CLIMATE POLICY INITIATIVE

Towards a More Sustainable and Efficient Palm Oil Supply Chain in Berau, East Kalimantan

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Descriptors

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About CPI

With deep expertise in policy and finance, CPI works to improve the most important energy and land use practices around the world. Our mission is to help governments, businesses, and financial institutions drive growth while addressing climate risk. CPI works in places that provide the most potential for policy impact including Brazil, Europe, India, Indonesia, and the United States.

About LEOPALD

This paper is the first in a series of studies to be conducted by CPI in Berau, East Kalimantan, as part of Project LEOPALD (Low Emissions Palm Oil Development). The program is led by The Nature Conservancy and implemented jointly with GIZ and CPI. This project is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag. Project LEOPALD aims to support East Kalimantan to achieve its Green Growth Compact through more sustainable palm oil practices. CPI focuses on the climate financing aspects of this goal.

Foreword from Head of East Kalimantan Crop Estate Agency

The Provincial Government of East Kalimantan is committed to transforming its economy to free itself from dependency on non-renewable resources and to ensure regional economic growth from sustainable resources. The plantation sector, primarily oil palm, is a key commodity in East Kalimantan because it has an important role in developing the local economy, developing renewable energy, reducing the intensity of greenhouse gas emissions, and providing raw materials for agriculture-based downstream industries.

The plantation sector in East Kalimantan is developed sustainably - based on the premise of a Green Economy. The province has made several initiatives and innovative policies to protect the forests from unlawful encroachment. One of them is a pledge to support sustainability principles in developing the plantation sector, which was endorsed by all district governments in East Kalimantan on 11 September 2017.

The principles of sustainable plantation are reflected in plantation policies, which include: placing productivity improvement as a priority instead of land expansion, encouraging land expansion limited only to smallholder farmers and on land with low carbon stock value; conducting evaluation of licenses and protecting areas with high carbon stock value. We also commit to conserve the remaining 640.000 hectares of natural forests and 50.000 hectares of peatland until 2030 in all areas of East Kalimantan.

To increase the economic value and production efficiency of the plantation sector, both the companies and planters need a good understanding of the palm oil supply chain. Therefore, this study is an important contribution to provide thorough information about the current state of the palm oil supply chain, the challenges faced, and possible solutions to improve palm oil supply chain efficiency in East Kalimantan. The case study of Berau can someday be scaled up to a provincial level to give a more complete picture of the palm oil supply chain in the province. We hope that the output of this study can be taken into consideration when formulating a plantation development strategy for East Kalimantan.

Samarinda, July 2018

Head of East Kalimantan Crop Estate Agency,
Ir. Ujang Rachmad, M.Si

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Executive Summary

While for decades, the Berau district of East Kalimantan has relied on mining as an economic driver, the government has indicated that its future depends on the cultivation, not extraction, of natural resources. Palm oil holds strong potential in this regard. During the past six years, the total planted area of palm oil in Berau has increased significantly, from 40,000 to 120,000 hectares (ha), and the crop currently dominates more than 70% of agricultural land in Berau. Additionally, palm oil is a strong employer, and has grown from employing 3,000 people in 2012, to 21,000 people in 2014 (Disbun Berau 2016).

It is no surprise, therefore, that the Berau government sees oil palm development as an important. However, Berau wants to do more than just build an agricultural economy, they aspire to do so in a way that preserves natural resources for generations to come, meaning that careful considerations will need to be taken.

This study is the first in a series on low-emissions palm oil as part of a program led by The Nature Conservancy, funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), and implemented jointly with GIZ and CPI. This CPI analysis contributes to the goals of the Berau government by providing an overview of the palm oil supply chain in Berau. In regards to both upstream and downstream, we examine the land use efficiency of palm oil as indicated by yield per hectare, absorption of raw material into processing factories, and the accessibility between plantations and mills. We also highlight opportunities to improve productivity and efficiency, while ensuring the sustainability of natural assets in Berau.

Our findings include:

1. Berau can reach optimal production levels and fulfill mill capacity needs with minimal land expansion

Berau produces 11% of East Kalimantan's Fresh Fruit Bunches (FFB), which is equivalent to 1.2 million tons, and is grown on more than 120,000 ha of land (Disbun Kaltim 2017, BPS 2016). Plantation companies operated 74% of total planted area, and produced 88% of FFB in 2016. The majority of these companies are consolidated into four main plantation holding companies.[1]

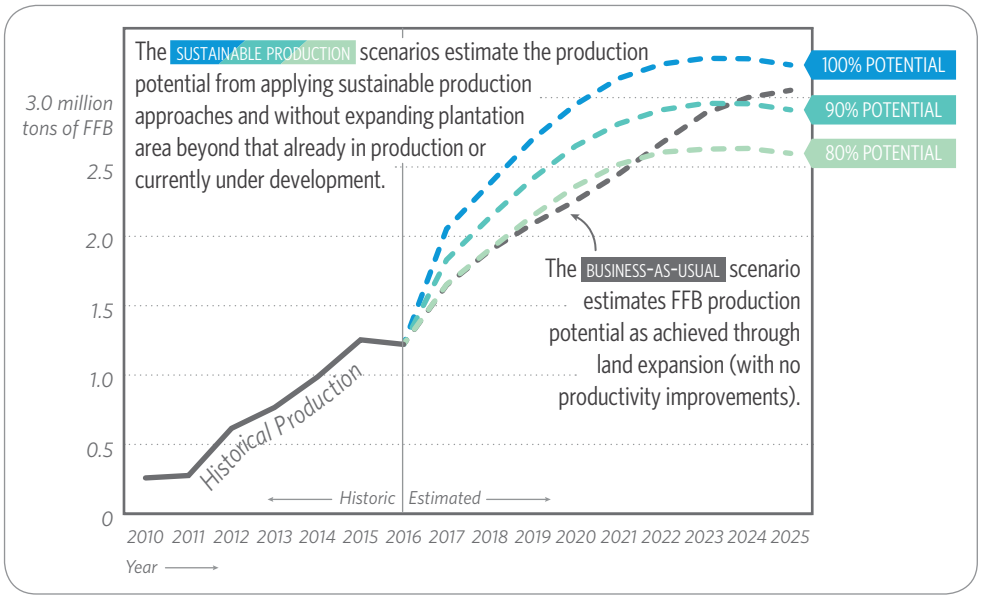
There are seven palm oil mills in Berau, which are owned by the four plantation holding groups. Mills in Berau have a combined total processing capacity of 2.8 million tons of FFB per year, but are currently only operating at 44% capacity.

Berau is producing oil palm at below its potential levels due to several reasons, including:

- most plants are between four to nine years old, whereas peak productivity starts after seven years;
- only approximately 41% of the total licensed area owned by company plantations have been planted on.

Based on our estimates, if Berau relied solely on crops reaching peak age and all concession areas becoming productive, Berau would reach a production level that is sufficient to fulfill mill capacity to 2.8 million tons by 2023. However, Berau only has 33,000 ha of low conservation value palm oil concession areas left still unplanted.

Figure I. Estimate of avoided deforestation through productivity improvement



Sources: IFC 2013, PILAR 2015, CPI analysis

1 These plantation holding companies are: Indofood, Triputra, Kuala Lumpur Kepong, and Teladan Prima.

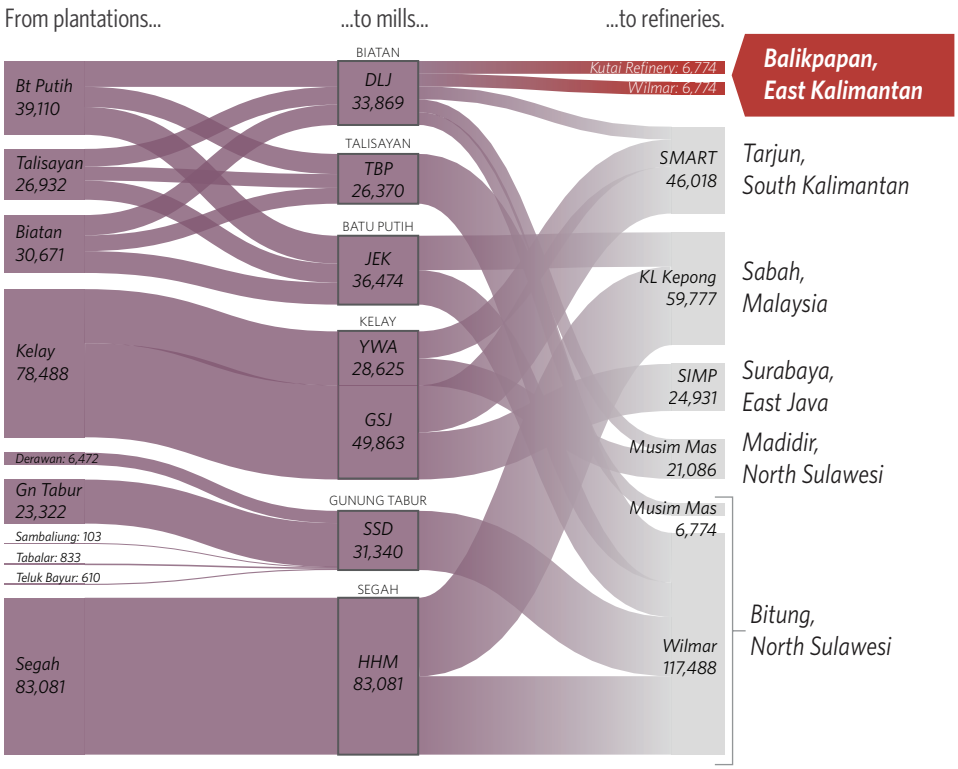
This does not provide a lot of room for land expansion, and if not supported by a viable strategy to intensify crops, the push to maintain oil palm growth will strain the existing limitations on land use.

In this study, we estimate the FFB production potential of currently producing trees in Berau under two scenarios: the sustainable production scenario and the business-as-usual scenario.

The *business-as-usual scenario* estimates FFB production potential as achieved through land expansion. The *sustainable production scenario* measures the oil palm trees' optimal production potential by applying the sustainable production approach (IFC, 2013), without expanding the plantation area beyond what has already entered into production age and currently under development (see Figure I).

Figure II. Flow of palm oil products from the plantations in Berau's sub-districts to the refineries

Without refineries, virtually all oil palm products produced in Berau (colored purple) are exported out of East Kalimantan to other provinces, and even Malaysia. Only a small volume of CPO (colored red) is ultimately refined in the same province in Balikpapan, East Kalimantan.



*Units are in tons of CPO, or CPO equivalent.

Our calculations estimate that, with better agricultural practices focused on improving yield, at just 90% optimum productivity Berau could be producing more than 2.8 million tons of FFB per year by 2021. On the other hand, under the business-as-usual scenario, production would still fall short of 100% optimum levels over the projected years. This implies that there is no need for further plantation expansion, as the existing concessions are sufficient to fulfill Berau's production needs.

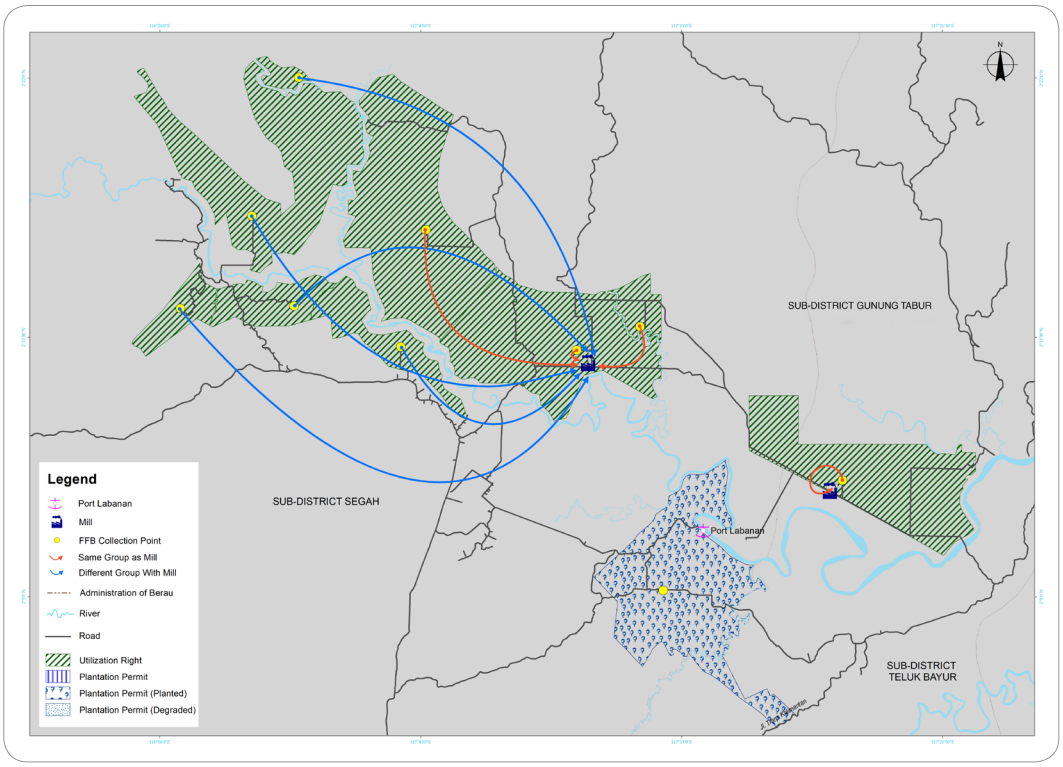
2. Palm oil plantations and mills are spread out evenly across Berau, but most crude palm oil leaves East Kalimantan raw and unrefined

This study maps, for the first time, the flow of palm oil products in Berau, from the plantation to the refinery. Of the 12 sub-districts in Berau, 10 have planted palm oil, with the largest supply of FFB coming from Kelay and Segah, comprising 56% of total production in Berau.

There are eight mills in Berau, seven of which are operational as of 2017. Plantations owned by private companies in Berau are typically integrated into their own mills, built in a location close to the plantation. These company-run plantations have efficiently arranged their supply contracts to connect to the closest available buyer.

There are no crude palm oil (CPO) refineries in Berau, however, so CPO from Berau mills are sent to eight refineries across Indonesia and Malaysia, the closest of which are located in Balikpapan, within the East Kalimantan province. Despite the existence of three refineries in East Kalimantan, Berau only supplies an insignificant amount of CPO to two of them, PT Kutai Refinery Nusantara and PT Wilmar Nabati. As a result, most of the CPO from Berau is sent to North Sulawesi and Sabah, Malaysia (see Figure II).

Figure III. Flow of company-produced FFB to mills



The blue lines represent the transport of FFB from company plantations that are not group-affiliated to the destination mill.

3. Company plantations are situated efficiently along the supply chain, but smallholders face additional challenges

Transportation is efficient from company plantations to mills. From our field research, we found that company plantations in Berau are typically integrated into mills they operate themselves, built in close proximity to the plantation. The map suggests that company-run plantations have efficiently arranged their supply contracts to connect to the closest available buyer.

The map in Figure III shows the same level of efficiency between plantation companies whose business is integrated with a mill, and with companies whose business is not integrated. This suggests that integration is not the only way to ensure supply chain efficiency, and that business partnerships between non-affiliated parties are equally as important.

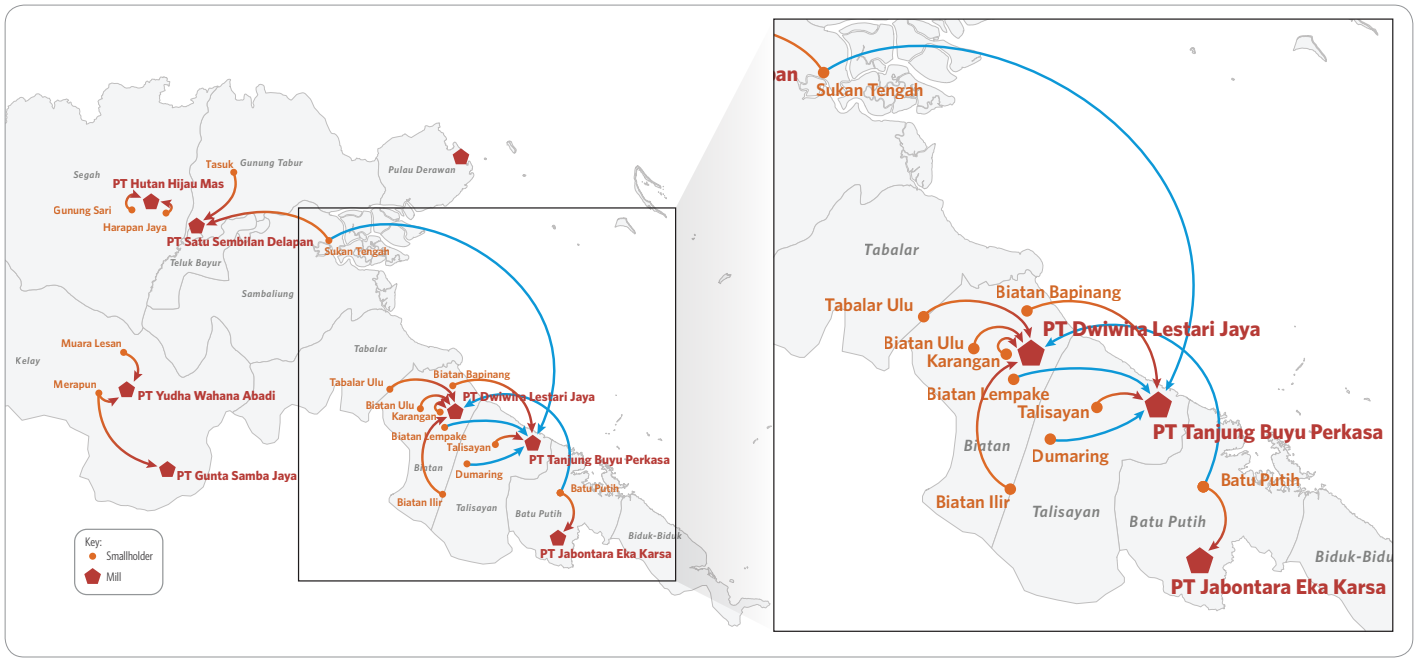
Operational barriers are limiting smallholders' efficiency

When comparing the supply chain routes that company plantations use to the smallholder routes, it is evident that several independent smallholders are not supplying FFB to their closest available mill, as they cannot meet certain standards imposed by that mill. As shown in the map in Figure IV, there are at least three villages in the south-eastern part of Berau that supply FFB only to mills further away from them (greater than the average distance of 30km), despite there being a closer mill available. The three villages, Biatan Bapinang, Biatan Lempake, and Dumaring, only supply to PT Tanjung Buyu Perkasa which is between 40-70 km away from the villages, instead of PT Dwiwira Lestari Jaya, which is between 8-20 km distance range from the mill.

Additionally, there are two villages that supply FFB both to the closest mill and to mills further away, Batu Putih and Sukan Tengah. Batu Putih smallholders supply to the nearest mill of PT. Jabontara Eka Karsa, which is located within the sub-district, and to PT. Dwiwira Lestari Jaya mill, which is two sub-districts away, with an approximate distance of 75 km. Sukan Tengah has the longest FFB supply route we encountered in Berau, supplying to PT. Dwiwira Lestari Jaya, which is three sub-districts away and an approximate distance of 137 km.

In some cases, the local cooperative has an agreement with the mill further away, but does not have an agreement with the closest mill. In the villages of Biatan Lempake and Dumaring, the cooperative in their respective villages has an agreement with PT Tanjung Buyung Perkasa mill, but does not have an agreement with PT Dwiwira Lestari Jaya mill, which is actually closer.

Figure IV. Flow of smallholder-produced FFB to mills



The blue lines represent the transport of FFB from smallholders to a mill that is further than the closest one.

Transportation distance is a significant factor in smallholder productivity and earnings, because FFB quality deteriorates within two days after harvesting, and transportation costs will also increase as the transportation distance increases.

The smallholder supply map in Figure IV shows that the supply route of several smallholders is inefficient. Under optimal market conditions, business actors would opt for the most efficient and cost-effective method of selling to a buyer. These findings indicate that there are challenges preventing the smallholders from acting efficiently.

4. Recommendations and follow up

Based on the findings in this study, the research team recommends future studies or projects that focus on:

1. Identifying strategies for Berau to reach optimal levels of production within the existing productive concessions.
2. Supporting a region-wide effort to map smallholders, in order to create functional cooperatives and Village Owned Enterprises (BUMDes) in strategic locations throughout the district, and to provide alternative financing so that smallholders can access operational capital.
3. Mapping other potential agricultural plants, apart from palm oil, at the village level, to provide smallholders with alternative sources of income and to strengthen villages with a diversified economy.
4. Analyzing the need and business case for refineries in Berau, and the challenges that presents.

In the next phase of this study, CPI will take a deep dive into two selected villages, to map and survey smallholders in more detail, and to obtain smallholder financial profiles. This will then be developed into a model to provide smallholders with access to finance.

Contents

1. Introduction

1.1 Supporting sustainable land use with efficient supply chains

For almost two decades, economic growth in the District of Berau, East Kalimantan, has been driven by a massive boom in mining. Until 2016, the mining sector, which is dominated by coal, contributed to 64% of Berau's economy, while the agriculture, plantation, forestry, and fishery sectors collectively contributed only 9%. However, since 2012, the growth of the coal industry has continually declined, from 19% in 2012 to -2% in 2016. Gross domestic regional product from both the forestry and fisheries sectors has also dropped during this time. Meanwhile, contributions from the agriculture and plantation sectors have steadily increased, from 41% in 2011 to 59% in 2016 (BPS Berau, 2017).

According to the Berau government, the strength of the region's economic future lies in cultivation, not extraction.[2] Palm oil holds particular promise, as it has grown significantly in size since 2012 compared to other crops. In just six years, the total planted area has increased from 40,000 to 120,000 hectares (ha), currently dominating more than 70% of agricultural land. Additionally, palm oil requires more labor than other crops, and has grown from employing 3,000 people in 2012, to 21,000 people in 2014 (Disbun Berau 2016).

It is no surprise that the Berau government places oil palm development as a priority program. However, Berau wants to do more than just build an agricultural economy, they aspire to do so in a way that preserves natural resources for generations to come, meaning that careful considerations will need to be taken.

More than 75% of Berau is still covered by natural, virgin forests and regenerated forests (Hartanto, 2014). Meanwhile, the province of East Kalimantan is committed to enforcing a moratorium on new plantation licenses.[3] They have also committed to mainstreaming High Conservation Value (HCV) assessment within their development planning procedures, and are requiring all plantation businesses to implement sustainable practices.[4]

To be successful, these measures to avoid and reduce deforestation need to be supported by both proper enforcement and economic support. Stringent measures need to be supported with economic sustainability, so that the region continues to grow and sustain itself with the limited land available. Regional economic strength that creates a sustainable livelihood for its people will be a powerful disincentive against unlawful encroachment into forested areas.

Berau and East Kalimantan are now focused on developing palm oil in a sustainable manner. As such, East Kalimantan's Crop Estate Office aims to accomplish the following objects, without issuing new plantation licenses:

- increase productivity,
- gain better visibility of the supply chain,
- strengthen independent smallholder organization, and
- strengthen the partnerships and integration between independent smallholders and plantation companies.

Increased smallholder connectivity to the supply chain, and a supply chain that maximizes value added within the region can help achieve these performance targets, while still supporting the efforts to protect forests in that region.

This paper aims to support those goals by answering the following questions:

Oil palm production

(a) What is the size of Berau's palm oil industry, and its scope of ambition?

(b) Are growers and mills in Berau operating at optimal capacity?

(c) Can Berau fulfill its palm oil production targets without expanding into forest areas?

Oil palm chain value relationships

(a) Who are the key palm oil players in Berau?

2 Lita Januarti Hakim, Head of Balances Section, Berau Statistics Center, in a quote reported by Berau News on 13 February 2017, stated that "As time passes by, the wheels of economy are being turned not by the mining sector, but by the agriculture, fisheries and forestry sectors instead. If we want to observe economic dynamics in Berau, look at these sectors." (translated)

3 East Kalimantan has issued Governor of East Kalimantan Regulation Number 1 of 2018 on the Management of Granting Licenses and Non-Licenses in the Mining, Forestry and Palm Oil Sector, which is an extension of a prior regulation Number 17 of 2015 expiring in April 2018.

4 A draft East Kalimantan Province Regulation on Development of Sustainable Agriculture has been approved by the regional parliament in December 2017 and is awaiting official promulgation.

(b) Where are they located and who are their suppliers/buyers?

(c) Are the logistics of buying and selling palm oil in Berau efficient?

Smallholders

(a) Are independent smallholders integrated into the supply chain?

(b) Are they adequately supported by organized institutions?

1.2 Approach

This study provides an overview of the palm oil supply chain in Berau, East Kalimantan. We examine land use efficiency as indicated by yield per hectare, absorption of raw material into processing factories, and their accessibility to each other. We also look at opportunities to improve productivity and efficiency, while still ensuring the sustainability of natural assets in Berau.

First, we identified the specific needs of the Crop Estate Office in order to align our study with Berau and East Kalimantan's targeted development goals. Table 1 shows some of the relevant program indicators set up by East Kalimantan's Crop Estate Office.

Table 1. Select program indicators for the East Kalimantan Crop Estate Office in 2017-2018

NO.	DIVISION	PROGRAM / ACTIVITY	TARGET / OUTCOME	INDICATOR
1	Plant cultivation	Increased plantation productivity	Palm oil, coconut, rubber, cacao, pepper	Palm oil: 18 ton/ha
2	Partnership development	Increased partnerships	Increased partnerships in plantations	Number of smallholders entering into partnerships: 20 households

Ibid.

Data collection was conducted in collaboration with Financial Access B.V. and Perkumpulan Menapak, with support and facilitation from the Crop Estate Office:

- The research team collected data specific to smallholder and company growers, mills, traders, and refineries.
- For smallholder data, the research team conducted field surveys and data verification involving 304 farmers, in nine villages, across nine sub-districts. The districts and villages were chosen for their presence of oil palm activities.
- For data on mills, the research team conducted a focus group discussion with representatives from all seven operational mills located in Berau, to obtain information on production and sales.

Defining Sustainability

This paper's approach is based on the premise that an efficient supply chain will provide support for sustainable land use. There are several caveats that underly this premise. First, this paper does not seek to define land use sustainability targets beyond what has been committed to by the government. Second, this paper does not argue that an efficient supply chain will lead to sustainable land use as a matter of causality. Rather, this paper argues that limits on land expansion set by the current sustainability targets will face pressure and criticism if not underpinned by economic sustainability.

In other words, sustainability cannot be sustained solely by limiting the land available. It must also mean that the available land is utilized to achieve optimum economic gains, and society enjoys the benefits of such land utilization. Together these form the three pillars of sustainability: planet, profit, and people.

Based on these three pillars, this paper addresses sustainability by answering these questions:

1. Given the limits on land expansion adopted by the government, how much land is available for legal expansion in Berau?
2. Given the limited area available to expand, are the current land utilization practices, particularly for oil palm, an efficient use of the land?
3. Who are the actors utilizing palm oil plantations, and are they receiving optimum benefit from it?

Analysis was conducted in four steps:

1. First, we calculated current palm oil productivity and compared it with future productivity projections to determine Berau's potential to fulfill optimal production within the limited land available.
2. Next, for supply chain visibility, we mapped out the locations of smallholders surveyed, as well as cooperatives (both plasma and independent), plantations, and mills across nine subdistricts. We connected each player with identified supply arrangements (e.g. contracts, group holdings, and interview data), and compared their relative distances from each other.
3. Then, to identify challenges to the supply chain, we zoomed in on anomalies in the supply chain map where inefficiencies are indicated, such as greater than average transport distances, or supply arrangements to an offtaker that bypasses a closer offtaker. Reasons for anomalies were then tested through interviews and focus group discussions.
4. Finally, to identify opportunities, we looked at potential solutions to the challenges faced.

1.3 Report structure

This paper provides new data and findings to support district and provincial level policy makers, as well as civil society organizations, to make more informed decisions on land use and agricultural practices. Chapter 1 provides the theoretical and methodological basis to link efficient palm oil supply chains with sustainable land use. Chapter 2 looks at palm oil production trends in Berau, and its likelihood of achieving optimal levels of production without further land expansion. Chapter 3 provides an overview of the supply chain and locations of palm oil players in Berau, and also provides a closer look at the flow of palm oil between smallholders to mills, large plantations to mills, and mills to CPO buyers. Chapter 4 discusses how some of the challenges identified can be addressed by interventions to improve the efficiency of the supply chain.

Defining Efficiency

In various sections, this paper will describe our findings on whether different parts of the palm oil supply chain in Berau is efficient. **Efficiency means, essentially, the maximum utility of available limited resources.** Different parts of this paper studies varying forms of efficiency as applicable to the relevant conditions in Berau.

Chapter 2 looks at the relative efficiency of land use in producing FFBs. Here efficiency refers to: a) the level of mills' utilized capacity relative to the current and future supply of FFBs; and (b) whether production targets can be achieved with minimum land expansion, and by maximizing production potential of existing trees.

Chapter 3 explores the relative efficiency of the palm oil supply chain in Berau. Here, efficiency refers to the ability of growers to find buyer(s) without incurring large transaction costs (e.g. transportation costs). This is important as the value of FFB exponentially depreciates relative to time (typically FFB is best processed within/lose significant value after 2 days of harvest).

Chapter 3 also discusses how the inefficiencies found, particularly with regard to smallholders, may be negatively impacted by choice of business model, level of integration to the supply chain, and access to finance.

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2. An Overview of the Palm Oil Supply Chain in Berau

2.1 Oil palm in Berau: productive, with gaps

Oil palm plantations in Berau, accounting for 120,000 ha in 2016, constitutes approximately 1% and 10% of total oil palm planted area in Indonesia and East Kalimantan, respectively. In terms of production, Berau produces 11% of the Fresh Fruit Bunches (FFB) in East Kalimantan, equivalent to 1.2 million tons (Disbun Kaltim 2017, BPS 2016) (see Figure 1).

Large plantation companies are the main actors in Berau's oil palm sector , operating 74% of total planted area, and producing 88% of FFB in 2016 (Disbun Kaltim, 2017). The majority of these companies are consolidated into four main plantation holding companies.[5]

Among smallholders, we estimate that about half of their plantation area is organized under a plasma-nucleus business scheme, while the other half is operated independently (Disbun Berau, 2016) (see Figure 2).

In terms of productivity, smallholders consistently underperformed when compared to large-scale plantation companies - over the past five years, the productivity gap varied between 3 tons per ha and 9 tons per ha (see Figure 3). Such a productivity gap is typical in the oil palm sector in Indonesia, as smallholders tend to underinvest in sustainable agricultural practices (IFC, 2013). A more detailed analysis on factors affecting smallholders' underperformance are discussed in Chapter 3.

Oil palm growers in Berau rely on seven palm oil mills located in six sub-districts to purchase and process their FFB. These mills operate at a total capacity of 480 FFB ton per hour, and are located in six sub-districts: Batu Putih, Biatan, Gunung Tabur, Kelay, Segah, and Talisayan (Menapak 2017).[6] These mills are also owned by the four plantation holding groups, producing about 240,000 tons of CPO in 2016.[7]

2.2 Oil palm in Berau is increasing at a high rate, but land is already limited

The development of the palm oil sector in Berau only started in 2010, yet it has already seen remarkable growth. The amount of oil palm planted in the area has almost tripled in the past eight years, from 42,000 ha in 2010 to 120,000 ha in 2016, while FFB production

Figure 1. Amount of oil palm plantation area in East Kalimantan vs. other provinces vs. other districts

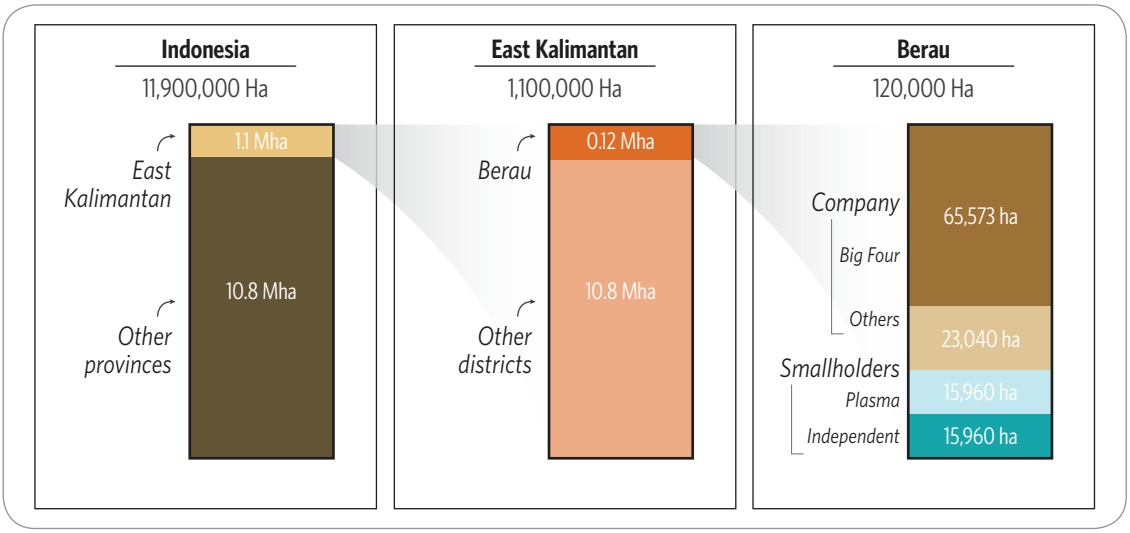
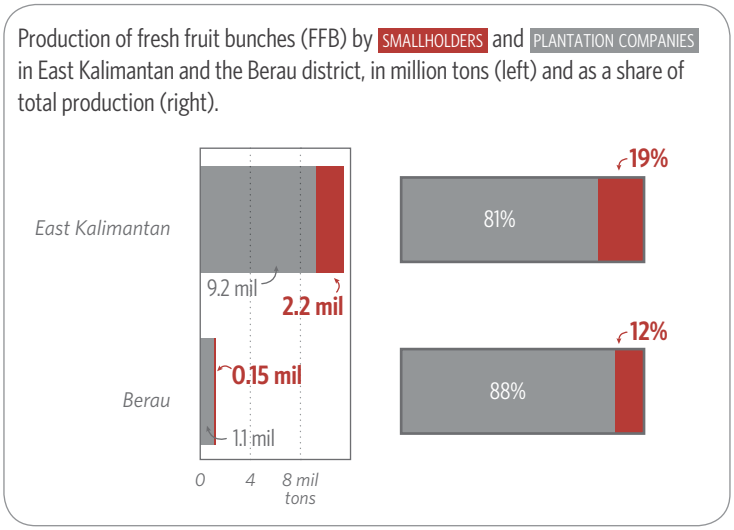


Figure 2. Amount of oil palm smallholders in comparison with company-owned FFB production in Berau and East Kalimantan



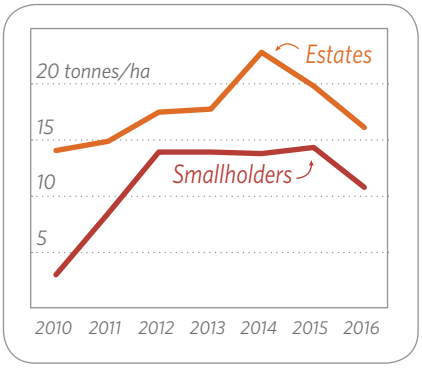
5 These plantation holding companies include: Indofood, Triputra, Kuala Lumpur Kepong and Teladan Prima.

6 The number of operating mills and their location are based on 2016 data. One additional mill began operation in 2017, located in Derawan Sub-district.

7 The calculation assumes that the mills only source their FFB within Berau.

has increased by almost five times during the same period, from 250,000 tons to 1.2 million tons (Dinas Perkebunan Berau, 2017). The producing oil palm trees in Berau are relatively young—our estimation shows that approximately 77% of producing trees in 2016 are seven years old or younger. [8] Typically, oil palm trees hit their peak production between 7-14 years after planting (IFC, 2013). This means FFB production from the existing, producing trees is set to increase even further over the next five to ten years as they enter their "peak age." In addition to this, production will also come from the trees that are currently still under development and have yet to reach production age, as well as from future tree replanting.

Figure 3. Gap of productivity level between smallholders and plantation companies



As illustrated in Figure 4, if the oil palm sector continues to grow at the current trajectory, we estimate that oil palm plantation area in Berau can double in size by 2025, reaching 240,000 ha. However, policy measures are already in place to limit such expansion.

Some of these policies include:

(a) East Kalimantan and its districts, including Berau, signed a commitment on September 11, 2017 to preserve 640,000 hectares of natural forest and 50,000 hectares of peat forest located within a concession up to 2030.

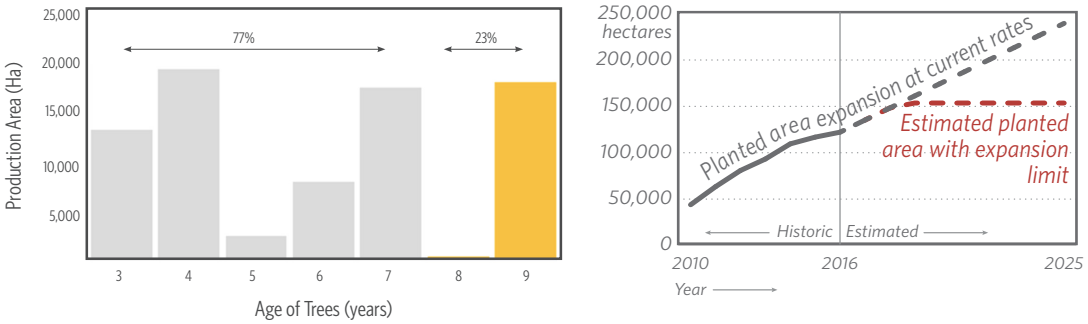
(b) East Kalimantan has enacted a moratorium on new plantation licenses from 2015 to 2017. The latest "Governor Regulation No. 1/2018 on Plantation Licensing Procedures" is more stringent and contains a requirement for plantation owners to commit to safeguarding high conservation value areas within their concessions.

Of the total licensed area owned by company plantations, only approximately 41% have been planted on (Berau Dalam Angka, 2016), leaving 36,000 ha for expansion. If high conservation value land is truly safeguarded, Berau is only left with 33,000 ha of concession land available for oil palm development in Berau.[9]

We expect that this remaining concession land will be fully developed in only a few years. This means, from that point onward, the government will not be able to rely on oil palm expansion to grow the economy, and will need to devise a non-expansionary strategy for the oil palm sector.

This situation shows competing trends. On one hand, oil palm production is increasing rapidly, such that the palm oil sector has become an increasingly dominant part of Berau's economy. On the other hand, available land is diminishing fast. If not managed and strategized carefully, one of them will bear the impact. Either the oil palm-based economy will suffer from limited growth, or the push to maintain oil palm growth will strain the existing limitations on land use. Ensuring efficient productivity across the oil palm supply chain will be key to supporting Berau's sustainability goals.

Figure 4. Profile of oil palm trees in Berau and oil palm growth trajectory



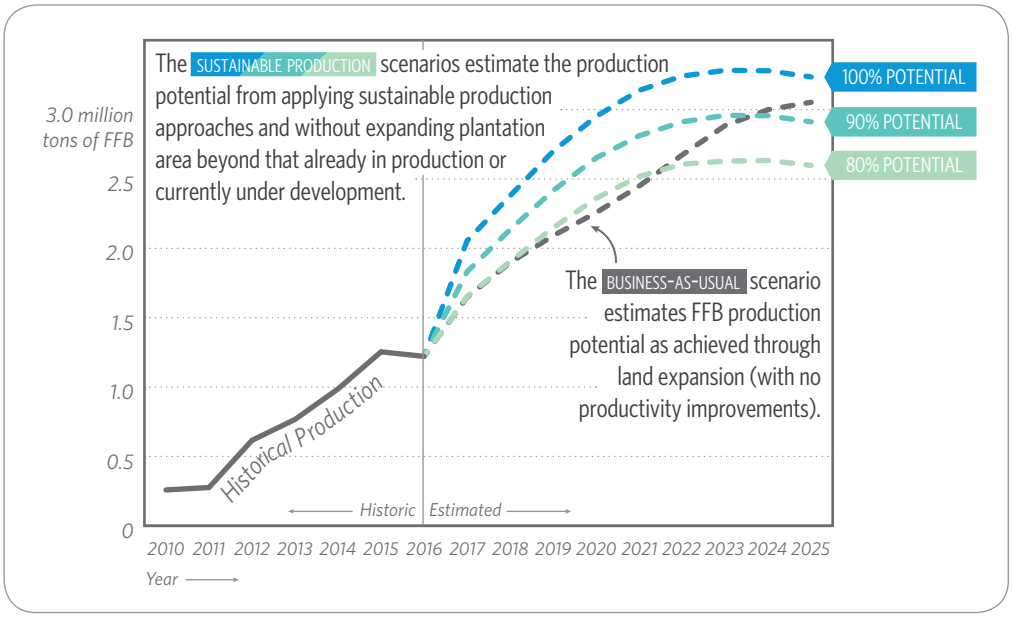
8 The estimated age distribution of oil palm trees is based on CPI analysis utilizing publicly available data from Badan Pusat Statistik and Dinas Perkebunan Berau dan Kalimantan Timur.

9 East Kalimantan Spatial and Land Use Plans 2017; East Kalimantan Land Coverage 2017.

2.3 Berau can reach projected FFB production with minimal land expansion

One of the key factors to achieve Berau's sustainability goals is to encourage higher land productivity and land intensification in terms of yield per hectare. This is particularly true for the oil palm sector because of the vast area of land required to cultivate oil palm plantation, as well as the significantly high rate of land expansion, causing large scale deforestation over the past decade.

Figure 5. Estimate of avoided deforestation through productivity improvement



Sources: IFC 2013, PILAR 2015, CPI analysis

Our analysis indicates that focusing on, and encouraging, higher land productivity not only provides more environmental benefits, but also provides economic benefits similar to those achieved by land expansion. For this paper, the research team measured the estimated level of avoided deforestation that can be achieved if more effort is put into improving the productivity of existing oil palm trees, as opposed to increasing production through further land expansion. We find that it can be done without jeopardizing the large economic benefits offered by oil palm expansion (see Figure 5).

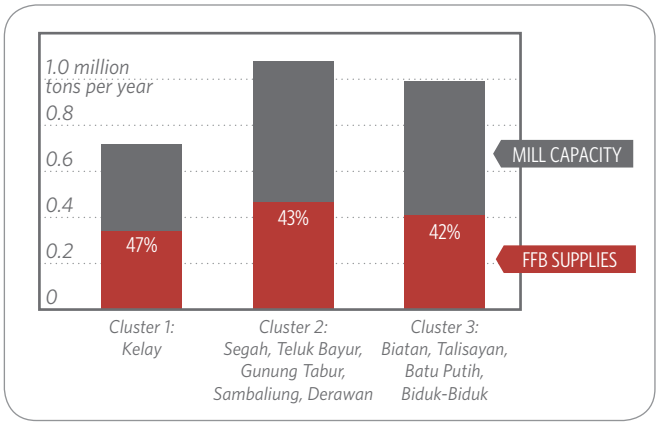
First, we estimated the FFB production potential of currently producing trees in Berau under two scenarios: the sustainable production scenario and the business-as-usual scenario.

The business-as-usual scenario estimates FFB production potential as achieved through land expansion.[10] The sustainable production scenario measures the oil palm trees' optimal production potential by applying sustainable production approach (IFC, 2013) and without expanding plantation area beyond what has already entered into production age and is currently under development.[11] The production potential is estimated by taking into account the different production potentials of oil palm plantation according to the types of growers, age of trees, type of seedlings, and other inputs. We start from the most optimal condition, whereby 100% production potential can be reached. We then lessen the potential by degrees of percentage down to 90% potential, 80% potential, and so on.

Through this method, we find that Berau can achieve higher production by 2023 if it deployed just 90% optimum implementation of the sustainable production approach. On the other hand, under the business-as-usual scenario, production would still fall short of 100% optimum levels over the projected years.

Our analysis suggests that there are significant opportunities to increase FFB production in Berau by improving the level of productivity of existing trees. Depending on the level of improvement, we project that the

Figure 6. FFB supplies and mills processing capacity in three clusters of sub-districts in Berau



10 The projected planted area is capped at 153,000 ha, assuming existing policies to limit oil palm expansion will be implemented (there is only an additional of 33,000 ha of available land allocated for oil palm).

11 Under the sustainable production scenario, planted area is capped at 120,000 ha as per 2016.

sustainable production approach is consistently capable of achieving higher productivity than the business-as-usual approach.

At 80% production potential, the sustainable approach yields slightly more FFB than the business-as-usual approach each year until 2020. At 90% production potential, the sustainable approach yields more FFB than business-as-usual each year until 2023. At 100% production potential, Berau can consistently achieve significantly higher FFB production than business-as-usual scenario throughout the projected years. This analysis is particularly relevant to ongoing discussions, both at the district and provincial levels, around managing high conservation value areas located within agricultural concessions. To the extent there is a mechanism to legally avoid land expansion within existing concessions, our analysis supports such avoidance by arguing that it would not be a detriment to palm oil productivity.

2.4 Mills are anticipating further oil palm plantation expansion and positioning themselves efficiently across the supply chain

As of the end of 2016, there were seven operational mills, located in six sub-districts—Batu Putih, Biatan, Gunung Tabur, Kelay, Segah and Talisayan. These mills have a combined FFB processing capacity of 465 ton per hour, or equivalent to 2.8 million ton per year, capable of producing 560,000 ton of CPO per year.[12] When compared to the total FFB production in Berau in 2016, the estimated average utilization capacity of all mills in Berau is currently only 44%.[13]

In general, plantations are clustered around mills in a geographical concentration. We compared the mills' combined processing capacity against FFB supplies produced from the same locations, and we found that, on average, mills are still operating below 50% of their capacity. Figure 6 illustrates the comparison between FFB supply and mill capacity in the same geographical clusters within Berau.

Mills are clustered according to their geographical location based on the study team's analysis of FFB supply from inter sub-district plantations to mills. See Chapter 3 for more detail. This suggests that mills are not yet operating at their optimal capacity, or may be expecting FFB production to increase significantly in the coming years as existing trees will be entering their peak production and new trees (currently under development) will also start producing.

In theory, there is plenty of capacity to process all FFBs produced in Berau, and growers should not find significant challenges to find a buyer, even in the months when trees reach peak production. As an illustration, assuming a productivity level of 15 ton per year,[14] the mills are able to absorb FFB production from a total of 180,000 ha of plantation area. That is 100,000 ha more than the existing plantation area which are already producing—as per 2016, there is only 80,000 ha of plantations already producing (Dinas Perkebunan Berau, 2017).

This condition seems to, at least theoretically, put growers in a better negotiating position against the mills, as the mills are not in a position to reject FFB supplies in order to increase their processing capacity. In practice, there will be complications that may impede growers from selling to certain mills, as will be explained in the next Chapter.

Similarly, if growers intend to seek better bargains at other mills, the cost of switching for growers would not be cheap. Selling to an alternative mill may require traveling great distances (e.g., to another sub-district) and inevitably incur additional costs. The mill being in close proximity to the growers' plantation location is essential, as FFB will lose significant value if not processed within two days after harvest.

Despite the low capacity utilization, the mills are positioned relatively efficiently along the oil palm supply chain in Berau. The mills are present in areas where FFB production is high, while the mills with the largest capacity operate in the sub-districts which produce the highest volume of FFB.

The mills' sub-optimal capacity utilization and the lack of competition in a particular sub-district presents an interesting opportunity for smallholders. The mills are in need of more FFB, and smallholders can fill that gap. Theoretically, this presents smallholders with a high bargaining position to the mills, yet in practice, manifesting such a position often becomes difficult because the conditions of efficient supply from smallholder to mill is not yet there.

In fact, early indications suggest that the current set-up of supply chains may have an impact on prices, as evidenced by the very large price discrepancies that

12 The mills are assumed to operate effectively for 20 hours per day, 25 days per month and 12 months per year, and CPO yield of 0.2.

13 The estimate does not take into account possible FFB supplies from locations outside of Berau.

14 in 2016, the productivity of oil palm plantation in Berau reach 15.2 FFB ton per year (Dinas Perkebunan Berau, 2017).

farmers receive—according to our surveys, smallholder FFB prices ranged from as low as IDR 400 to IDR 1,500 per ton FFB.

Therefore, while large scale plantations are arranged quite efficiently around mills, and mills are well positioned to benefit from increasing supply, it is more difficult to gauge whether this situation will also benefit smallholders. The following chapter will describe the supply chain in more detail to better understand the relationship between supply chain efficiency and smallholders, particularly in the presence of other stakeholders, such as middlemen and traders.

3. Mapping the Supply Chain

3.1 Palm oil players in Berau are spread out evenly across the region, but lack refineries

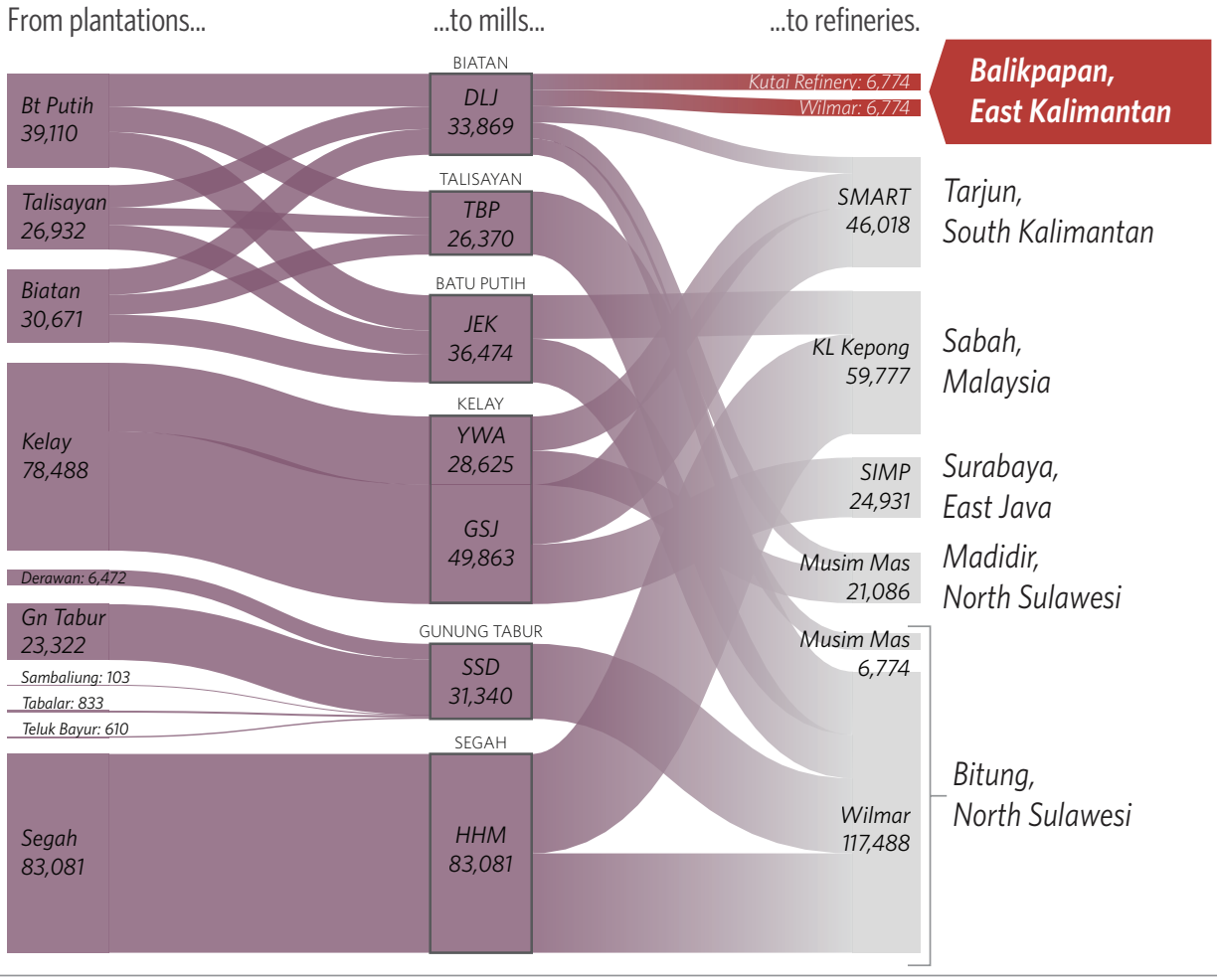
This chapter maps, for the first time, the flow of palm oil products in Berau, from the plantation to the refinery. Of the 12 sub-districts in Berau, 10 sub-districts have planted palm oil. The largest supply of FFB comes from Kelay and Segah, comprising 56% of total production in the north west of Berau. These two sub-districts also have the largest land area of all the sub-districts.

The mills in Berau are spread out in six sub-districts, and the sub-district of Kelay has two mills. One more mill is currently under development in the sub-district of Derawan Island. The mills producing the most CPO are operating in Kelay and Segah. Mills in Talisayan, Batu Putih, Biatan, and Gunung Tabur receive additional supply from the neighboring districts of Berau, such as Kutai Timur.

There are no palm oil refineries in Berau. As a result, CPO from Berau is sent to refineries in Balikpapan City of East Kalimantan, other Indonesian provinces including South Kalimantan, North Sulawesi, and East Java, and also to Sabah in neighboring country Malaysia. Refineries in Balikpapan are the closest together, however, our findings indicate that only a small portion of Berau CPO goes to Balikpapan (see Figure 7).

Figure 7. Flow of palm oil products from plantations in Berau's sub-districts to the refineries

Without refineries, virtually all oil palm products produced in Berau (colored purple) are exported out of East Kalimantan to other provinces, and even Malaysia. Only a small volume of CPO (colored red) is ultimately refined in the same province in Balikpapan, East Kalimantan.



*Units are in tons CPO or CPO equivalent. Estimated numbers were processed from various public sources.

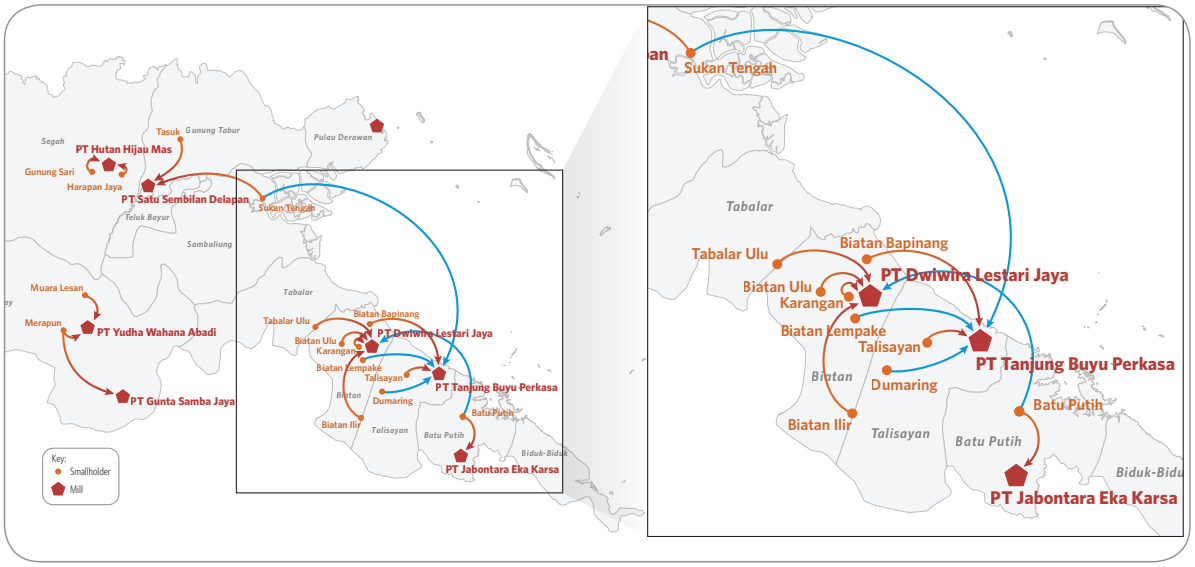
Box 1. Operational barriers are limiting smallholders' efficiency

Our analysis finds that several independent smallholders are not supplying FFB to their closest available mill, as they cannot meet certain standards imposed by that mill. As shown in Figure 8, there are at least three villages in the south-eastern part of Berau that supply FFB **only** to mills further away from them (greater than the average distance of 30km), despite there being a closer mill available. The three villages, Biatan Bapinang, Biatan Lempake, and Dumaring, only supply to PT. Tanjung Buyu Perkasa which is between 40-70 km away from the villages, instead of PT. Dwiwira Lestari Jaya, which is between 8-20 km distance range from the mill.

Additionally, there are two villages that supply FFB **both** to the closest mill and to mills further away, Batu Putih and Sukan Tengah. Batu Putih smallholders supply to the nearest mill of PT. Jabontara Eka Karsa, which is located within the sub-district, and to PT. Dwiwira Lestari Jaya mill, which is two sub-districts away, with an approximate distance of 75 km. Sukan Tengah has the longest FFB supply route we encountered in Berau, supplying to PT. Dwiwira Lestari Jaya, which is three sub-districts away and an approximate distance of 137 km.

In some cases, the cooperative has an agreement with the mill further away, but does not have an agreement with the closest mill. In the villages of Biatan Lempake and Dumaring, the cooperative in their respective villages has an agreement with PT Tanjung Buyung Perkasa mill, but does not have an agreement with PT Dwiwira Lestari Jaya mill, which is actually closer.

Figure 8. Flow of smallholder-produced FFB to mills



The blue lines represent the transport of FFB from smallholders to a mill that is further than the closest.

Anecdotes suggest that it is common to see a bunch of abandoned FFBs belonging to smallholders' in the streets of the villages. These FFBs are being offered at a very low price to the passing trucks belonging to middlemen, and left to rot when there are no buyers. Smallholders' struggle to sell FFB leads to income uncertainty.

Transportation distance is a significant factor in smallholder productivity and earnings, because FFB quality deteriorates within two days after harvesting, and transportation costs will also increase as the transportation distance increases.

The smallholder supply map in Figure 8 shows that the supply route of several smallholders is inefficient. Under optimal market conditions, business actors would opt for the most efficient and cost-effective method of selling to a buyer. These findings indicate that there are challenges preventing the smallholders from acting efficiently.

3.2 Smallholders face significant challenges preventing them from operating efficiently along the supply chain

Through interviews with farmers and companies, we have collected anecdotal evidence that describes the many challenges faced by smallholders. As Figure 9 shows, challenges occur throughout the supply chain, which, in turn, prevent farmers from operating efficiently.

Smallholders lack of land certificates and cooperatives hampers their access to financing

Our research indicates that only 28% of independent smallholders own a land ownership certificate (*Sertifikat Hak Milik or SHM*). The majority of smallholders that do not own a land ownership certificate find it hard to obtain formal credit from conventional financial institutions, which, in turn, hampers their ability to purchase quality seedlings, inputs, equipment, and trucks for installment.

This problem is worsened when there is no available cooperative or smallholder organization in the area that can facilitate loans for smallholders. Some villages do not have an active cooperative, as is the case in Sambaliung and Tabalar. In fact, 46% of independent smallholders that we surveyed report they are not part of any cooperative.

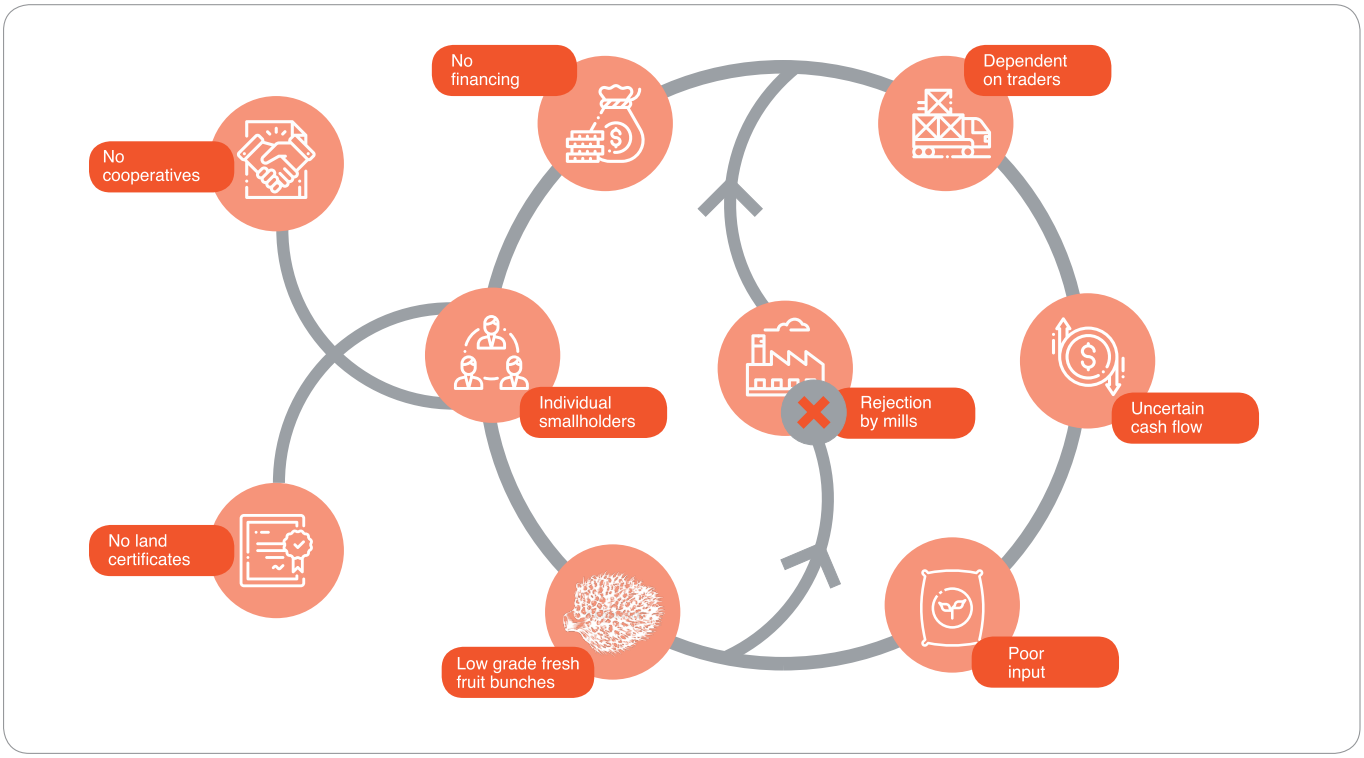
The lack of a cooperative is particularly problematic because banks are more likely to lend to organized smallholders than to independent ones due to lower transaction costs and the ability to manage risks (PILAR, 2016). Pooling collective interest in a cooperative, therefore, becomes key to gain access to finance.

Although there are other options to access finance through informal channels (which do not always require collateral), such as microfinance institutions or credit unions, they do not always satisfy farmers' financial needs. For example, replanting may require investments of up to IDR 50 million per ha (Daemeter, 2016). Accessing finance of this size may not be available through these channels. In addition, the terms of finance can be burdensome for farmers, since a loan from these institutions typically charge significantly higher interest rates and do not offer long-term tenor.

Smallholders lack of financing hampers their access to quality input, maintenance, and harvesting

Of the smallholders surveyed, 38% said that the lack of capital is the most significant barrier to planting and harvesting.

Figure 9. Various factors causing inefficient supply of FFB from smallholders to mills, through to traders



This barrier to planting occurs because some smallholders either cannot afford or do not have the knowledge to purchase certified seedlings. This affects the quality and grading of the FFB, which, in turn, lowers the price it fetches on the market. FFB from uncertified seedlings can get discounted by up to 20%, and mills may also reject FFB that does not meet their quality criteria including FFB from uncertified seedlings.

The lack of capital presents a barrier to maintenance as well. Based on surveys, pests are also a major problem in oil palm plantation. Farmers need proper tools, fertilizer, as well as skilled workers to combat pests and other problems, such as fire. If farmers are unable to deal with these risks effectively, the quality of the FFB they produce will also suffer.

Uncertain payment terms hurt smallholders' cash flows

Farmers have also expressed, in surveys, that delayed payment when selling to traders or cooperatives is a problem during harvest, given the informal nature of relationships between farmers and traders, there is a lack of certainty regarding the terms of payment. The preferred method of payment is cash on hand directly after sales, but traders and cooperatives will often delay payment, mirroring the monthly payment schedule of mills. If farmers had sufficient working capital, delayed payments would not be a problem. But when farmers rely on immediate payments to continue maintenance of the other non-harvested crops, delayed payments will negatively impact the quality of crops.

Smallholders lacking a cooperative and producing low-quality FFB face the risk of rejection by their nearest mills

Mills tend to give a higher preference to cooperatives and a group of smallholders (represented by traders) than to individual smallholders in securing a supply contract. This preference is given, not only to reduce transaction costs, but also to minimize various risks related to supply quantity and quality. The middlemen may act as a supply guarantor to the mills.

Anecdotal evidence collected from surveys suggests that having a reputation as an influential person with the ability to impose a level of control on smallholders will make it easier to gain a supply contract. When smallholders are not part of a cooperative, their next best option is to sell their FFB to a trader, on terms and prices that are less certain.

However, being organized into a cooperative in and of itself does not guarantee the ability to sell to the closest mill. Different mills may have different standards of FFB quality, and it is important that smallholders and cooperatives in the surrounding area are attuned to the applicable standards. The problem is that smallholders are often not given the necessary technical assistance, and find later on that the closest mill either buys their FFB at a low price, or rejects their FFB altogether.

The problem is exacerbated when a mill is certified, or in the process of certification, with RSPO, as certified mills apply a more stringent requirement. The mill of PT. Hutan Hijau Mas is currently in the process of obtaining RSPO certification, and is already starting to become more selective about its supply source. Once mills are RSPO certified, the entire supply chain will need to be certified, and all sources will need to follow the same stringent quality standards. Suppliers that do not meet this requirement, whether smallholder, trader, or cooperative, will need to sell to a mill further away.

In summary, smallholders face several challenges that hamper their ability to operate in an efficient manner. First, their lack of land certificates and lack of support from nearby cooperatives hampers their access to financing. Second, their lack of financing hampers their access to quality input such as seedlings and fertilizers, and hampers their ability maintain and harvest their crops well. Third, when smallholders are not organized into a cooperative, and produce low-quality FFB, they face the risk of rejection by the nearest mills.

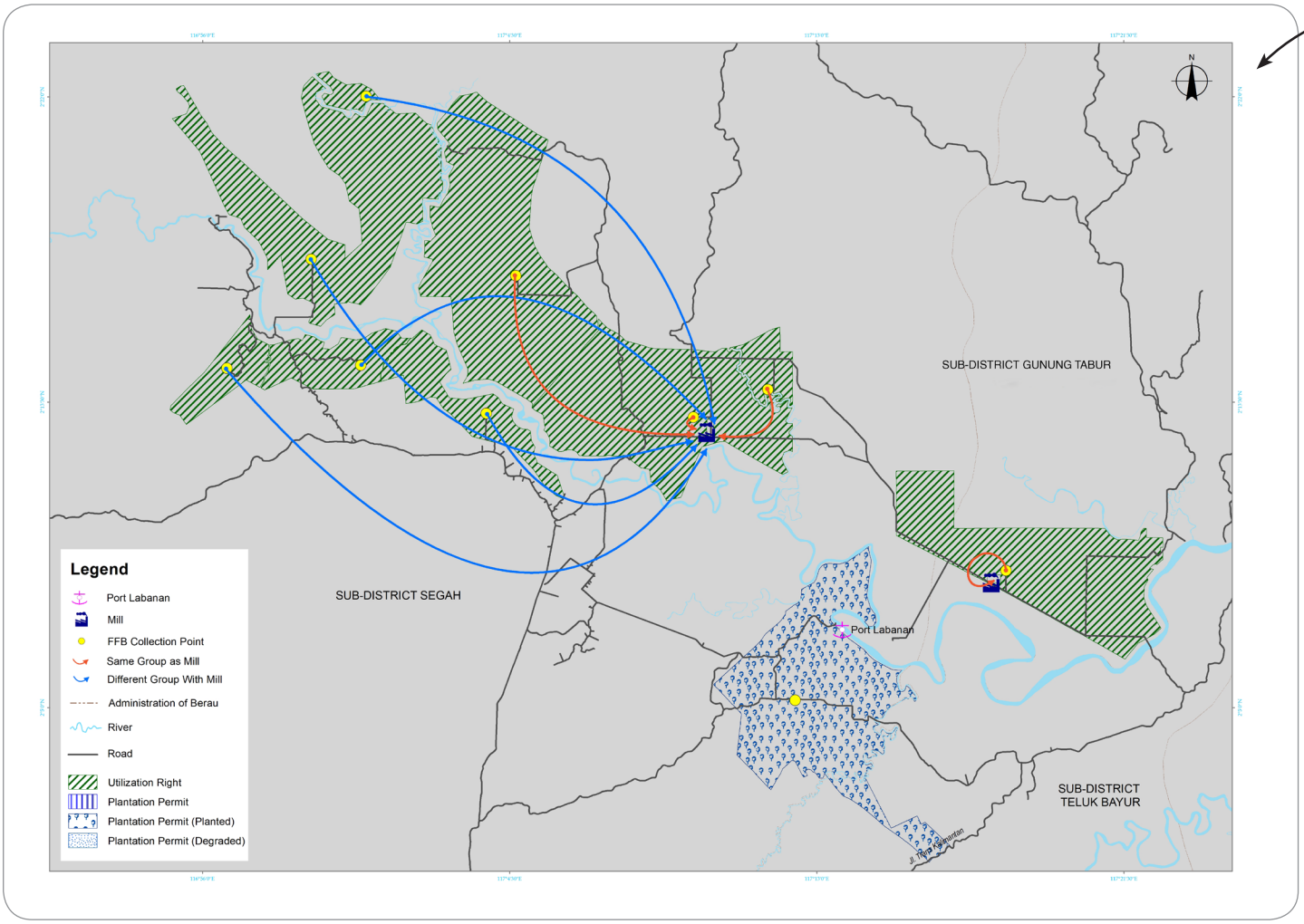
3.3 Company mills have a more efficient transportation route

Transportation is efficient from company plantations to mills. From our field research, we found that company plantations in Berau are typically integrated into their own -mills, built in a location close to the plantation. The map suggests that company-run plantations have efficiently arranged their supply contracts so as to connect to the closest available buyer.

This is not surprising given that many plantation companies in Berau are part of the same holding group that owns the mills which they supply to. The integrated nature of company-run plantation and mill businesses are a significant factor in determining a higher level of logistical efficiency.

However, the map in Figure 10 shows the same level of efficiency for plantation companies whose business is not integrated with a mill, suggesting that integration is not the only way to ensure supply chain efficiency, and that business partnerships between non-affiliated parties are equally important. The fact that supply arrangements can be done to an efficient degree between independent companies and mills, suggests that the same can be done between independent smallholders and mills.

Figure 10. Flow of company-produced FFB to mills



The blue lines represent the transport of FFB from company plantations that are not group-affiliated to the destination mill.

3.4 Crude palm oil leaves Berau raw, without adding value to the region

CPO from Berau mills are sent to eight refineries across Indonesia and Malaysia, the closest of which are located in Balikpapan within the East Kalimantan province.

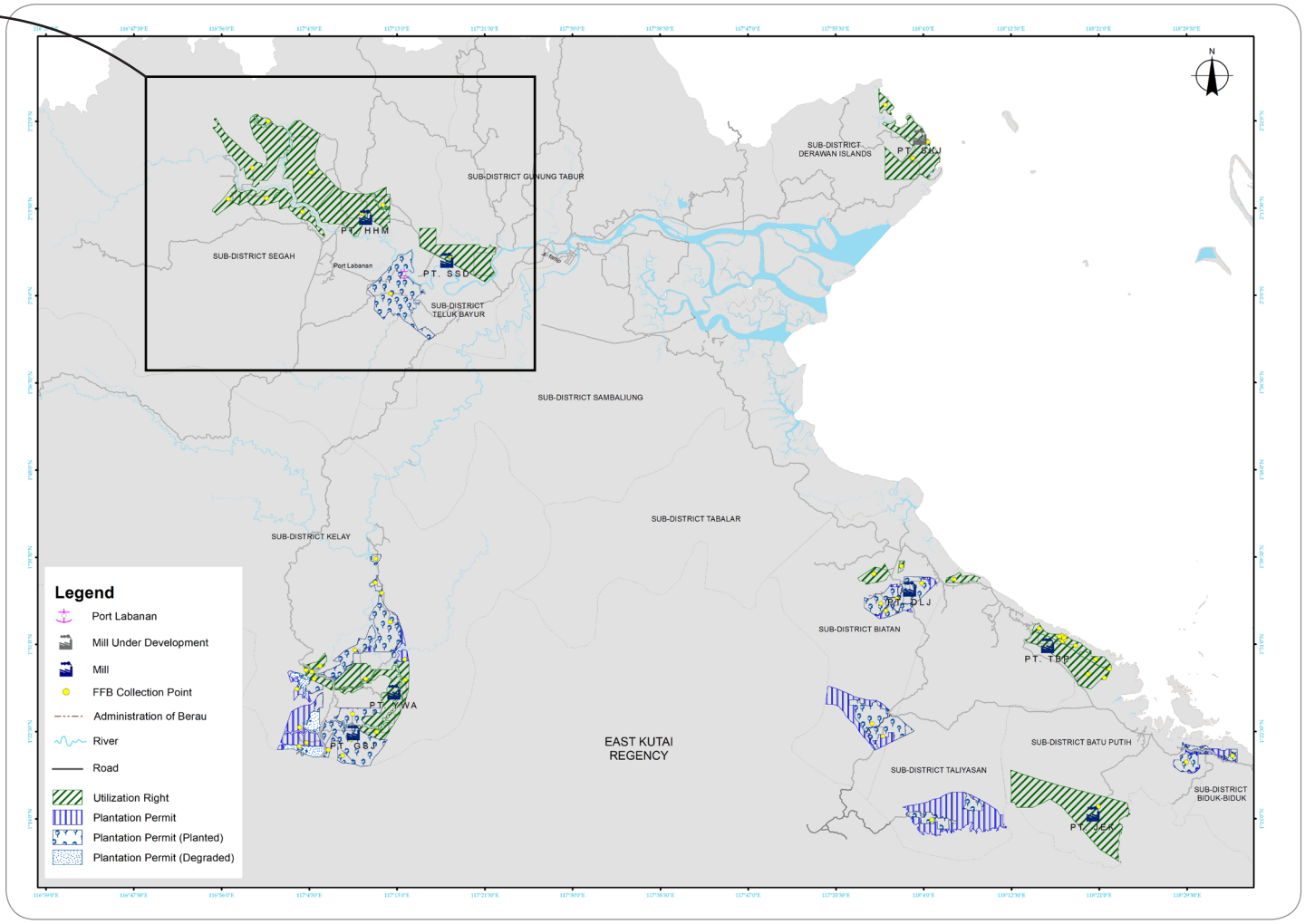
There are three refineries in Balikpapan (PT. Kutai Refinery Nusantara, PT. Dermaga Kencana Indonesia, and PT. Wilmar Nabati Indonesia). Despite the existence of three refineries in East Kalimantan, Berau only supplies CPO to two of them, PT Kutai Refinery Nusantara and PT Wilmar Nabati Indonesia.

Berau mills supply six other refineries:

1. PT. SMART in Tarjun, South Kalimantan;
2. PT. Salim Ivomas Pratama Tbk (SIMP) in Surabaya, East Java;
3. PT. Agro Makmur Raya (Musim Mas Group) in Bitung, North Sulawesi;
4. PT. Agro Makmur Raya (Musim Mas Group) in Madidir, North Sulawesi;
5. PT. Wilmar Nabati Indonesia in Bitung, North Sulawesi; and
6. Kuala Lumpur Kepong Berhad (KLK) in Sabah, Malaysia.

In the absence of a CPO refinery in Berau, since 2009, the Labanan Port has been acting as a depo, or a terminal, for CPO before being transported to offtakers. Labanan Port, in the Labanan village, is strategically located in the Teluk Bayur sub-district on the Segah River riverbank that leads out to the sea on Makassar Strait. The Labanan Port is strategically placed for access by the sub-districts of Kelay, Segah, Teluk Bayur, Derawan, as well as neighboring district Kutai Timur.

There have been talks to upgrade the Labanan Port into a refinery, given that it is already being treated as a temporary storage location by mills. Labanan Port has installed tanks with a capacity of approximately 20

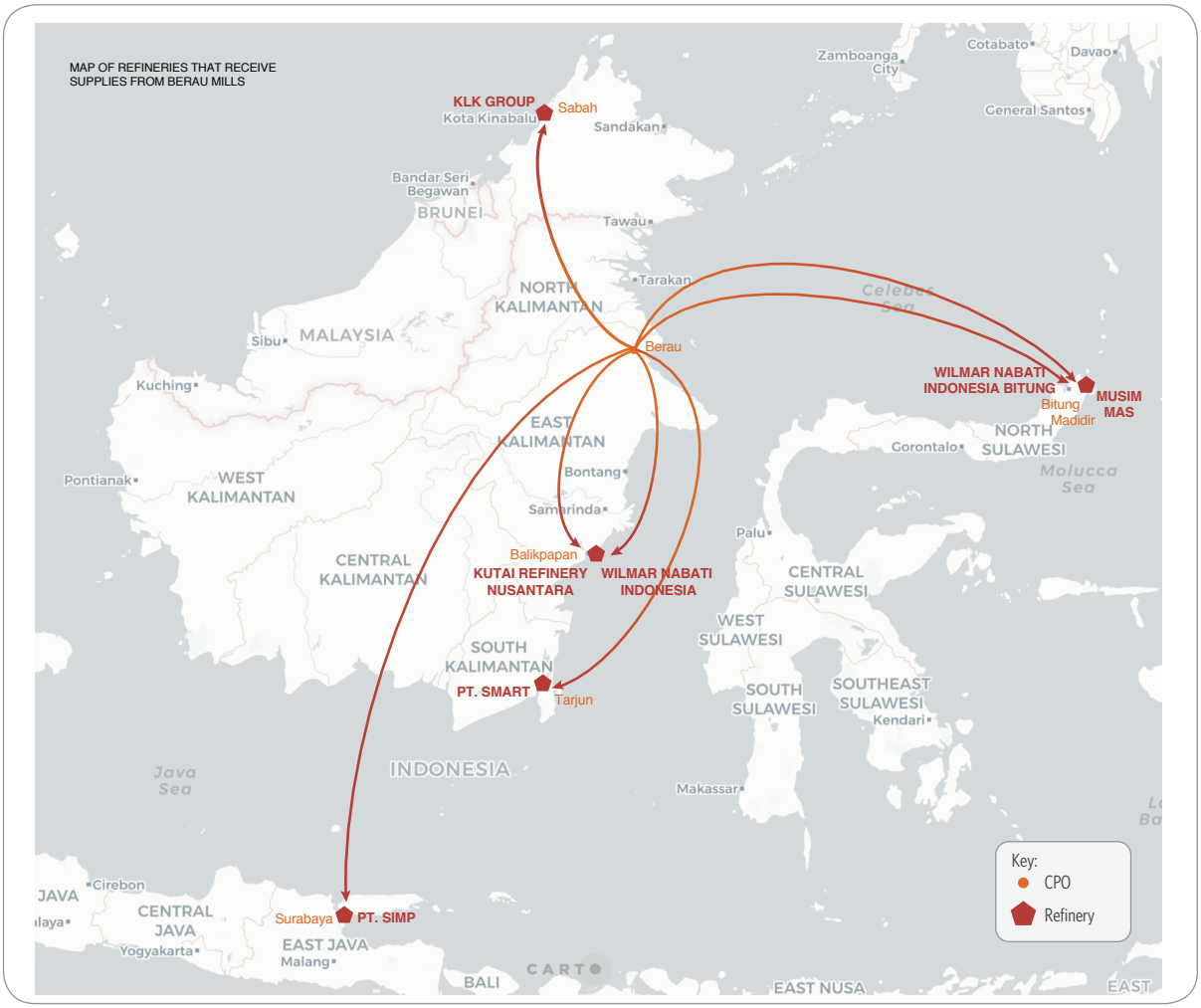


thousand tons of CPO. CPO is transported by truck from the mill to the depo, and from the depo it is then transported by boat on the Segah river. However, very little is known regarding which mills store their CPO at the Labanan Port depo, and where the CPO goes from there. None of the mills interviewed in this study mentioned Labanan as an intermediate port of storage.

Apart from the Labanan Port, the government also has plans to build a palm oil refinery in Berau as a part of the Palm Oil Green Economic Zone (POGEZ) development plan in Tanjung Redeb. POGEZ is also in the process of being established in Dumai and Sei Mangkei in Sumatra in partnership the with Malaysian government through the Council of Palm Oil Producing Countries (CPOPC).

Further study is needed to analyze why other refineries in East Kalimantan are not getting their CPO supply from Berau, and to analyze the challenges hampering Berau's plans to build a refinery within the district.

Figure 11. Flow of CPO produced in Berau to Refineries



4. Conclusion: Significant opportunities exist to optimize land use and benefit the supply chain

This study has looked at the characteristics of oil palm production in Berau including the size of its industry, the capacity and projected growth of growers and mills, and likelihood of future production. We have also looked at the oil palm value chain, identifying the key palm oil players in Berau, their locations, and the supply relationships between growers to mills. The study also took a close look at smallholders to see whether they are fully integrated into the supply chain, and identifies the challenges hampering smallholders from achieving the same level of supply chain efficiency as company plantations. Based on these findings, we have identified several opportunities to optimize the limited land available in ways that will benefit the palm oil players along the supply chain.

By focusing on improving the quality of yield through a sustainable production scenario, and comparing it with best practice benchmarks, we find that Berau has the potential to produce more yield than if it were to solely focus on expansion.

1. With targeted efforts to meet at least 90% of production potential, Berau can fulfill optimal palm oil production without expanding into forest areas.

Palm oil yield per ha in Berau is still lower than the national best practice, and mills are operating under capacity. Productivity is currently below 17 tons per ha, whereas national best practice is at 22 tons per ha for the same crop age range. Mills in Berau have a combined total processing capacity of 2.8 milllion tons of FFB per year, but are currently operating at 44% capacity.

Based on our analysis, Berau is producing oil palm at below its potential levels due to several reasons, including:

- plants are between four to nine years old, whereas peak productivity starts after seven years;
- only approximately 41% of the total licensed area owned by company plantations have been planted on; and
- challenges impeding the productivity of smallholders.

There are two ways in which production will undoubtedly increase. First, production will improve as crops age and reach peak production. Second, production will increase when new acres of licensed land are planted on.

Our calculations estimate that with better agricultural practices focusing on improving yield, at just 90% optimum productivity, Berau could be producing more than 2.8 million tons of FFB per year by 2021, an amount sufficient to meet 100% of total mill input needs. This implies that the existing concessions are sufficient to fulfill Berau's production needs.

Moreover, Berau only has 33,000 hectares of low conservation value palm oil concession areas left still unplanted. There is a push to preserve not only the forests lying outside of concession areas, but also forests still existing inside concession areas. These efforts are manifested in Berau government policies and commitments, and there are also discussions around management of high conservation value areas within concessions (Pollard et.al., 2005), land swaps, and compensation schemes.[15]

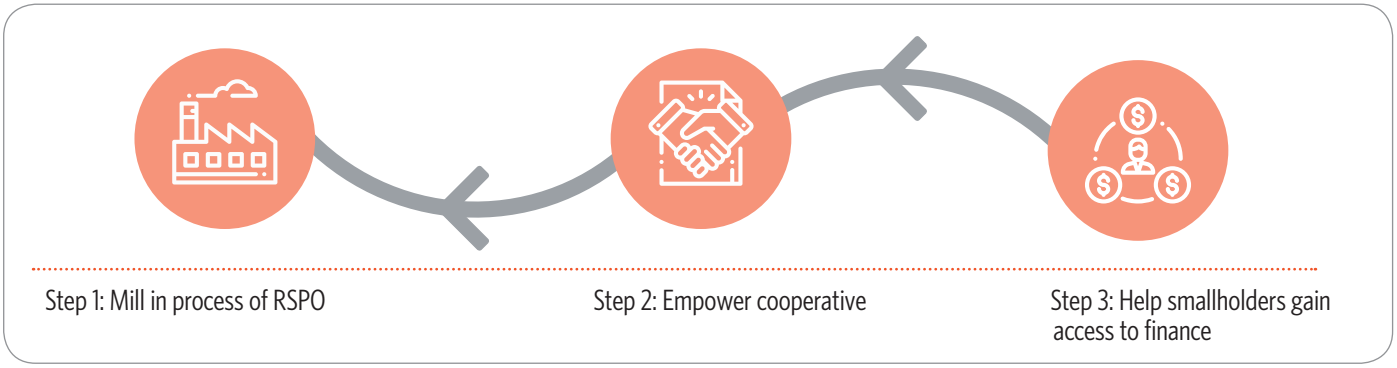
Given this conclusion, policymakers can focus on identifying strategies for Berau to reach optimal levels of production through improving yield quality.

2. Supporting partnerships between smallholders and company mills will pave the way to better supply chain efficiency

The East Kalimantan Province Crop Estate Office has set a target for 20 smallholders to enter into new partnerships with company plantations and mills by 2018, a target likely to be replicated each subsequent year. Our analysis provides support for this target, and a method to identify priority smallholders that would stand to gain the most from a partnership with companies.

15 For example, the Roundtable for Sustainable Palm Oil (RSPO) has created the RSPO Remediation and Compensation Procedure Related to Land Clearance to provide members with the option of remediating or compensating for land clearance in the absence of HCV assessment.

Figure 12. Improving supply efficiency of smallholder-produced FFB to the mill in three steps



While several intervention points can be used to improve efficiency, this paper lays the groundwork for one possible intervention scenario based on three steps. This intervention scenario envisions a program whereby partnerships are formed with financial institutions, leading to increased access to finance for smallholders. Financing will be utilized to improve input (including knowledge training, seedlings, fertilizer, and operational needs) in line with a sustainable production approach. Improved input will lead to better output and optimal productivity, enabling the smallholder to obtain supply contracts (via cooperative or BUMDes) with nearby mills.

With this intervention scenario in mind, we recommend the following three steps to prioritize which actors should assist in developing partnerships:

Step One: Select mills that are in the process of gaining RSPO certification

In Berau, there are currently three mills that have either obtained or are undergoing RSPO certification.[16] There is an added advantage, as well as an added complexity, to working with mills interested in, or in the middle of gaining, certification, because they will have to comply with higher standards for FFB quality and FFB sourcing, which will need to be mirrored during the supply chain to the smallholder level.

In fact, our analysis has found that sustainability certifications by themselves, when not accompanied with a smallholder empowerment program, may lead to alienation and negative consequences for smallholders in the surrounding area, including being forced to sell their FFB to mills further away. RSPO certification is a good step towards sustainability, but may lead to an inefficient supply chain if the surrounding smallholders are not assisted in complying with the same standards.

Therefore, there is actually an increased risk for smallholders located near a mill that is in the process of RSPO certification.[17] Thus, it makes sense to identify mills seeking certification, and to work with smallholders in the nearby locations.

Step Two: Upgrade to a Village Cooperative with a mill supply contract

Company mills are more likely to have a supply contract with a cooperative or another form of organized entity (such as a village-owned company or "*Badan Usaha Milik Desa*") rather than individual smallholders. Cooperatives that own a supply contract with a mill normally have one or more of the following characteristics:

- sufficient capital to provide services to their members
- upfront financing, enabling them to be paid by the offtaker on a monthly basis
- providing input facilities to smallholders such as fertilizers, seedlings, and technical assistance
- providing financing facilities to smallholders such as small loans to purchase trucks or equipment
- transportation trucks
- a depo facility to store FFB before it is sent to mills

16 These are PT Jabontara Eka Karsa, PT Satu Sembilan Delapan, and PT Hutan Hijau Mas.

17 This recommendation refers specifically to RSPO and not to ISPO (Indonesia Sustainable Palm Oil Certification) because while ISPO is mandatory under Indonesian law, it does not require traceability of the supply chain. Therefore, compared to RSPO, it poses less risk of disrupting existing supply channels.

In field surveys, the research team has found cooperatives that exist, but are not fully operational and do not play an integral role in helping smallholders. This is because several, or all, of the characteristics previously described are lacking.

Smallholders with access to a nearby functional cooperative have a significant advantage. For example, a cooperative that provides access to trucks and helps with harvest scheduling can reduce costs for smallholders. Within an oil palm's productive age, the average harvesting cycle is once every two weeks. The cooperative can arrange for the collective purchase by truck (by a farmers' group or cooperative), and arrange a properly scheduled harvest among different smallholders. This will minimize transport cost and optimize truck loading capacity.

Given the existence of underperforming cooperatives, there is potential to upgrade these cooperatives, particularly when they are located near smallholder clusters and do not yet have a supply contract with a mill.

Step Three: Improve bankability of smallholders to access various financing opportunities

The key entry point in assisting cooperatives gain the necessary star characteristics described in "step two" is to provide their smallholder members with access to finance. Not only is access to finance an end goal to provide sufficient working capital, but it also acts as a hard push to streamline operations in order to become bankable.

In order to become bankable, smallholders need to be organized, tenured, receive quality input, and have a solid business plan projecting output.

Smallholders need to organize themselves into a group institution, as independent smallholders are less likely to access bank loans individually (PILAR, 2016). Pooling collective interest in a cooperative and applying for a bank loan, collectively, increases the likelihood of being financed. Apart from cooperatives, other forms of organized entities could also be explored, such as village-owned companies (BUMDesa).

Typically, in order to obtain credit, smallholders need to have a legal land tenure in the form of land ownership titles. However, there may be exceptions to this rule. An increasing number of alternative financing schemes are willing to forego land as collateral, but use a portfolio approach to assessing future cash flows (Bronkhorst et.al., 2017). Given the complexity of achieving land tenure, it is worth exploring the alternative financing schemes.

Smallholders also need to improve the input of their operations, as this contributes to quality FFB products that will demand a higher price on the market. For banks, this means, at minimum, their seedlings need to be certified and their fertilizer must be of reputable quality.

Lastly, smallholders need assistance in creating a sound business plan that projects a robust future of productivity. This will include a projection of production, as well as demand from potential buyers, and costs of transportation from the land plot to the buyer. Interestingly, other sources of income may also contribute to a more robust business plan. If farmers are not only relying on palm oil, but are also working on other forms of income-generating activities such as maize, pepper, and/or animal husbandry, these alternative sources of income also count towards increasing their chances of gaining access to finance.

To help achieve and implement the three steps previously described, the research team recommends future studies or projects to focus on:

- Supporting a region-wide effort to map smallholders, to create functional cooperatives and BUMDes in strategic locations throughout the district, and to provide alternative financing so that smallholders can access operational capital.
- Mapping other potential agricultural plants, apart from palm oil, at the village level, to provide smallholders with alternative sources of income and to strengthen villages with a diversified economy.

In the next phase of this study, CPI will conduct a deep dive into two selected villages to map and survey smallholders in more detail, and to obtain smallholder financial profiles. This will then be developed into a model to provide smallholders with access to finance.

3. Berau has enough mills, but more information is needed to understand the business case for establishing refineries in the region.

The total installed capacity of mills in Berau is enough to absorb FFB produced in Berau at the current productivity levels. By the time peak production is reached, there may be a need to establish more mills, but this will not happen until 2022.

As for the need for refineries, the lack of any refinery means raw CPO continues to leave Berau at a low value. It is evident that Berau has planned refineries for several years now, but this has not yet been implemented.

The Berau District government has two main plans to build a palm oil refinery in the region as a part of a larger plan to develop its downstream industry.

The first is to develop the Labanan Port depo, which has been operational since 2009, and turn it into a refinery. The second is to develop the Palm Oil Green Economic Zone (POGEZ) in partnership with the Malaysian government through the Council of Palm Oil Producing Countries (CPOPC). The current plan for POGEZ is for it to be established in the Tanjung Redeb sub-district.

Establishing a CPO refinery in Berau will increase the added value of palm oil and support the economic growth of the region. However, a number of unknowns remain.

First, it is not yet known whether current CPO production in Berau is sufficient enough to justify establishing a refinery. If this is not determined from the outset, establishing a refinery might lead to increased pressure to open up more concessions.

Second, having a refinery nearby does not guarantee that CPO is processed within the region. CPO from Berau is sent to refineries in Balikpapan in East Kalimantan, South Kalimantan, North Sulawesi, East Java, and Sabah in the neighboring country of Malaysia. The closest refinery is located in Balikpapan within the East Kalimantan province, but despite this, only a small portion of CPO goes to Balikpapan.

Further research is needed to analyze why the other refineries in East Kalimantan are not getting their CPO supply from Berau, and to identify the challenges hampering Berau's plans to build a refinery within the district.

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