the fruit is transported to processing factories on trucks or transporters hired by the oil palm company. On average, the buying factories pay GH¢15.00 per metric ton. In the case of large-scale processors that have their own farms, the companies' own farm trucks or tractors haul to the processing factory.

The ex-factory price of palm oil per metric ton is based on the prevailing world market price of crude palm oil. This is the price large mills sell to their customers, mainly soap and cooking oil producers, using the world market price per the last day of the previous month. As of July 2009, the ex-factory price of palm oil was US$690 per metric ton, whereas processing costs have been estimated at GH¢150 (US$100) per metric ton.
Processed palm oil is transported to customers in either drums or containers, with the transport cost to local customers being GH¢45.00 per metric ton (see table 12 below).

### TABLE 12 COSTS STRUCTURE PALM OIL FOR THE DOMESTIC MARKET

<table>
<thead>
<tr>
<th>Type of costs</th>
<th>Per metric ton FFB (US$)</th>
<th>Per metric ton palm oil (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex-farm price FFB</td>
<td>40-49</td>
<td>330-400</td>
</tr>
<tr>
<td>Transport costs to factory</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Total costs</td>
<td>50-60</td>
<td>690</td>
</tr>
<tr>
<td>Processing costs</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Ex-factory price (July 2009)</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Transport to consumers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Ecorys and CDC Consult (2010)

**Sector competitiveness strategy.**

The weaknesses of Ghana’s industry are characterized by:

- Lack of formal organizational linkages among major industry actors within the production value chain
- Lack of investments in the palm oil processing industry
- Low productivity (although not in all estates), and
- Less efficient small-scale CPO processors

Improving the competitiveness of the palm oil industry in Ghana will necessitate:

- Ameliorating the OER of small to medium mills. This is a major bottleneck. With an average 12-15% OER for medium sized mills, while major mills average 19-21%, medium sized mills can increase efficiency by processing more Tenera FFB varieties, improving quality control, oil clarification, and recovery from sludge.

- Improving road conditions for FFB transportation. A study shows that the per metric ton per kilometre transportation cost of delivering FFBs is GH¢ 0.53 on asphalt roads, and GH¢ 1.55 on earth feeder roads (Ecorys and CDC Consult, 2011).

There are 400 small processor units in Ghana, which account for 68% of the country’s FFBs and can produce up to 5 metric tons of CPO per day with FFB to CPO extraction rates of 10-15%. Improving the efficiency of small-scale processors by supplying market-smart subsidized extraction machines can positively impact the sector’s competitiveness.
After converting the costs figures from metric tons to gallon, the per gallon CPO production cost is GH¢1.10 and the per gallon CPO price is GH¢5.40 leading to an average profit of GH¢4.30 per gallon of CPO produced. In other words, the average monthly revenue of these units is US$800.

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### BOX 1 OPERATING COST OF SMALL-SCALE PROCESSORS IN KADE

We interviewed eight small-scale processors in Kade, a palm oil producing community located 3 hours north of Accra, to determine their operating costs. The average processing capacity of small-scale processors is 350 gallons per month and most of them extract oil using basic motorised diesel digesters. Their main source of FFB is smallholder farmers who sell at an average price of GH¢170 per metric ton (US$91). In general, the processing cost breakdown is as followed:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (in GH¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-boiling cost</td>
<td>18.83 per metric ton</td>
</tr>
<tr>
<td>Boiling cost (labor)</td>
<td>9.60 per metric ton</td>
</tr>
<tr>
<td>Extracting (labor)</td>
<td>3.20 per metric ton</td>
</tr>
<tr>
<td>Extraction machine rental</td>
<td>38.5 per metric ton</td>
</tr>
<tr>
<td>Sub-total</td>
<td>70.13 per metric ton</td>
</tr>
<tr>
<td>FFB cost</td>
<td>170 per metric ton</td>
</tr>
</tbody>
</table>

**Total** 240.13 per metric ton
Value capture opportunities

In table 13, we provide an initial overview of value capture opportunity areas for SSA countries, ranking their feasibility based on the country study analysis presented in section 5.

Based on Africa’s existing capabilities and areas of comparative advantage, this report suggests four main focus areas where countries can capture additional value: increasing FFB yield, improving OER of small-scale processors, addressing high value niches, and investing in biodiesel to generate energy for specific industries, such as mining.

**TABLE 13 KEY OPPORTUNITIES TO CAPTURE VALUE FOR AFRICAN COUNTRIES (ON A SCALE FROM 1 TO 5)**

<table>
<thead>
<tr>
<th>Increasing yield</th>
<th>Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase yield by adopting Teneravariety</td>
<td>4</td>
</tr>
<tr>
<td>Encouraging the adoption of leguminous cover crops by smallholder farmers</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Improving OER and CPO quality of small millers</th>
<th>Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investing in efficient machinery for small processors</td>
<td>3</td>
</tr>
<tr>
<td>Improving FFB collection after harvest</td>
<td>5</td>
</tr>
<tr>
<td>Provided subsidized loans for equipment purchase</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strengthening out-grower schemes</th>
<th>Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers receive fertilizer inputs at reasonable price on credit and pay for it during the harvesting season</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biodiesel of specific sectors</th>
<th>Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producing biodiesel for mining industry</td>
<td>2</td>
</tr>
<tr>
<td>Seek CDM credit for producing biodiesel</td>
<td>1</td>
</tr>
<tr>
<td>Identifying buyers in the EU market</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: ACET Analysis

Challenges and barriers for value capture

The challenges SSA faces across the value chain are summarised below in table 14. To increase market share, Africa will need to make considerable efforts towards narrowing existing gaps (such as productivity and quality management), and build on its comparative advantages. Africa’s comparative advantage lies in its abundant low cost labor, and easy accessibility to the European market.
Although overcoming most of these challenges will require long-term investments; some limitations can be overcome in the short-term. For example, improving poor access to inputs and addressing the state of oil extraction machineries could be done within a reasonable number of months, assuming the right finances are available.
Improving SSA palm oil competitiveness

SWOT analysis of SSA oil palm industry

Strengths

- Agro-ecology conducive to oil palm production
- Regional expertise
- At maturity the palm oil crop provides income throughout the year for farmers
- CPO prices are predicted to remain strong

Weaknesses

- Linkages between industry and research and development (R&D)
- Low yields, low tech production, and poor agronomic practices
- Small farmers not associated with outgrower or off-take schemes; quality issues
- Few medium sized millers
- Limited access to reliable energy sources

Opportunities

- Further planting with demand increasing globally, particularly in China, India, Nigeria, and Pakistan
- Outgrower schemes
- Foreign direct investment (FDI) from Southeast Asian corporations
- Biodiesel potential
- Generating power from palm waste to supplement energy requirements

Threats

- Environmental concerns; deforestation
- Volatility of prices
- Increasing competition from Indonesia as they allocate more land to palm oil production
- Potential neglect of agriculture in the midst of petroleum crude oil finds, specifically in Ghana and Nigeria
Improving competitiveness of FFB production in SSA

SSA countries with low FFB yields must replace old trees and make aggressive efforts to adopt high yield varieties. Considering the large yield gap with Indonesia and Malaysia, SSA countries should facilitate farmer access to available technologies. They must also:

- Strengthen extension services to facilitate transfer of R&D to small palm oil farms
- Improve smallholder practices. In Ghana, such investment promises a 14% rate of return (Ecorys and CDC Consult, 2010)
- Support outgrower schemes, as they will reduce farmer’s liquidity constraints

Improving processing mill efficiency is also necessary. Except for a few large processors, most processing mills have OERs below 18%. Placing improved processors in strategic locations, plus improving farm gate FFB collection coordination is necessary to reduce FFAs. This can be done by:

- Training agronomists employed by medium-scale millers
- Reimbursing part of medium-scale processors’ costs for working with smallholder farmers

As palm oil production increases, environment sustainability must also be taken into account. Concerns of massive deforestation could undermine the viability of a sustainable palm oil industry. Therefore, policy makers must be mindful of initiative such as the Roundtable on Sustainable Palm Oil (RSPO) and:

- Interpret sustainability principles to their individual countries
- Facilitate eco-friendly certification by providing transparency in procedures relating to the supply chain
BOX 2 INDONESIA (AND MALAYSIA)—A CASE STUDY OF
A COMPETITIVE PALM OIL INDUSTRY

From 1990, world exports of palm oil have increased dramatically, driven by burgeoning demand from China, South Asia, and the EU. Indonesia and Malaysia provide over 85% of these exports, and their exports of palm oil and derived products now exceed the value of all food and agricultural exports from sub-Saharan Africa, the region from which the oil palm tree originated.

In the period since 1990, the industry has grown especially rapidly in Indonesia, whose share of world exports has risen from 10% to 45% today, contributing US$14 billion in foreign exchange. The ready availability of know-how and FDI from Malaysia played a key role, in a relatively open economic environment. However, the Indonesian government also provided a range of incentives directed to the industry, especially an export tax to encourage downstream processing, credit lines and allocation of 12 million ha of forest estate land at prices well below opportunity cost. It also actively promoted smallholders through support to their investment costs and smallholders now provide over one third of production. The available evidence points to Indonesia’s strong competitive position in oil palm with high economic returns to producers and to the country. It estimated that some 3 million jobs have been created.

An even stronger set of incentives was provided to plantation forestry in Indonesia, where pulp and paper product exports have increased from virtually zero in 1990 to over US$4 billion today. A special reforestation fund channelled over US$1 billion dollars of grants and interest free loans to the sector to subsidize establishment of plantations and mills, in addition to tax exemption for 8 years and provision of cheap land. Much of this funding was directed to specific firms with close ties to the Suharto government. However, the estimated benefit-cost ratio of these investments is questionable especially if environmental costs are considered.

On the negative side, investments in both oil palm and forestry have been widely associated with environmental and social costs. In particular, half of the increased area has been planted on tropical forest land with high biodiversity and carbon sequestration, adding to Indonesia’s poor record in preserving tropical forests and mitigating greenhouse gas emissions. In addition, with poorly defined land rights, establishment of both large estates and smallholders has often trodden on rights of existing land users.

Finally, in an environment of relatively poor governance, transfers of state resources to specific firms have been associated with significant corruption. Large areas of land have been allocated for oil palm and plantation forestry but left idle after extracting commercial timber, and many loans have not been repaid and have been classified as non-performing. Notably, while many of the same policies were pursued in Malaysia, the overall outcomes have been more favorable there, in large part due to better governance. Some progress is also evident in Indonesia under recent democratic governments although much corruption has been “decentralized”.

Improving efficiency of small-scale processors

**Cost-benefit analysis of investing in improved oil extraction machineries.**

The up-to-date milling technology used in Indonesia makes the cost 3.5 times lower than in Nigeria. Therefore, improving the efficiency of small-scale millers is important for making the palm oil industry more competitive.

Below we present a simple cost benefit analysis of investing in efficient oil extraction machines. The majority of palm oil is produced and extracted using either spindle press or hydraulic press, yielding an average 15% OER. A $12,500 to $13,500 investment in semi-continuous units with either motorized digesters or screw-presses improve OER efficiency by 15-46%, with all else remaining constant.

<table>
<thead>
<tr>
<th>Semi-continuous combined units with</th>
<th>Average investment cost</th>
<th>Spindle press</th>
<th>Hydraulic press</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorised digester + hydraulic + spindle-press</td>
<td>$12,500</td>
<td>38%</td>
<td>15%</td>
</tr>
<tr>
<td>Digester + screw-press</td>
<td>$13,500</td>
<td>46%</td>
<td>22%</td>
</tr>
</tbody>
</table>

Source: ACET Analysis

With a $12,500 to $13,500 investment in efficient oil extraction machineries per hectare revenue increases by $272 to $691 per metric ton of CPO (assuming the following factors: FFB average yield of 10 metric tons per hectare, 15% OER, 22% maximum OER potential, and an average $1,200 per metric ton CPO price). It is important to note that the above analysis only compares the initial investment cost to the additional revenues from the investment. It does not include the additional production costs, such as fuel that the new machinery may add as this is variable.

**Improving energy access for a competitive palm oil manufacturing sector**

Energy is the key to agroprocessing development in Sub-Saharan Africa. Palm oil manufacturing, processing, and transportation all require energy in processes such as drying, extraction, pumping, heating, pressing, and packaging. At the FFB and CPO production level, energy is mostly derived from burning FFB fruitlet fibres and shells. But to press CPO out of the fruitlets, a diesel powered extraction machine is used.
In the context of reducing palm oil manufacturing costs, energy access must focus on innovative policies designed to satisfy demand on the ground. In the United Nations Industrial Development Organization’s (UNIDO) 2011 publication, *Agribusiness for Africa’s Prosperity*, they present the following generic energy policy alternatives:

- **Incorporating decentralized energy distribution approaches.** Creating energy supply points in remote rural areas that provide the needed energy services has the potential to encourage small and medium-scale processing and production. Although small-scale decentralized energy is not the ultimate solution to the energy needs, its role is crucial and must be incorporated in energy planning at all levels.

- **Improving locally available energy supply resources.** The hydroelectricity generation potential of the continent remains largely untapped, as is also the case for solar and geothermal energy sources. Large hydroelectric power projects have had bad press of late, in part due to social and environmental costs. As the debate over new hydropower projects continues, the continent lags behind with only 1,500 hydroelectric dams out of the world total of 45,000.

- **Matching energy technologies with needs.** The design of energy systems for the agroprocessing sector should be driven by needs—the most important needs are electricity for heating, cooling and mechanical services. The basis of the plan should be aimed at meeting a need and not simply supplying energy, as the latter does not guarantee that the needs will be met.

- **Financing energy services.** Considering the reduced effectiveness of the public-private partnership (PPP) model associated with the recent financial crisis that made international banks shy away from long term loans, carbon finance is now an emerging source of financing that is gaining recognition in developing countries, suitable for agro-processing infrastructure investment, such as the Clean Development Mechanism (CDM). This mechanism aims at reducing greenhouse gas (GHG) emissions, while at the same time providing funds for development in developing countries. Projects such as wind farms and solar panels can easily be financed via the CDM.4

**Improving land access for large-scale plantations**

Africa’s land rights policies are still dominated by customary laws with land owned by local traditional chiefs. These less market friendly laws can be a major deterrent for large-scale plantations. To circumvent this problem, the government must play its part by securing tracts of land and other natural resources, and lease them. We recommend three important steps/actions:

1. **Establish and advertise a market-based land bank with information on available land for oil palm cultivation.** Prepare an information package for potential FDI in the sector. A good example is the Ethiopian land Bank. In 2008, the Ethiopian government established a land bank in charge of selecting and appropriating land to both local and foreign investors. A similar land bank can be established in countries with high oil palm potential whereby lands are ethically acquired and leased to the highest bidder.

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4 Kandeh K. Yumkella, Patrick M. Kormawa, Torben M. Roepstorff and Anthony M. Hawkins, Eds, UNIDO (2011)
2. **Harmonize land policies and the legislative framework with customary law for sustainable land administration.** Most land in Africa is owned by local chiefs who give user-rights to local farmers. Designing land policies that allow long-term leasing such that the lease agreement is understood and signed by the land users, local chiefs, and the government will address some of the ethical issues raised in the land grab literature.

3. **Develop adequate environmental standards.** Given the controversy around attempts to expand the oil palm industry in Malaysia, the RSPO and other environmental standards were established for the industry. Any effort toward expanding oil palm plantation must adhere to these standards through consultative processes.

**Developing country-specific policy**

The preceding sections provided a generic overview of key trends in the palm oil sector, identified important opportunities for SSA as a region, and highlighted success factors for greater value capture. In order to develop a palm oil strategy that is country-specific, policymakers need to identify the country’s comparative advantage, current barriers, and key policy trade-offs to make in order to drive transformative growth.

**Identify and prioritize opportunities for value capture**

- **Benchmarking the current economics of the sector.** Policy-makers need to develop a robust understanding of the vertically integrated economics of the palm oil sector. This should include the current level of efficiency of palm oil production and extraction as well as the scale of the market for palm oil co-products. It should also include an assessment of the cost and resource implications of increasing production to identify the key bottlenecks across the palm oil value chain. An equivalent analysis for palm oil processing and manufacturing sectors also needs to be undertaken, with a review of the current operating capacity and efficiency of the sectors, followed by an assessment of the cost sensitivity to drive increases in production.

- **Forecasting the key variables with the most impact on economic viability.** Anticipating price expectations of palm oil, CPO, and high value manufactured palm oil products at the farm/factory-gate level, by different grades, and the likely reactions of processors, manufacturers, traders, and farmers to forecasted changes.

- **Sizing the opportunity.** Creating scenarios based on the above benchmarks and forecasts, for the potential opportunity for scaling up production and processing at each stage of the value chain.

- **Assessing opportunity costs for market participants in the sector.** Comparing the opportunity cost of cultivating, processing, and supporting palm oil production to other oil crop sectors, given limited financial and human resources.
• **Identifying areas of comparative advantage/disadvantage.** Analyzing the relative costs of palm oil production and processing locally versus competing markets.

• **Outlining policies to take advantage of opportunities, and paring them with possibilities.** For example, in the case of building an oelochemicals or shortening factory, policy-makers need to examine the ability and willingness of government to provide attractive incentives for inward investment, and the capacity to tolerate extended periods of limited fiscal returns from the sector in order to foster an entrenched set of long-term investments from major multinational players.

• **Prioritize opportunities.** Ranking opportunities for value capture based on the above and an overall assessment of the net gains, feasibility, and risks.

**Identify current policy bottlenecks**

It is necessary to determine the country-specific policy bottlenecks at work in each country. On the generic level, some policy-related challenges include:

• **Competitive production costs in major markets.** Low production costs in Indonesia and Malaysia are one of the biggest challenges to palm oil producers in Africa.

• **Lack of key inputs regulation.** A lack of monitoring or regulation of seed quality is an important determinant of the relatively low yields of African palm oil producers.

• **Poor business environment.** A lack of business and enterprise support, limited access to finance and reliable energy inhibit prospects for locally based and owned processors to emerge, especially given the comparative cost of capital for major vertically integrated multinationals.

**Address potential policy trade-offs and questions**

Policymakers typically need to take into account the reality that any sector-specific strategy must compete with many other overlapping, and potentially conflicting, priorities. However, there are several additional policy trade-offs specific to the palm oil sector that should be addressed when determining an overall approach to strategizing a palm oil plan for any country, including:

• **Balancing the use of directly interventionist approaches versus laissez faire or market based approaches.** A highly interventionist approach to regulation and support of the palm oil sector can reduce risk and volatility for players, especially palm oil farmers, and can be an effective means for improving and maintaining quality. As an example, the Ghana Cocoa Board (COCOBOD) has been successful in ensuring the generally higher quality of Ghanaian cocoa beans versus other major producers such as Côte d’Ivoire. However, this needs to be offset against the challenges of creating opportunities for rigidities and rent seeking, and the cost of developing and maintaining a transparent sector bureaucracy. Box 3 highlights the necessary steps for evaluating the feasibility of establishing an oil palm board.
BOX 3 FEASIBILITY STUDY ON OIL PALM BOARD

There have been calls for an Oil Palm Regulatory Board or an Oil Palm Production and Processing Association, to improve public private partnerships in Africa. One of the recommendations suggests setting up a Board that will incorporate participation from government and the private sector (out growers, large and small plantation companies, and processors and manufacturers). Such a body would play an active role in (i) looking after the interest of the stakeholders within the sub-sector, (ii) developing and disseminating new technologies, (iii) ensuring positive development and policy programs, (iv) coordinating international programs, investment promotion and linkages, market development activities, and global awareness of Africa’s palm oil industry. We propose a simple feasibility study outline for establishing an Oil Palm Board, taking into account the experiences of other countries in which such a Board has been established (e.g. in Malaysia).

The feasibility study should address:

- Tasks and responsibilities of the Board
- Organisational structure
- Board composition (ensuring private sector participation)
- Required funding and possible sources
- Determining how to manage the risk of growing environmental tensions. RSPO restrictions can inhibit the expansion of FFB production, so policymakers must factor this into their policy implementations

Source: Ecorys and CDC Consult (2010)
References


