In search of sustainable and inclusive palm oil production:

The role of smallholders in Indonesia

Idsert Jelsma

In search of sustainable and inclusive palm oil production: The role of smallholders in Indonesia.

Op zoek naar duurzame en inclusieve palmolie productie:
De rol van kleine boeren in Indonesië
(met een samenvatting in het Nederlands)

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List of Abbreviations

ADP	Area development plan
APL	Areal penggunaan lain (non-forest estate land)
ANT	actor-network theory
B	Boron
BBC	Black bunch count
BD	Bonai Darussalam
BMZ	German Ministry of Economic Cooperation
BPS	Badan Pusat Statistik (Indonesian Bureau of Statistics)
CIFOR	Centre for International Forestry Research
CPO	Crude palm oil
CRH	Central Rokan Hulu

DJP	Direktorat Jenderal Perkebunan (Directorate of Estate Crops)
DM	Dry matter
EFB	Empty fruit bunches
FFB	Fresh fruit bunches
GAP	Good agricultural practices
GTZ	German Agency for Technical Cooperation (now GIZ)
HCA	hierarchical cluster analysis
IDR	Indonesian Rupiah
IPOA	Indonesian Palm Oil Association (Indonesian acronym is GAPKI)
ISPO	Indonesian Sustainable Palm Oil
IQR	Inter-quartile range
IUP-B	Izin usaha perkebunan untuk budidaya
K	Potassium
KfW	German Bank for Reconstruction and Development
KKPA	Kredit Kooperasi Primer Anggota
LPI	Large peat investors
LRF	Large resident farmers
masl	Meter above sea level
Mg	Magnesium
MLF	Medium-sized local farmers
MMF	Medium-sized migrant farmers
Mt	Metric ton
N	Nitrogen
P	Phosphorus
PCC	Provincial Coordinating Committee
PTPN	Perseroan Terbatas Perkebunan Nusantara (State-owned plantation company)
PIR/NES	Perkebunan Inti Rakyat/Nucleus Estate Smallholder
RP	Rock Phosphate
RSPO	Round Table on Sustainable Palm Oil
SHM	Surat hak milik (nationally recognized land certificate)
SKT	Surat keterangan tanah (village level document stating land history/ownership)
SKGR	Surat keterangan ganti rugi (letter from sub-district stating compensation for land has been given)
SMF	Small migrant farmers
SMPF	Small & medium-sized peat farmers
SPKS	Serikat Petani Kelapa Sawit
STD-B	Surat tanda daftar usaha budidaya tanaman perkebunan (plantation registration certificate)
US$	United States Dollar

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Bali, March 2019

1 Introduction

Neatly maintained independent smallholder oil palm plantation in Central Rokan Hulu (photo taken by the author in May 2015)

1.1 The debate

This dissertation builds on an old debate. Already at the end of the 19th century, Kautsky published The Agrarian Question, in which he debates the dynamics of capitalist agriculture, and the role of the peasant and the small farm therein, and the need for policies to steer these dynamics. According to Kautsky, peasants and their small farms were self-exploitative and therefore socially undesirable, and he predicted a gloomy future for both. Further policies were deemed unnecessary, as they would eventually disappear by themselves (Birner and Resnick, 2010; McLaughlin, 1998).

Despite the lack of clear and uniform definitions of smallholders or family farmers and the difficulties associated with this, smallholder farmers have far from disappeared and still form the backbone of many rural societies. Lowder (2016) estimates that globally there are roughly 500 million family farms, of which 475 million cover less than two hectares. Not only have small farmers persisted but policies that support smallholder agriculture have proven a successful strategy in poverty reduction (Birner and Resnick, 2010; Lowder et al., 2016; Valdés and Foster, 2010). Smallholder farmers and supportive policies therefore appear indispensable in achieving Sustainable Development Goal 2.4.1 on sustainable agriculture and fighting hunger.

Interest in agricultural policy development and the position of smallholder farmers therein has undergone considerable fluctuations over time and between regions. In Asia and Africa, colonial governments put a strong emphasis on large-scale plantation agriculture for export; smallholders generally received limited support (Birner and Resnick, 2010; Wiggins et al., 2010), as they were deemed traditional and inefficient, as opposed to large-scale plantations with their modern production techniques. In many countries, this paradigm remained intact after independence and government support for smallholders generally remained minimal (Budidarsono et al., 2013; Byerlee, 2014; Hayami, 2010). Agriculture was generally discriminated against and regarded as a labour pool for industry rather than a source of raw materials and the surplus needed for industrialization and poverty reduction (Birner and Resnick, 2010; Wiggins et al., 2010). Research in the 1960s, however, showed that smallholders hardly need to be motivated to properly manage their plots, rarely shirk labour activities compared to plantation workers and, if properly supported, are likely to be more efficient producers than large-scale plantations (Hayami, 2010; Poulton et al., 2010; Rigg et al., 2016). In the 1970s, there was acknowledgement of the importance of smallholders in poverty alleviation and policies to support smallholder farmers were implemented. The 'green revolution' highlighted the alignment of public investments in agricultural research, subsidized access to credit and other inputs, and price guarantees for smallholders, and led to smallholder-based intensification and poverty reduction (Birner and Resnick, 2010; Hazell et al., 2010). However, the structural adjustment programmes of the 1980s and 1990s promoted market liberalization and limited the involvement of the state. Funding for agriculture diminished, resulting in reductions in smallholder support and services (Birner and Resnick, 2010; Wiggins et al., 2010).

As a result of the 2007/08 agro commodity price hike, agriculture and agricultural investments were put back on the development agenda (Birner and Resnick, 2010; Wiggins et al., 2010; World Bank, 2010). The World Development Report 2008 emphasized the importance of agriculture for development and achieving the Millennium Development Goals. Several pathways for sustainable agricultural development and possible roles for smallholder farmers therein were explored (Oya, 2009; World Bank, 2007). The price hike, however, also increased interest in large-scale land investment and it soon became evident that many of these investments had negative consequences for local populations (Schoneveld, 2013; Vermeulen and Cotula, 2010b). These findings fuelled the land grab debate (Li, 2017; Zoomers and Kaag, 2014) and revived the old debates on how to include

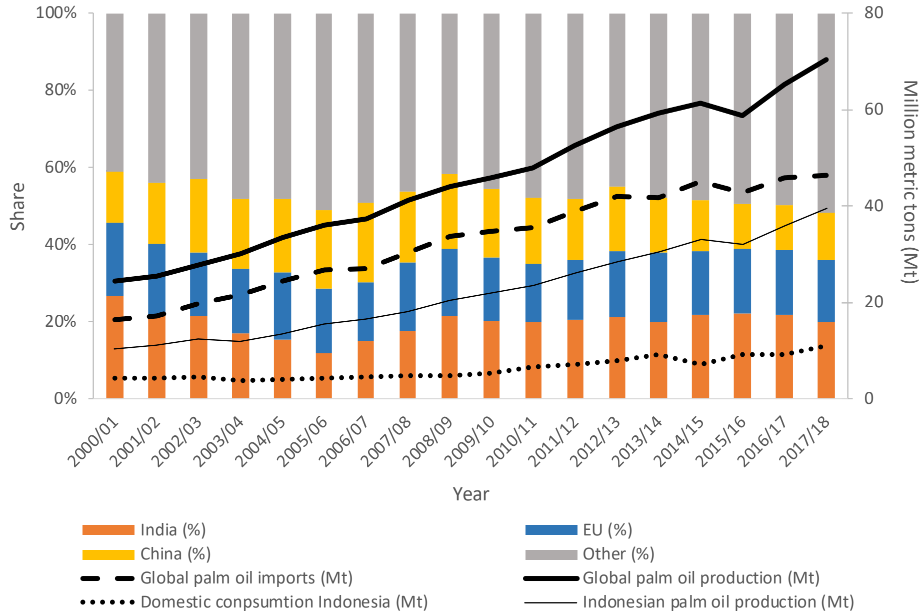

Figure 1.1 Palm oil production and major destinations
Sources: USDA (2005, 2007, 2011, 2015 & 2019)

local populations in agricultural value chains (Lorenzo and Leonard, 2010; Paglietti and Sabrie, 2013) and large-scale plantations versus smallholder farming (Byerlee, 2014; Hazell et al., 2010).

A 2010 special issue of World Development (volume 38) titled the 'Future of Small Farms' shows that the debate on policy development for smallholders has changed since Kautsky. The current debate highlights market failures and deals with such issues as the increasing regime complexity of global food systems and related barriers to market participation, upgrading challenges in contemporary global value chains, challenges in institutional conditions under which smallholders enhance competitiveness, as well as the possible trade-offs between conservation and development, to name just a few (see e.g. Hazell et al., 2010; Narrod et al., 2009; Oosterveer, 2015). Although all these debates feed into each other, and many will be touched upon in the following chapters, this dissertation primarily contributes to the debate on inclusive and sustainable business models.

Inclusive business refers to linking low-income communities in an economically viable manner with businesses that allow the former to participate in value chains (Chamberlain, 2018; Lorenzo and Leonard, 2010; Paglietti and Sabrie, 2013). However, it is not just about participation but also about the conditions under which participation takes place (Cramb and McCarthy, 2016; du Toit, 2009). There are often unequal relations between businesses and their local partners, resulting in the risk of inclusion on adverse terms, corporatization and the loss of autonomy for local populations (Chamberlain, 2018; Cramb, 2013).

A sector in which these processes are highly relevant is Indonesia's smallholder oil palm sector, which has experienced massive smallholder engagement, faces considerable sustainability challenges, is part of global value chains and highlights the influence of complex global agro-commodity governance initiatives on smallholders. It therefore provides an interesting case to further explore the policy, sustainable development and smallholder agriculture nexus.

1.2 The case: Smallholder oil palm farming in Indonesia

In 2017/18, palm oil accounted for 35% of all major oil crops, making it the most produced and traded vegetable oil globally (USDA, 2018). Its popularity is largely based on its versatility for use in a huge number of food and non-food products and its unmatched productivity per hectare compared to other major oil seeds. Although the oil palm (*Elaeis guineensis*) originates from West Africa, the vast majority of palm oil is currently produced in Southeast Asia. Indonesia and Malaysia are the world's main palm oil producing countries, accounting for 55% and 29%, respectively, of global production in 2017/8 (USDA, 2018). Palm oil has become the most important single source of foreign exchange in Indonesia, provides millions of jobs in rural Indonesia and has been hailed by the Indonesian Palm Oil Association as 'God's gift to the world through Indonesia' (GAPKI, 2018).

The vast increase in palm oil production over the past two decades has provided many parts of the world with a cheap and abundantly available vegetable oil (see Figure 1.1). Furthermore, the United Nations World Population Prospects (2017) predicts a global population increase of 2.8 billion people by 2050; of these people, 2.3 billion will be born in less developed countries where vegetable oil consumption per capita is expected to increase due to economic growth (Corley, 2009). In light of the predicted population growth, the increasing vegetable oil consumption per capita and the current aggressive bio-fuel targets set by such countries as Indonesia, the demand for Indonesian palm oil is expected to increase from 38.5 million Mt in 2017/18 (USDA, 2018) to 51.1 million Mt in 2025 (Khatiwada et al., 2018). The clear indications of a steady rise in demand for vegetable oils mplies that the oil palm sector has bright prospects.

However, the rapid expansion of oil palm is controversial and oil palm has become one of the world's most scrutinized agro commodities (Cramb and McCarthy, 2016; Ivancic and Koh, 2016). The crop has been associated with a large number of environmental and social ills, including large-scale deforestation (Abood et al., 2015; Susanti and Maryudi, 2016), biodiversity loss (Koh and Wilcove, 2008; Meijaard et al., 2018), greenhouse gas emissions (due to peat subsidence in oil palm plantations) (Hooijer et al., 2012; Miettinen et al., 2013), smoke and haze hazards associated with the burning of especially peat for oil palm plantation development (Gaveau et al., 2014; Purnomo et al., 2017), land rights issues (Afrizal, 2013; McCarthy, 2010), dubious benefit sharing agreements between local populations and companies (Cramb, 2013; Gillespie 2011), labour issues (Bou Dib et al., 2018; Sinaga, 2013) and corruption (KPK, 2016; Li, 2017). The sector also experiences limited yield increases and increasing labour costs compared to competing oil crops such as soybean (Fry, 2017). These unresolved performance issues have been acknowledged by both the private and the public sector as threatening the long-term sustainability of the palm oil industry (Hidayat et al., 2018; Pacheco et al., 2018; Susanti, 2016).

A myriad of initiatives have been launched to improve sector sustainability in order to counter these threats. Some of the most relevant in the Indonesian context are the Round Table on Sustainable Palm Oil (RSPO) and the Indonesian Sustainable Palm Oil (ISPO) initiatives (Hidayat, 2017; Ivancic and Koh, 2016; Rival et al., 2016). The RSPO is a private governance initiative that was established in 2004 by Unilever and the World Wide Fund for Nature. These organizations responded to civil society demands in especially Northern countries, where public campaigns highlighted the negative environmental and social consequences of the oil palm boom in producer countries (Casson, 1999; Pacheco et al., 2018; Schouten and Glasbergen, 2011).

In June 2017, the RSPO covered 3.2 million ha of oil palm globally and claimed that 19% of global palm oil is RSPO certified (RSPO, 2017b). In the same year, the RSPO certified plantations covered 1.7 million ha in Indonesia and thereby accounted for about 14% of the country's estimated 12.3 million ha of oil palm (DJP, 2017b). Although the RSPO is the most relevant global sustainable palm oil initiative (Ivancic and Koh, 2016), it suffers legitimacy issues as it is based on voluntary acceptance, lacks direct public sector involvement and holds predominantly Northern views about sustainability (Hidayat et al., 2018; Rival et al., 2016; Schouten and Glasbergen, 2011).

The ISPO was launched by the Indonesian Ministry of Agriculture in March 2011 through regulation No. 19 (Hidayat et al., 2018). The ISPO can be regarded as an attempt by the Indonesian state to regain control on setting the sustainable oil palm agenda and to further the development of the oil palm sector, countering the increasing influence of private sector governance initiatives such as the RSPO (Hidayat et al., 2018; Hutabarat et al., 2018; Schouten and Bitzer, 2015). The ISPO is based on the implementation of existing legislation, mandatory for all local firms and verified through third-party audits. Besides social and environmental concerns, the ISPO also emphasizes the improvement of the sector's competitiveness (Hidayat et al., 2018; Hutabarat et al., 2018; Schouten and Bitzer, 2015). The ISPO certification scheme, however, suffers severe credibility issues especially in Northern countries but also within Indonesia itself. The authority and capacity of the ISPO organization to implement or enforce sanctions are limited and solutions for the numerous conflicting laws and regulations are yet to be developed (Hidayat et al., 2018; Rival et al., 2016). Whereas ISPO certification was to be obligatory for companies from 2014 onwards, the ISPO has so far failed to achieve extensive company certification and it is therefore doubtful that the even more complex smallholder sector will be ISPO certified by 2022, as initially planned (Hidayat et al., 2018). However, the Ministry of Agriculture and the Coordinating Ministry for Economic Affairs are currently engaged in the multi-stakeholder processes required to increase the credibility of the ISPO, which increasingly appears to align with RSPO standards, indicating momentum towards improving the sector's performance (Luttrell et al., 2018; Pacheco et al., 2018). In 2017, smallholdings accounted for 5.6 million ha of oil palm in Indonesia, which is equivalent to 46% of the country's total oil palm area (BPS, 2018). It is thus clear that oil palm provides a relevant example of smallholders' participation in a global agro-commodity value chain. However, whilst initiatives such as RSPO and ISPO aim to improve social, economic and environmental wellbeing, their impacts on smallholders are questionable. Although a common and important differentiation among smallholders is the scheme versus independent smallholders, they generally have lower yields than companies (BPS, 2018) and are included in the value chain on adverse terms. Whereas scheme smallholders usually maintain relations with the plantation company that assisted plantation development, especially independent smallholders often receive low prices, are last in line to sell their produce, have poor access to high-quality planting material and other agricultural inputs, have difficulty accessing technological knowhow, often do not possess formal land titles and have limited access to formal credit suppliers and subsequently suffer low yields (Cramb and McCarthy, 2016; Hidayat, 2017; McCarthy, 2010). With the increasing importance of emerging public and private sustainability standards, it appears that smallholder participation in the oil palm value chain is increasingly shaped by differentiated capabilities to comply with sustainability standards such as ISPO and RSPO.

Although the RSPO and the ISPO acknowledge the importance of smallholders in the oil palm value chain and have developed strategies and pathways for the certification of smallholders, these have thus far proven effective or beneficial to smallholders to only a limited degree (Hidayat et al., 2018; RSPO, 2017a). Whereas in 2015 the total smallholder oil palm area in Indonesia amounted to 4.5 million ha (DJP, 2017b), only 148,856 ha of plots belonging to scheme smallholders were RSPO certified as of November that year (RSPO, 2015). For independent smallholders, the figure is even lower: in 2017, only 501 farmers were RSPO certified (RSPO, 2017b) and only one independent smallholder group held ISPO certification, a group which had already undergone more stringent RSPO certification (Hutabarat et al., 2018). These certified independent farmers have often received considerable external assistance from companies and NGOs and certification schemes interested in promoting smallholder certification (Hidayat, 2017; Hutabarat et al., 2018), assistance that is unlikely to be available to the vast majority of smallholders. The number of RSPO certified independent smallholders fell from 810 in 2016 to 501 in 2017 due to the expiration of smallholder groups' certificates (RSPO, 2017b). It is clear that although the aim of certification is to increase sector sustainability, it currently fails to include the vast smallholder sector and may even lead to the further marginalization of smallholders.

The RSPO and the ISPO – as well as other key organizations whose aim is to improve smallholder performance, such as the CPO replanting fund – regard the formation of farmers groups as a key instrument to improve smallholder performance and have established group formation as a precondition for certification (DJP, 2017a; Johnston et al., 2018; RSPO, 2017a). Benefits associated with smallholder organization are related to scale advantages in production, marketing, monitoring compliance, traceability, knowledge dissemination, networking and community benefits (Brandi et al., 2015; Ibnu et al., 2018; Poulton et al., 2010). However, smallholder organization leads not only to benefits: the oil palm sector is frequently associated with corruption scandals, and corruption is also common in many farmers' organizations (KPK, 2016; Li, 2017). Other frequently encountered issues in farmers' organizations are their complex structures, management's lack of required skills, a lack of focus on business activities, politicization, slow decision-making and a lack of transparency therein, and benefits accruing to the organization but not reaching members (Chamberlain, 2018; Paglietti and Sabrie, 2013).

Smallholders' organizations have also been highly politicized in Indonesia. Whereas in the Soekarno era farmers' organizations played an important role in advocating the interests of peasants and the rural poor, this political force was largely destroyed during the New Order regime's purges of anything associated with communism (Lee Peluso et al., 2008). Farmers' organizations remained popular under the New Order regime in the 1970s–1990s but were fundamentally transformed under, for example, the village cooperative programme (Suradisastra, 2006). These cooperatives primarily functioned as the government's resource distribution centres, aimed at building support for the government and increasing production (Hazell et al., 2010; Suradisastra, 2006). However, with structural adjustment programmes in full swing in the 1990s, decreasing Indonesian oil incomes and the eventual collapse of the New Order regime, state-led support diminished (Badrun, 2011; McCarthy, 2010). These village cooperatives often no longer received government input and collapsed (Suradisastra, 2006), leading people to associate cooperatives, or farmers' organizations more broadly, with failure.

Farmer organization is currently strongly promoted as a tool for improving the sustainability of the oil palm smallholder production systems. However, it is doubtful whether an organization of farmers by itself can lead to improved conditions for sustainable smallholder oil palm cultivation. The objective of this dissertation is to provide a better understanding of the dynamics within the Indonesian smallholder oil palm sector and thereby contribute to the debate about the role of smallholders in sustainable production.

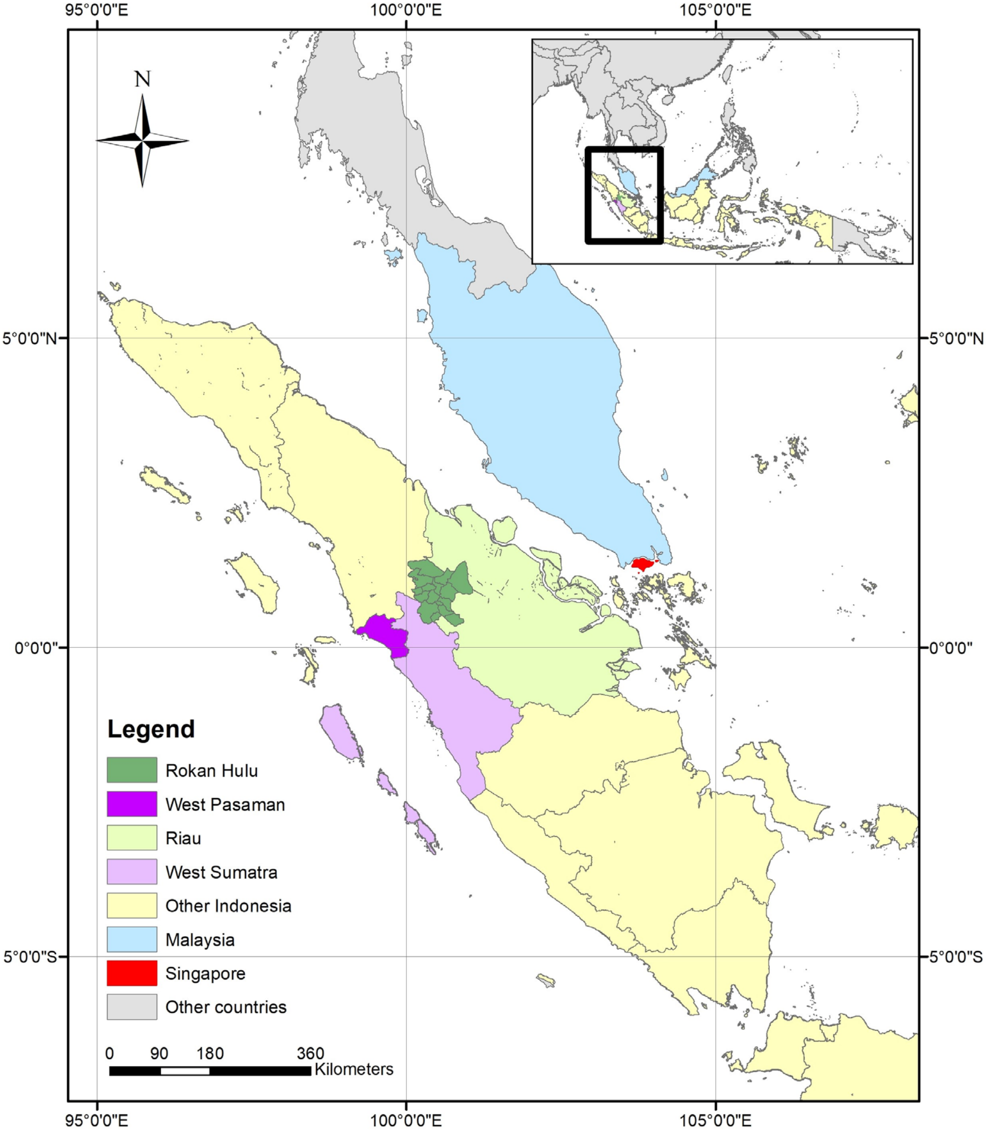

Figure 1.2 Research area

1.3 Research design

1.3.1 Research questions

It is clear that smallholders in Indonesia have massively engaged with the oil palm sector but face considerable sustainability challenges. The lead research question was therefore:

What is the role of smallholders in Indonesian oil palm cultivation and how to enhance inclusive and sustainable production?

In analyzing the role of smallholders, a distinction is made between two categories of smallholders, tackling four questions. First the independent smallholders (Chapters 2-3), which further investigates the following sub-questions.

1. *What are the characteristics of Indonesian oil palm smallholders and how to deal with diversity?*
2. *How to improve smallholder performance?*

Second, the organized smallholders (Chapters 4-5). This case involves nearly 40 years of smallholder oil palm developments the following sub-questions guide the research.

3. *What is the importance of collective action and farmers organization and how can this be achieved?*
4. *What are key challenges and possible solutions for maintaining beneficial farmer organizations and collective action?*

1.3.2 Research sites

The present research primarily focussed on developments in Rokan Hulu district in Riau province and West Pasaman district in West Sumatra, both of which are located in central Sumatra (see Figure 1.2). The sites are approximately 170 km apart but are separated by the Barisan mountain range. Rokan Hulu and West Pasaman border North Sumatra, where the first of Indonesia's commercial oil palm plantations were established in 1911. They then gradually spread southwards, where suitable land was abundant (Budidarsono et al., 2013; Susanti and Maryudi, 2016). The research focussed on the area where Indonesia's oil palm boom took place from the 1980s onwards. However, even within central Sumatra it is possible to find what can be considered frontier areas and a diversity of oil palm landscapes, as Chapters 2 and 3 show. Whereas Chapters 2 and 3 provide snapshots of current smallholder oil palm landscapes in Riau, Chapters 4 and 5 explore nearly 40 years of smallholder oil palm development, highlighting developments in an organized farmer scheme in West Sumatra that was established in the early 1980s. This dissertation thus provides insights not only into established or frontier oil palm areas, but also into an oil palm landscape trajectory.

1.3.3 Research approach and methods

The research applied both qualitative and quantitative research techniques, including literature review and production data analysis, multiple surveys, semi-structured interviews, photo analysis and use of geographical information systems (GIS) (see Table 1.1). In dept descriptions of methods and approaches are provided in the respective empirical chapters. Fieldwork in West Sumatra spans a nearly 10 year period in which fundamental change was observed and documented. Former project staff was interviewed in Germany, the UK and Indonesia. Riau fieldwork spanned a shorter timeframe but was much more intense and includes an extensive and detailed mapping exercise.

Multiple theoretical approaches were used to answer the research questions. Chapter 2 opens the black box of Indonesia's independent smallholders and has a strong geographic and land use component. It highlights differences in socioeconomic and legal conditions as well as physical environments in which different types of smallholders operate. Chapter 3 builds on the diversity of smallholders identified in Chapter 2 but focusses on the implementation of good agricultural practices (GAP) among the different independent smallholder types. In Chapters 4 and 5, the focus shifts towards the organized smallholder production system. An institutional analysis approach based on Ostrom's design principles was used to capture the institutional setup of a business model that allowed smallholders to produce intensively for more than 25 years. Chapter 5 continues with the organized smallholder business model and borrows from actor-network theory (ANT) to make explicit the dynamics that shape smallholder production system and the continuous reassembling of the smallholder production system. More details on methods and approaches are provided in the various chapters.

Table 1.1 Summary of research techniques and activities, and data obtained for this research (see empirical chapters for details)

	Riau	West Sumatra
Years in which field visits were undertaken	2014–15	2009, 2011, 2014, 2016 and 2018
No of recorded semi-structured interviews	54	108
GIS mapping	303,270 ha	4,800 ha
No of farmer surveys	231	105
No of farm surveys	231	-
No of photo analyses of plantations	220	-
No tissue samples	118	-

1.4 Structure of dissertation

This introduction highlights the broader debate, introduces the case, provides the research design, and presents the limitations and the structure of this dissertation. Chapter 2 is the first empirical chapter. It explores the heterogeneity of the independent smallholders in two different landscapes in Rokan Hulu, Riau. Seven types of smallholders are identified, their relevance in the smallholder oil palm landscape is given and sustainability challenges are identified.

That the yields of independent smallholders are generally low has already been established (Euler et al., 2017; Molenaar et al., 2013). However, there is only a limited understanding of the implementation of GAP by independent smallholders and how these practices differ among smallholders. Chapter 3 uses the smallholder typology developed in Chapter 2 to provide a detailed assessment of the implementation of GAP by different types of independent smallholders. The chapter thereby explores the practices of independent smallholders and what prevents them from implementing more sustainable practices.

In Chapter 4 the focus shifts from independent to organized smallholders. The chapter presents an analysis of the institutional setup that allowed smallholders to collectively cultivate oil palm, implement GAP and maintain high yields for more than 25 years. It thereby provides a counterexample to the generally poor performance of smallholders.

Chapter 5 continues with the organized smallholders in Ophir but highlights that smallholders' organizations are always in flux. This chapter explores why and how the collective Ophir smallholder plantation changed over a nearly 40-year period. It discusses three constellations of the Ophir smallholder plantation and presents an analysis of both internal and external changes. Thereby it makes explicit the dynamics and renegotiations in the Ophir plantation that explain the different outcomes within a single business model. Whereas Chapters 2, 3 and 4 have been published as articles already, Chapter 5 has been submitted recently.

In the conclusion (Chapter 6) results are synthesized and the opportunities and limitations of making palm oil production more inclusive and sustainable are further explored

2 Unpacking Indonesia's independent oil palm smallholders: An actor-disaggregated approach to identifying environmental and social performance challenges

Guardian lion at the entrance of a Sino-Indonesian farmer's plantation in Bonai Darussalam (photo taken by the author in June 2015).

This Chapter has been published as:

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2.1 Introduction

An estimated 84 percent of the world's farms are managed by smallholders who cultivate less than 2 ha of land (Lowder et al., 2016). Although most smallholders in developing countries are involved primarily in subsistence-based production, in recent decades globalization and increasing global trade flows have enabled many smallholders to participate in and benefit from more commercialized global value chains (Lee et al., 2012; Rigg et al., 2016). Changing rules and relations in many of these global value chains have, however, begun to raise concerns over the appropriate modes and the effects of smallholder participation. For example, the proliferation of safety and quality standards and quality-based competition, along with increasing market concentration, is increasingly shifting power relations between farmers and processors/retailers in favour of the latter and bringing about new barriers to smallholder market participation (Lee et al., 2012; McCullough et al., 2008). This poses new challenges for leveraging commercial smallholder production in support of inclusive and sustainable development objectives and calls for targeted support in order to enable smallholders to more effectively compete in global markets. However, because public statistics and discourse tend to treat 'smallholders' as a homogenous population (e.g. DJP, 2015) or as a dichotomy of company-assisted and independent smallholders (e.g. Brandi et al., 2015; Euler et al., 2016; Lee et al., 2013), development policies often fail to adequately account for the wide range of actors they represent and issues they face. In order to avoid inefficient and sometimes detrimental one-size-fits-all solutions, there is a need to further unpack smallholder attributes and develop more actor-disaggregated interventions (Fan et al., 2013).

This chapter focuses on smallholder oil palm farmers in Indonesia, which account for an estimated 40.8% of the total Indonesian oil palm acreage (DJP, 2015). The dynamics within Indonesia's oil palm sector illustrate the types of competitive challenges smallholders face in their integration into global agro-commodity chains. For example, because of public concern over the poor social and environmental performance of the sector (e.g. Enrici and Hubacek, 2016; Lee et al., 2014; Obidzinski et al., 2013), most major buyers from Europe and North America have over the past decade begun demanding producer compliance with voluntary certification systems such as the Roundtable on Sustainable Palm Oil (RSPO). Increasingly, major chain actors are augmenting these requirements with so-called zero-deforestation commitments, the aim of which is to eliminate deforestation and peatland conversion from their entire supply chain (Pirard et al., 2015). In an attempt to enhance the global competitiveness of Indonesian palm oil, the Indonesian government has also developed a mandatory public standard, namely the Indonesian Sustainable Palm Oil (ISPO) system. Despite the latter being widely criticized for attempting to undermine the more encompassing private standards (McCarthy et al., 2012), the increasing imperative to comply with the various standards has placed increasing sustainability and legality demands on Indonesia's oil palm smallholders. Independent smallholders are currently poorly equipped to comply with standards (Hidayat et al., 2015; Rietberg and Slingerland, 2016) and without adequate support, many smallholders are at risk of becoming increasingly alienated from both domestic and global palm oil markets (Cramb and McCarthy, 2016; Lee et al., 2012). Recognizing that many oil palm smallholders lack compliance capacity, numerous development agencies, corporations and multi-stakeholder initiatives have begun designing initiatives to address compliance barriers and enhance smallholder competitiveness[1]. However, failure to properly account for the heterogeneity of the smallholder oil palm sector threatens to undermine the effectiveness and scalability of such initiatives.

By developing a typology of smallholder oil palm farmers in Rokan Hulu district, Riau province, this chapter reveals the wide diversity of actors that compose Indonesia's smallholder oil palm economy, some of the compliance barriers they face and the sustainable development challenges they pose. By examining the social geography of independent smallholder oil palm production, we illustrate how global agro-commodity chains can drive agrarian differentiation and offer new insights into the complex dynamics of agricultural frontier expansion. We also evince the policy significance of adopting an actor-disaggregated approach in the development of a smallholder typology through hierarchical cluster analysis.

As context, this chapter first presents a historical overview of smallholder oil palm development in Indonesia and a reflection on how smallholders are formally classified. This is followed by a description of methods and the analytical approach. The results that are subsequently presented comprise an analysis of the social geography of the smallholder oil palm landscape and a smallholder characterization drawing on hierarchical clustering. The chapter is concluded with a discussion and a reflection on findings.

2.2 Background

2.2.1 Transformation of smallholder oil palm production in Indonesia

Smallholder oil palm farming in Indonesia began to be actively promoted under the New Order regime with the support of the World Bank in the 1970s through so-called Perkebunan Inti Rakyat/ Nucleus Estate Smallholder (PIR/NES) schemes. The schemes principally served as a vehicle for the socioeconomic development and political integration of Indonesia's outer islands (McCarthy et al., 2012; Molenaar et al., 2013). Early iterations of the schemes were state-led, which linked smallholders to state-owned plantation companies through outgrower arrangements. Under these arrangements, the plantation companies developed plantations for smallholders (such plantations are referred to as plasma) and provided inputs, technical assistance and finance. When the cost of plasma establishment was repaid, the formal ownership of the land was transferred to the smallholders. As the state, in the face of international criticism, began to take a less active role in the sector over the course of the 1980s (McCarthy et al., 2012), responsibilities for plasma development began to shift to the increasingly prominent private sector (Badrun, 2011; Zen et al., 2016). Although numerous variations of the original PIR/NES were introduced during this transition (e.g. PIR Akselerasi, PIR Swasta, PIR-Trans), in the 1990s the Kredit Koperasi Primer Anggota (KKPA) scheme became the dominant model for smallholder integration. In an attempt to promote rural entrepreneurship, KKPA schemes adopted a more decentralized governance system, whereby Village Unit Cooperatives were responsible for credit and infrastructure management (Gillespie, 2010; Molenaar et al., 2013; Zen et al., 2016). Many of these cooperatives also took on plantation management responsibilities, albeit with mixed success. Although some district and provincial governments continued to promote PIR schemes during the 2000s (Zen et al., 2015),

1 This include, for example, activities undertaken under the Indonesian Palm Oil Platform (InPOP), Sustainable Palm Oil (SPO) Initiative, IDH Palm Oil Program, and the Smallholder Acceleration and REDD programme (SHARP).

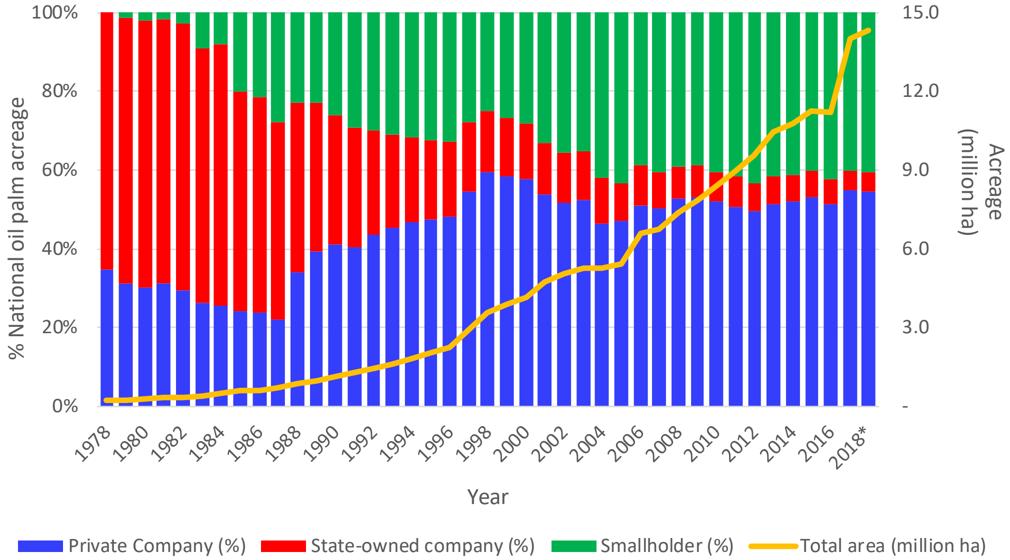

Figure 2.1 Indonesia's oil palm production, by actor type (1978–2018)
Source: DJP (2017c), * data are based on projections

state subsidies to the schemes began to dry up following the East Asia Crisis and the end of the New Order regime in the late 1990s. Plantation companies were reluctant to guarantee commercial loans to smallholders and sector investments increasingly suffered. In order to reinvigorate the sector, in 2007 the originally mandated 70:30 land split between plasma (smallholders) and nucleus (company) was replaced with a 20:80 land split (Gillespie 2011; McCarthy et al., 2012). However, to date many companies still fail to achieve this 20% obligation and many new plasmas are 'one roof management' schemes, whereby plantation companies fully manage smallholder plantations (Gillespie 2011; Zen et al., 2016).

Despite their declining significance, the various PIR schemes made important contributions to rural development and the development of smallholder oil palm management capacities. As the oil palm market in Indonesia matured and infrastructure improved, many smallholders were increasingly able to develop oil palm independently (see Belcher et al., 2004; Feintrenie et al., 2010) for a more elaborate review of the emergence of the independent oil palm sector). Although the PIR programmes managed to incorporate smallholders across an estimated 700,000 ha (Badrun, 2011) to 900,000 ha (Zen et al., 2015), the vast majority of the 4.8 million ha cultivated by (what the government classifies as) smallholders in 2016 is likely to be independent smallholders (see Figure 2.1).

In contrast to PIR development, the growth of the independent oil palm sector occurred without any far-reaching government planning or support (McCarthy and Zen, 2016). Partly due to a lack of state oversight, most independent smallholders receive little or no extension support and are often required to depend on informal land, input and offtake markets. As a result, they are often perceived as marginal and backwards compared to modern estate agriculture (Gillespie 2011; McCarthy and Zen, 2016) and difficult to monitor through existing traceability systems (e.g. in the context of RSPO and zero deforestation). Moreover, due to insufficient use of and access to high quality production inputs and adoption of poor management practices, most independent smallholders tend to be considerably less productive than commercial estates and PIR smallholders (DJP, 2015; Euler et al., 2016a; Molenaar et al., 2013). The need to address this large yield gap and high level of informality is, however, increasingly featuring in Indonesian policy and development discourse since it is increasingly recognized that failure to improve smallholder compliance with emerging market standards is not only an inclusive development issue, but also a sector competitiveness and sustainability issue.

2.2.2 The arbitrary definition of smallholders in Indonesia

While the Directorate of Estate Crops (DJP) and the Indonesian Bureau of Statistics (BPS) divide oil palm producers into three categories – namely smallholders, state-owned companies and private sector companies (DJP, 2015) – they do not provide clear definitions of what these categories entail. As noted by Cramb and Sujang (2016), although the term smallholder oil palm farmer often lacks a precise definition, in practice it tends to refer to differences in size and level of reliance on family labour. This aligns with the definition of the RSPO (2016): '… *farmers who grow oil palm, alongside subsistence crops, where the family provides the majority of labour and the farm provides the principal source of income, and the planted oil palm area is less than 50 ha*'. The Ministry of Agriculture's Guidelines for Plantation Licensing (Regulation No.98/Permentan/OT.140/9/2013) does make a distinction between producers based on size. For example, those that cultivate less than 25 ha of oil palm are required to apply for a Plantation Registration Certificate (STD-B), while those cultivating more than 25 ha require a Plantation Business License (IUP-B). The latter involves complex procedures and requirements such as an environmental impact assessment (Paoli et al., 2013). Those with an STD-B are exempt from most of these requirements. This points to a legal distinction between smallholders and commercial producers based solely on land area.

Interviews with government officials and producers revealed that these regulatory requirements are typically not known to producers or are circumvented. Meeting requirements is generally perceived to be a cumbersome, lengthy and expensive process. Many producers also contend that completely formalizing operations attracts increased state scrutiny. The circumvention of regulations is typically achieved by registering different landholdings in different names. Government officials in the Regent's Office and the regency's Forestry and Plantation Office also confirmed that both STD-Bs and IUP-Bs are rarely issued in practice. This lack of proper administration and documentation poses serious obstacles to regulating and providing targeted support to independent oil palm farmers. It also raises questions about the accuracy of official statistics, since issues of both under- and over-reporting are simultaneously present. Realities on the ground, for example, showed that the local government – the primary source of data for the DJP and BPS – classifies farmers cultivating between 25 and 250 ha as *perkebunan rakyat*, which is translated as 'smallholders', despite these technically requiring business licenses. On the other hand, since many producers are able to circumvent regulations entirely, many are not captured by the local government at all.

2.3 Methods

2.3.1 Case study context and site selection

This research was undertaken in Sumatra's Riau province, which has vibrant fossil fuel, plantation agriculture, and pulp and paper industries. The main ethnic groups are Malay (indigenous to

Riau, 33%), Javanese[2] (indigenous to Java, 30%), Batak (indigenous to North Sumatra, 13%), and Minang (indigenous to West Sumatra, 12%) (Na'im and Syaputra, 2011). Riau is strategically located across the Strait of Malacca – in close proximity to major markets in Malaysia and Singapore – and south of North Sumatra, where Indonesia's plantation agriculture originally emerged in the late 19th century under Dutch colonialism (Budidarsono et al., 2013). With Riau's comparatively low population density and the abundance of cheap and 'empty' agro-ecologically suitable land, many oil palm producers began to migrate from North Sumatra to Riau towards the end of the 20th century in pursuit of new land (Budidarsono et al., 2013). By 1999, North Sumatra had been overtaken by Riau as the largest oil palm producing province in Indonesia (Mirza et al., 2014). Riau accounts for an estimated 23% of Indonesia's total mature oil palm acreage and 30% of Indonesian oil palm smallholders. Of the 2.5 million ha of land under oil palm cultivation in Riau (equivalent to 28% of Riau's land area), 59% is officially classified as being under smallholder oil palm cultivation, with 4% and 38% cultivated by state-owned and private companies, respectively (DJP, 2015). Mills without plantations, also referred to as stand-alone mills, account for 33% of Riau's palm oil processing capacity (DIS-BUN Propinsi Riau, 2015). These mills source primarily from independent smallholders, highlighting the maturity of the independent oil palm sub-sector in Riau.

Within Riau, the research activities focused on Rokan Hulu regency (Figure 2.2). With a total processing capacity of 1,605 MT of fresh fruit bunches (FFB) per hour (34% of which by stand-alone mills), Rokan Hulu egency has the largest palm oil processing capacity in Riau (DIS-BUN Propinsi Riau, 2015). Approximately half of its land area is devoted to oil palm, with 'smallholders' accounting for approximately 55% of the total cultivated area (DJP, 2015). Seven of Rokan Hulu's 16 sub-districts were selected for research activities across two similarly sized but ecologically and demographically distinct areas. One is Bonai Darussalam in the northeast (comprised of one sub-district), which consists largely of peat soils, has experienced high rates of deforestation in recent years and has a population density of only 29.5 inhabitants per km^2 (see Appendices A and B for deforestation and peat distribution maps). This area can be considered a recently converted forest frontier. The other area is Central Rokan Hulu (comprised of six sub-districts), which has mineral soils[3]. Deforestation there was most prevalent before the 1990s and Central Rokan Hulu has a comparatively high population density of 151 inhabitants per km^2 (BPS Rokan Hulu, 2015). This area can therefore be regarded as an established agricultural area. Recent oil palm expansion in Rokan Hulu has taken place in Bonai Darussalam on a considerable scale, often on lands legally classified as state forestlands and where peat fires associated with oil palm expansion are common. Smallholder oil palm production can legally take place only on land classified as 'non-forest estate land' (*Areal Penggunaan Lain*, APL), and not in the state forest domain[4]. Unpacking dynamics in such different locations within one district provides valuable insights into peatland conversion processes in oil palm in Indonesia (Bonai Darussalam), especially when juxtaposed against independent oil palm smallholder development in more established agricultural areas (Central Rokan Hulu). Although Bonai Darussalam can be considered a frontier area, Figure 2.2 shows that there are a considerable number of mills in and around both research areas, indicating that Riau as

2 In this research Javanese includes Sundanese, who are indigenous to West Java.

3 Mineral soils refer to sand, loam, silt, clay and/or volcanic soils. These are usually more suitable for oil palm than peat soils, which are classified as organic soils (Corley and Tinker, 2016).

4 APL is a legal classification of land that is not part of the state forestry domain. This does not imply, however, that APL land is devoid of forests or that state forestland is necessarily forested. For more details on the forestry domain and non-state forest lands, see Enrici and Hubacek (2016).

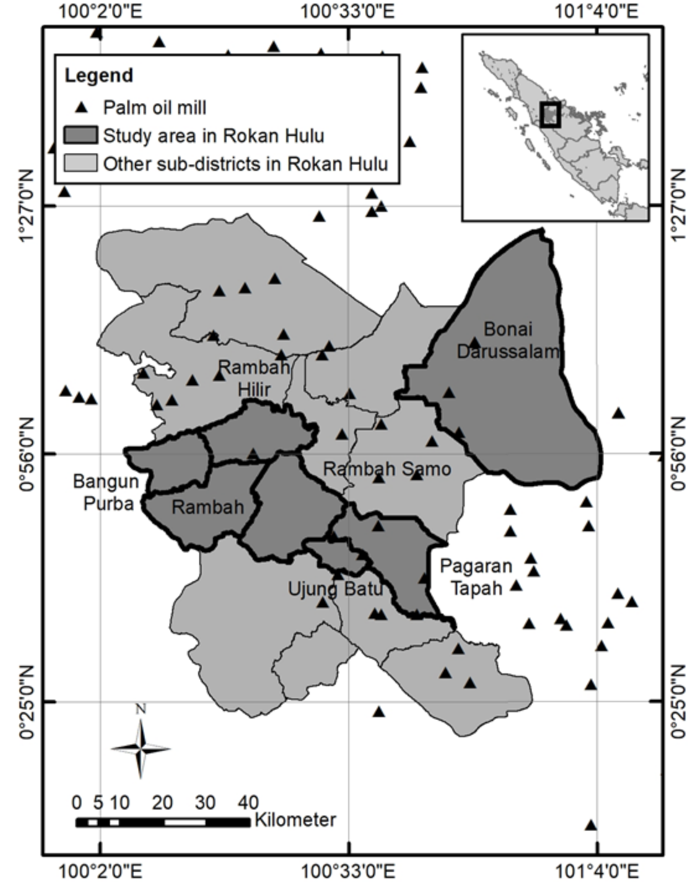

Figure 2.2 Research area and distribution of palm oil mills.
Sources: author's representation based on CIFOR mill identification (unpublished) and BAPPEDA Rokan Hulu (2015)

a whole has a well-established oil palm landscape. This shows that smallholders in neither area are subject to monopsonic market conditions.

2.3.2 Surveying activities and data

Due to a lack of administrative oversight and smallholder licensing, no reliable sample frame could be derived from official data. Therefore, smallholders were sampled spatially using recent high-resolution satellite imagery available through Google Earth. Using images taken between August 2013 and July 2014, all individual oil palm plots in the research area were manually photo-interpreted with ArcGIS 10.3. A total land area of 303,437 ha was mapped (see Table 2.1). Approximately 3% of the selected sub-districts' land area could not be mapped due to excessive cloud cover. Those areas identified as being planted with oil palm were classified as being either independently or company planted, based primarily on planting patterns. In areas with a low elevation gradient, like much of our research area, companies are typically distinguishable by a large

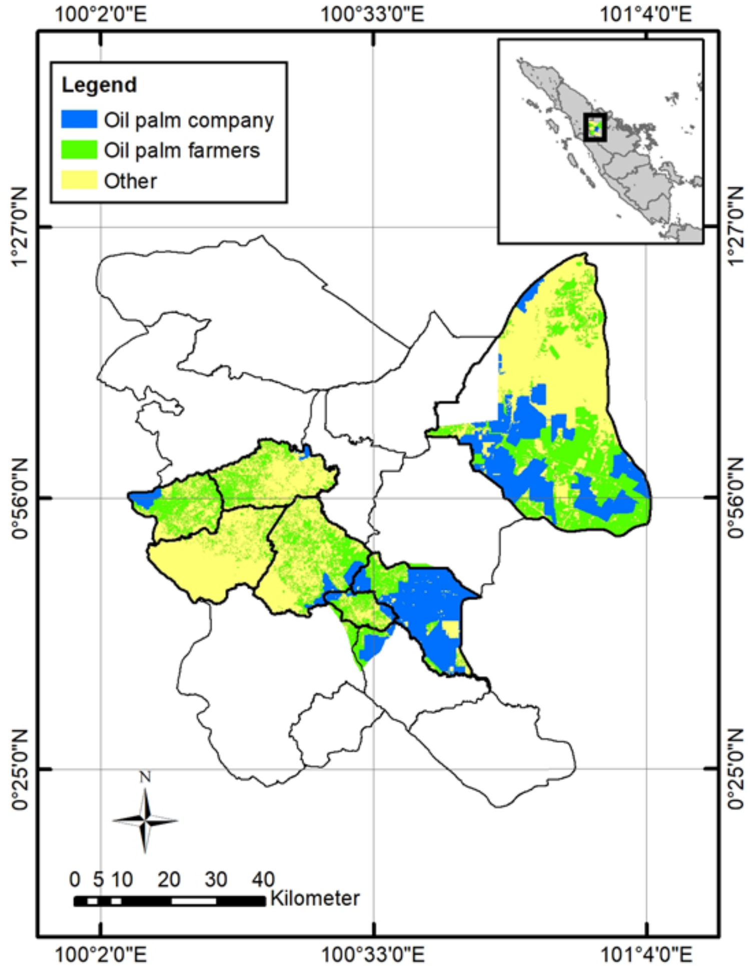

Figure 2.3 Classification of oil palm ownership in research area.
Sources: author's representation based on field research and Google Earth (2015).

number of rectangular 50 ha blocks composed of oil palm of similar age and clear road patterns. Smallholders often have less uniform planting patterns, smaller plots and a less distinguishable infrastructure. Those areas where this distinction could not be confidently made were subsequently visited. Figure 2.3 depicts the geographic distribution of these two classifications in the study area.

The area identified as being cultivated by independent oil palm smallholders was subsequently partitioned into 500 m by 500 m (25 ha) cells and assigned a unique code. This cell area was deemed appropriate since it struck a balance between capturing geographic diversities and time and cost efficiency. A total of 287 cells, comprising 5.3% (equivalent to 4,331 ha) of the total mapped smallholder oil palm acreage, were randomly selected using Hawth's Analysis Tools (see Table 2.2 for an overview of cells and surveying activities). Every smallholder oil palm plot within the

Table 2.1 Photo-interpretation results, peat and land classification in research area

Type of land use	**Frontier (BD)**		**Established agricultural area (CRH)**		**Total**	
	Area (ha)	**Share**	**Area (ha)**	**Share**	**Area (ha)**	**Share**
Oil palm	75,275	54%	76,302	46%	151,746	50%
Independent smallholder oil palm	39,253	28%	43,133	26%	82,487	27%
Company developed oil palm	36,023	26%	33,169	20%	69,204	23%
Non-state forest land (APL)	51,399	37%	101,050	62%	152,449	50%
State forest land	87,538	62%	64,367	39%	151,905	50%
Peatland (>100 cm)	101,635	73%	0	0%	101,635	34%
Total area	138,949		164,321		303,270	

Table 2.2 Sample overview

	Frontier (BD)	Established agricultural area (CRH)	Total
Number of cells surveyed	119	168	287
Average areas under independent smallholder oil palm per cell (ha)*	18.0	13.0	15.1
Total area mapped from satellite (ha)	2141.5	2189.9	4331.4
Total area identified on the ground (ha)	2202.5	2248.4	4450.9
Proportion total mapped area surveyed	5.5%	5.1%	5.3%
Number of rapid plot surveys	509	1,331	1,840
Number of farmer surveys	82	149	231

* For logistical purposes, only cells containing more than 3.5 ha of independent oil palm were selected for analysis

selected cells was visited between April 2015 and November 2015 by the lead author and a team of six field technicians. In Bonai, the 119 sampled cells were cultivated by a total of 509 farmers, while in Central Rokan Hulu the 168 sampled cells were cultivated by a total of 1,331 farmers, reflecting differences in average farm size and farm density between the two areas. There were, however, minor discrepancies between the areas identified within selected cells through photo-interpretation and field measurements due to plantings and cuttings made since July 2014.

Field technicians collected data from the 1,840 plots on inter alia the identity of the plot owner, his/her origin, ethnicity and place of primary residence, the age of the planted oil palms, the plot area and the size of additional oil palm plots. Data were obtained from local sources, namely plot owners or, where these were unavailable, plot labourers, middlemen, and community and neighbourhood leaders knowledgeable about the nearby plantations and their owners. The reliability of this approach was validated by cross-referencing data provided by non-plot owners with data obtained from follow-up surveys with plot owners. In the first surveying phase, survey depth was intentionally sacrificed for a large locally representative sample size that captures actor diversity within and across the two landscapes. We contend that valuable insights into the social and economic differentiation amongst plot owners can be generated using basic demographic and plot data.

Within each of the cells, the plot owner located in the middle of the cell was, where feasible, selected for an in-depth survey. This survey instruments captured a wide range of topics, ranging from former and current livelihood activities to input and offtake markets, sources of finance, and standards compliance barriers (e.g. proof of land ownership, use of certified planting material, and production practices). The objective of the survey was to enable a more rigorous assessment of upgrading challenges faced by different producer groups, as identified by the clustering (see section 2.3.3). In total, 231 in-depth surveys (12.6% of previously surveyed plot owners) were conducted. Absenteeism of large farmers, especially in Bonai Darussalam, was an issue, but was in most cases resolved by interviewing the plantation manager, who often had considerable knowledge of plantation management and the owner.

2.3.3 Analytical approach

The first part of the analysis involved characterizing the social geography of the smallholder oil palm landscape in Rokan Hulu. It examined the distribution of smallholders in both numbers and the area they occupy within the landscape on the basis of ethnicity and the first three variables used in the cluster analysis (see below). This data were corrected for sampling bias. Because farmers were sampled spatially, a large farmer was more likely to be sampled than a small farmer. To correct for this, we assigned probability weights to the different farmers using the following simulation-tested expression.

$$P = 1 - ((1 - c)^{(\frac{\sqrt{h}}{g}+1)^2})$$

Where P is the probability of being selected; c the proportion of total grids sampled; h the farm size (in ha); and g the diameter of a cell (in hectometres).

Although the descriptive data offer important insights into smallholder characteristics, they provide limited insights into within group differences and patterns across variables. In order to gain a more integrated perspective, we developed a smallholder typology through cluster analysis in order to cluster sampled plot owners into more homogenous sub-groups where within-group variances were minimized across a range of variables. Specifically, we adopted a hierarchical clustering procedure using agglomerative techniques, which sequentially formed clusters by merging individual cases based on similarity. A hierarchical procedure was preferred over clustering procedures such as, for example, k-means and two-step since the number of desired clusters could not be pre-identified and because of its appropriateness for our type of clustering variables (e.g. being either nominal or ordinal) (Mooi and Sarstedt, 2010). We employed one of the most widely used clustering algorithms, Ward's method, because of the absence of outliers and the algorithm's tendency to combine clusters with small numbers of observations (Dolnicar, 2002; Ward, 1963). The number of clusters was determined through the analysis of a dendrogram and scree plot, which, based on the change in distance between mergers, pointed to either a five- or a seven-cluster solution. A seven-cluster solution was considered more appropriate since that split large farmers into two separate groups, whereas the five-cluster solution would treat them as one group. This better aligned with qualitative field observations, which suggested that larger farmers in peatland areas adopt different business strategies and have a different social background than larger farmers in established agricultural areas.

The cluster analysis drew on five variables, namely (1) *total area of oil palm land owned by plot owner* (split into three categories: small farmers (≤ 3 ha), medium-sized farmers (3.1 – 15 ha) and large farmers (> 15 ha), representing differences in wealth between farmers; (2) *primary* *place of residence of plot owner*, in order to capture absenteeism and possible involvement in day-to-day plot management; (3) *origin of plot owner*, in order to capture the role of external/migrant actors in sub-sector development; (4) *plots' primary soil type*, to capture differentiation based on geography (this also functions as a proxy for preparedness to take risks due to the hazardous nature of production on peatlands); and (5) *land status,* which illustrates the legality or potential legality of land ownership. Although ethnicity is often considered to strongly shape social differentiation in Indonesia (Aspinall and Sukmajati, 2016), and is therefore included in the results, it was excluded from the hierarchical cluster analysis because it strongly correlated with the 'origin of plot owner' variable, thereby resulting in clusters being excessively defined by differences in heritage. Because mixed variables should not be used in a hierarchical cluster analysis, all variables were converted into binary variables. Cases with missing data were omitted from the analysis. This reduced the total number of cases used in the cluster analysis from 1,840 to 1,728.

2.4 Results

2.4.1 The social geography of smallholder oil palm production

In the research areas, small independent oil palm farmers made up more than half the total smallholder population, but own only 20% of the area (Figure 2.4). Large independent oil palm farmers are, despite comprising only 8% of the population, the most dominant land users, owning 50% of the area under oil palm in the two research areas. Large variations between the two sampled landscapes can be observed, however. For example, in the established agricultural landscape of Central Rokan Hulu (CRH), small farmers, proportionally, occupy almost four times more land than they do in the frontier landscape of Bonai Darussalam (BD). Conversely, large farmers occupy 70% of the smallholder land area in the frontier area (BD), but only 25% of the smallholder land area in the established agricultural area (CRH). This suggests that smallholder oil palm in peatland areas is rarely owned by genuine smallholders, who instead tend to gravitate towards more populous

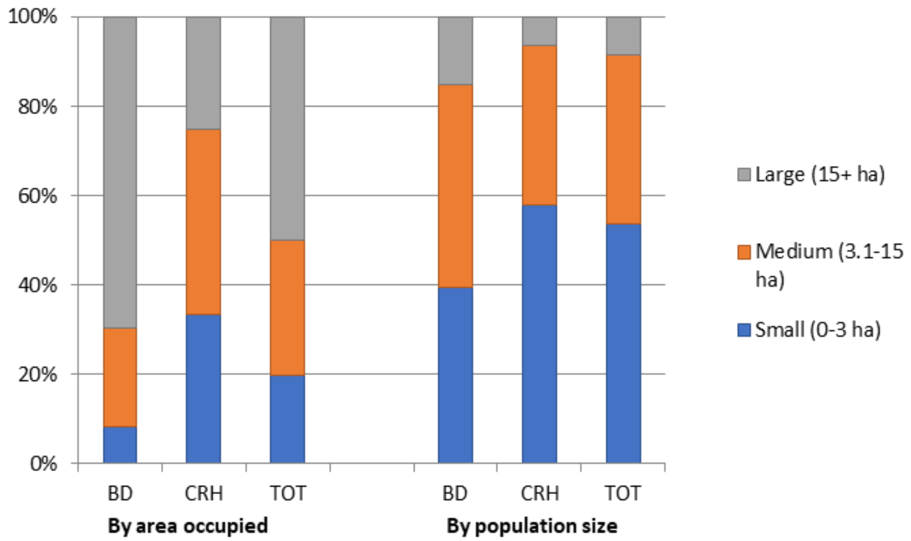

Figure 2.4 Prevalence by farmer size category

and established agricultural areas on mineral soils. This can be attributed to the comparatively high costs of establishing plantations on peatland soils (e.g. due to additional land preparation and water management) and comparatively high risks (e.g. due to fire and pests), and hence frequent low productivity (Gaveau et al., 2014; Lim et al., 2012; Woittiez et al., 2017). Moreover, in peat areas, physical and production infrastructure tends to be less developed, thereby further increasing production costs and reducing access to production inputs. Off-farm economic opportunities and public services are also more plentiful in the established agricultural area than in the frontier area. On the other hand, land prices in frontier areas tend to be considerably lower than in more populous established agricultural areas, thereby making it attractive for land speculation.

An often-cited advantage of smallholder agriculture over corporate agriculture is that those working on smallholder plantations often have a more vested interest in the plantation's productivity than those working on corporate plantations due to the use of household rather than hired labour, which by and large has a greater vested interest in the performance of the plantation (Hayami, 2010; Hazell et al., 2010). The plot owner's primary place of residence is a useful indicator of the possibility of the direct involvement of the plot owner (and his/her household) in the day-to-day management of the smallholder plantation. Figure 2.5 shows that in the established agricultural area (CRH), 75% of the farmers live by their plots or within the village nearest to them and that 58% of the planted oil palm area is owned by these farmers, suggesting that much of the planted smallholder oil palm can be directly managed or monitored by its owners. In the frontier (BD), however, only 55% of the farmers live in the same village as their oil palm plantation. They cultivate only 22% of the planted oil palms, while 70% of the planted smallholder area is cultivated by farmers living outside Rokan Hulu district. This shows that smallholder production in frontier areas is more likely to be characterized by absenteeism. This in turn suggests that smallholders operating in such areas are less likely to comply with the popular definition of smallholder (e.g. a person who relies predominantly on household labour for agricultural production activities) or directly involved in monitoring of plantation performance.

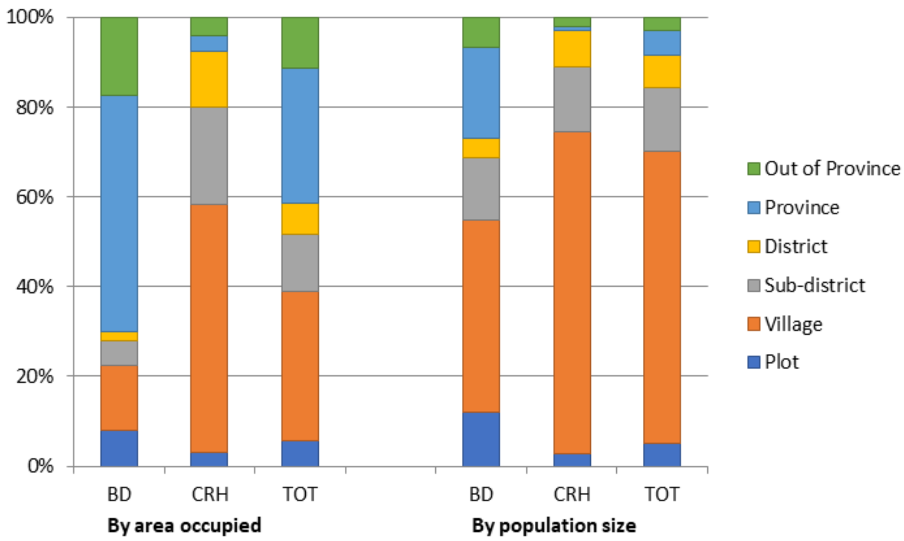

Figure 2.5 Prevalence by place of primary residence

Ethnicity is widely considered to strongly shape the social geography of oil palm production, with non-indigenous, more affluent and politically aligned migrant groups often viewed as benefiting disproportionately from sector expansion (Budidarsono et al., 2013; McCarthy and Zen, 2016; Zen et al., 2016). The results show that in terms of numbers, the most dominant group is Javanese (50% of smallholders in the study areas), followed by North Sumatran and indigenous Batak (25%) and the indigenous Malay (23%). According to BPS data (2011) on the 59 villages captured in the research, 39% are predominantly Javanese, 19% predominantly Batak and 42% predominantly Malay. Because Malay villages are often less populous than Batak and Javanese villages, this distribution suggests that the participation rates of the Malay population may be comparatively low and those of the Batak population comparatively high. Much of the Javanese population settled in Riau through the government's transmigration schemes in the 1980s, but many also came as spontaneous migrants (often from North Sumatra). These Javanese, who are often referred to as Java – Medan, migrated to Riau for the reasons as many Bataks, namely high land prices in North Sumatra and the availability of cheap land in Riau (Susanti and Maryudi, 2016). As the Javanese population plays a dominant role in Indonesian politics and culture, they have historically often been prioritized in Indonesia's development initiatives (e.g. through the allocation of land under transmigration schemes). While certainly evident in the number of Javanese farmers active in the sector, Figure 2.6 shows that their footprint on the smallholder landscape is relatively modest. This suggests that Javanese oil palm farms are on average small in comparison to Batak and Sino-Indonesian farms in particular. The findings show that of all the ethnicities, Javanese farmers have the smallest average plot size (1.8 ha), reflecting the Javanese demographic participating in transmigration schemes. The footprint of transmigration is also evident in Bonai, where a transmigration scheme is located in the southwest, partly explaining the uncharacteristically large share of small farmers in that area. In contrast, Malay farmers have 2.4 ha plots on average, Bataks 5.3 ha and Sino-Indonesians 226.2 ha. While Sino-Indonesian farmers comprise only 0.3% of smallholders, they account for 17.9% of the total area cultivated by smallholders in the study area and 31.8% in the frontier areas. As they are most economically dominant ethnic group in Indonesia,

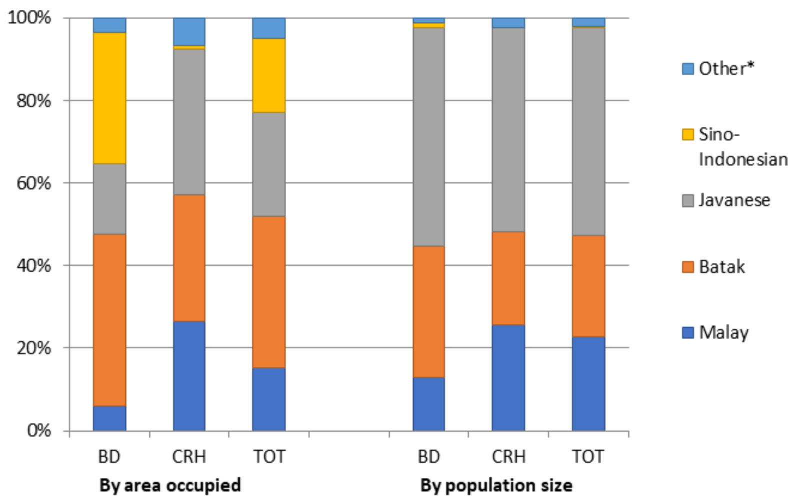

Figure 2.6 Prevalence by ethnicity

* The 'Other' category is comprised largely of Minang, an ethnic group indigenous to West Sumatra

this further points to the tendency of more affluent and arguably entrepreneurial groups to drive oil palm expansion onto peatlands/frontiers (BD). Bataks appear well represented in the established agricultural as well as the frontier areas. Whereas some Bataks are indigenous to the established agricultural area (CRH), they are not to the Bonai frontier (BD). The Malay population on the other hand appears to predominantly exploit the more populous established agricultural areas (CRH), partly due to pre-existing land claims, risk aversion and other socioeconomic ties they have with their indigenous environment.

An analysis of plot owners' origins reveals, predictably, similar trends. The vast majority of plot owners (63%) originate from outside Riau, meaning they are first-generation migrants to Riau and/or they established farms in Riau while residing in different provinces (Figure 2.7). In line with the observed ethnic distribution, oil palm farmers originally from outside Riau are comparatively dominant in the frontier, in terms of both numbers and area. Only 4% and 31% of the smallholder oil palm area in the frontier (BD) and established agricultural area (CRH), respectively, is cultivated by farmers who originate from the village in which their plantation is located. This highlights the prominent role of external stakeholders in driving the development of the independent smallholder oil palm sector in Riau.

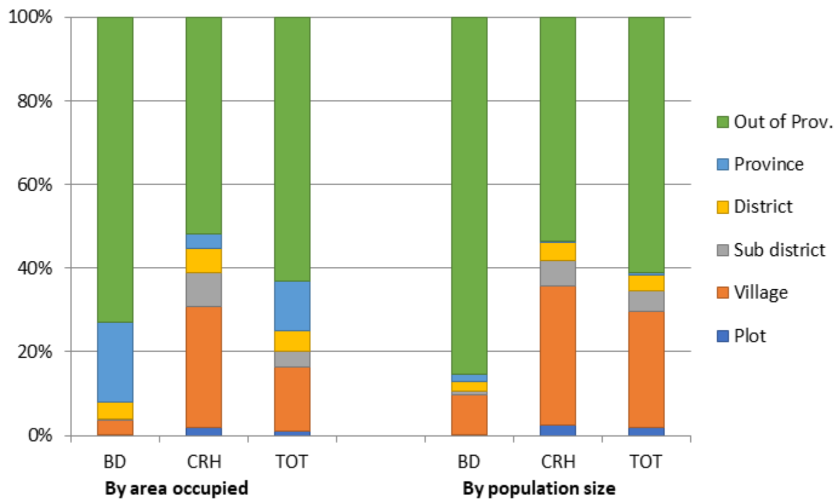

Figure 2.7 Prevalence by origin

2.4.2 The smallholder typology

The results of the hierarchical cluster analysis (HCA) are presented in Table 2.3. As indicated, seven relevant clusters were formed, each accounting for between 7% and 31% of the smallholder oil palm landscape and between 2% and 29% of the smallholder oil palm farmers (after correcting for survey bias). The seven clusters can be characterized as the following:

1) Small Local Farmers
   This group of small farmers both originates from and resides in the sub-district of their plantation. While the majority of this group are Malay (62%), Batak and Javanese farmers, who mostly migrated at least one generation ago, comprise 38% of farmers in this group. Although accounting for only 7% of the smallholder oil palm area, this group of farmers comprises 19% of all smallholder farmers, who on average have a 1.2 ha plot size. Most of these farmers are located on lands outside the forestry domain (thus in APL), typically because they have long established land claims in the more populous, mineral soil areas of Central Rokan Hulu.
2) Medium-sized Local Farmers
   These farmers are similar to the small local farmers in that all the farmers originate from and reside in the sub-district of their plantation. Although they, like the small local farmers, are dominated by the indigenous Malay, second-generation migrants, or migrants whose roots in the area go back even further, constitute the majority. Farmers in this group occupy 8% of the smallholder land area and constitute 11% of all farmers. While this group is located almost exclusively on the mineral soils of the established agricultural area, only 56% of this group are located at least partially on APL, significantly less than the small local farmers. This suggests that many farmers in this group have sought to expand individually onto lesser-populated state forestlands.
3) Large Resident Farmers
   Despite having an average plot size of 10.3 ha, these farmers usually own several of these plots and therefore are large farmers, as is shown in Section 2.4.4. Absenteeism is not prevalent since more than two thirds reside in the same sub-district as their plantations. While 28% originate from the sub-district, 67% originate from outside the district, indicating that this group is comprised especially of migrants. This group is ethnically diverse as it comprises a sizable number of Bataks, Malays and Javanese. These farmers cultivate 18% of the area and comprise 6% of the farmers, showing that despite not being numerous, they do have a significant footprint on the landscape. While they, like the farmers in groups 1 and 2, are located exclusively on mineral soils, they are considerably more likely to be located on state forestland (41%), suggesting that many of these farmers have sought to claim new land individually.
4) Small Migrant Farmers
   Farmers in this group are primarily migrants of Javanese origin who now live close to their plantations. Although this group accounts for only 10% of the smallholder oil palm area, with an average plot size of only 1.2 ha, they constitute 29% of farmers in the area, making it the most prolific group. These farmers exclusively cultivate mineral soils and are most likely to be established outside the legal forest zone. Because this group is comprised especially of trans-migrants and were therefore allocated land by the state, most of their plots have typically already been reclassified to APL.
5) Medium-sized Migrant Farmers
   On the basis of clustering variables, this group of farmers displays characteristics similar to those of the Small Migrant Farmers, with land size being the primary differentiating variable. Average plot size is about double (2.4 ha). This group is only present on mineral soils, lives close to their plantations and is largely Javanese. The farmers occupy 14% of the smallholder oil palm area and constitute 20% of all farmers in the area. Therefore, while they are less prevalent than small migrants, they have a larger footprint on the landscape.

Table 2.3 HCA results

Cluster	1	2	3	4	5	6	7
Size of farmers							
Small (≤ 3 ha)	100.0%	0.0%	0.0%	100.0%	0.0%	35.2%	0.0%
Medium (3.1 – 15 ha)	0.0%	100.0%	0.0%	0.0%	100.0%	64.8%	0.0%
Large (> 15 ha)	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
Soil type							
Peat soil	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
Mineral soil	100.0%	100.0%	100.0%	100.0%	100.0%	0.0%	0.0%
Primary place of residence							
Within sub-district	100.0%	100.0%	67.2%	86.6%	76.4%	64.8%	18.4%
Outside district	0.0%	0.0%	14.6%	5.7%	8.3%	28.8%	78.2%
Origin							
Within sub-district	100.0%	100.0%	28.5%	4.3%	2.1%	4.7%	2.3%
Outside district	0.0%	0.0%	67.2%	90.2%	88.8%	93.2%	95.4%
Land legal status							
Outside Forest domain (APL)	73.6%	55.7%	59.1%	82.8%	74.3%	26.3%	26.4%
Convertible production forest (HPK)	23.3%	37.0%	27.7%	10.4%	17.4%	11.9%	6.9%
Production forest (HP)	2.4%	1.6%	8.8%	7.0%	7.7%	62.7%	72.4%
Limited production forest (HPT)	2.0%	8.3%	6.6%	0.2%	1.5%	1.3%	6.9%
Ethnicity							
Malay	61.9%	47.6%	21.9%	9.6%	6.5%	7.2%	3.4%
Batak	20.6%	31.4%	40.9%	16.9%	23.6%	40.0%	54.0%
Javanese	17.2%	20.4%	29.2%	72.1%	66.4%	51.5%	14.9%
Sino-Indonesian	0.0%	0.5%	4.4%	1.4%	2.9%	0.4%	2.3%
Other	0.0%	0.0%	2.2%	0.0%	0.0%	0.4%	24.1%
Location							
Central Rokan Hulu (CRH)	95.3%	95.8%	80.3%	86.6%	86.7%	0.0%	0.0%
Bonai Darussalam (BD)	4.7%	4.2%	19.7%	13.4%	13.3%	100.0%	100.0%
Prevalence							
Total area within sample (ha)	281.6	342.4	793.1	437.9	638.5	638.0	998.3
Share of total area within sample	6.8%	8.3%	19.2%	10.6%	15.5%	15.4%	24.2%
Number of farmers within sample	296	192	137	441	339	236	87
Share farmers within sample	17.1%	11.1%	7.9%	25.5%	19.6%	13.7%	5.0%
Average plot size (ha) – bias corrected	1.2	2.4	10.3	1.2	2.4	3.5	49.8
Share of total research area (ha) – bias corrected	7.0%	7.7%	17.8%	10.3%	13.7%	12.7%	30.9%
Share of total farmers in research area – bias corrected	19.4%	11.3%	6.0%	28.9%	19.8%	12.5%	2.2%

6) Small and Medium-sized Peat Farmers
   The Small and Medium-sized Peat Farmers have an average plot size of 3.5 ha and are located exclusively on the Bonai peatlands. They account for 13% of the smallholder oil palm area and 13% of smallholder farmers. These farmers are mostly migrants from outside the district and although more than half reside within the sub-district, compared to farmers in groups 4 and 5 a large share resides outside the sub-district, illustrating that absenteeism is comparatively prevalent amongst these farmers and in such landscapes. Most farmers are Javanese or Batak; Malays comprise a small minority. Their farms are mostly located on state forestlands.
7) Large Peat Investors
   The farmers in this group are located exclusively in the Bonai peatlands and neither reside in nor originate from the area. With only 18% residing in the same sub-district as their plantations, few are likely to be involved in day-to-day plantation management. This group is the smallest in terms of numbers (2%) but the largest in terms of area (31%), with an average plot size of 49.6 ha. Although ethnically this group is dominated by Bataks, an ethnicity well represented across the clusters, it also comprises many Sino-Indonesians, who are rarely encountered in the other groups. Like the smaller peat farmers, most of these farmers are located on state forestland; only 26% are at least partially located on APL. This illustrates that this group plays an important role in oil palm expansion on to peatland and state forestlands. Considering their size and comparatively high rate of absenteeism, farmers in this group clearly operate more like companies than smallholders.

2.4.3 Productive and economic characteristics

This section provides an overview of selected results from an analysis of the 231 in-depth surveys. Based on these data, it presents the differences and similarities between the seven clusters across a range of themes, namely (1) the role of oil palm in livelihoods, (2) land legality, (3) market linkages and (4) production practices.

2.4.3.1 Role of oil palm in livelihoods

Oil palm accounts for the majority of income for most farmers in most groups (Table 2.4). Based on an average total farm size of 1.7-2.3 ha, small local and migrant farmers derive an estimated net income of 1.5-2.0 million IDR per month from oil palm cultivation[5]. This is close to the minimum wage in rural Riau (1.8 million IDR). However, since the cultivation of oil palm only requires an estimated 0.2 man-years per ha (Tinker 2016), it tends to be one of the more desirable locally accessible sources of income. While household labour constraints should therefore not inhibit further expansion, the comparatively high costs of plantations and land reduce smallholders' capacity to expand acreage under production, especially in relatively developed areas such as Central Rokan Hulu. For example, a regular oil palm plantation now costs 50-150 million IDR per

5 Based on an average price of 1,055 IDR kg^{-1} for FFB for independent farmers in Rokan Hulu in 2015 (data obtained from the District Plantation and Forestry Office) and an average yield of 15.5 tons of FFB per year (survey result, including immature stands), the average gross revenue per hectare is 16.5 million IDR per year or 1,375,000 IDR per month. With 35% of gross oil palm revenues being spent on fertilizers, herbicides and transport costs (Cramb and Sujang, 2016), net monthly income for independent oil palm farmers is estimated at approximately 900,000 IDR ha^{-1} month (excluding labour and land costs). Based on February 2017 exchange rates, 1 million IDR is equivalent to approximately 75 US$.

Table 2.4 Role of oil palm in livelihoods

Type of farmer		Small Local Farmers	Medium-sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium-sized Migrant Farmers	Small & medium-Sized Peat Farmers	Large Peat Investors
n		30	32	33	33	39	31	31
Plot size	ha	1.1	2.9	52.3	1.4	3.4	4.2	179.2
	Std. dev.	.6	1.4	76.2	.6	2.2	3.4	222.9
Total area under palm	ha	1.7	6.9	94.5	2.3	6.8	5.1	241.0
	Std. dev.	.6	3.0	106.0	.8	2.4	3.3	274.0
Other sources of income	Civil servant	10.0%	16.7%	20.8%	0.0%	21.6%	3.6%	16.0%
	Company employee	6.7%	3.3%	20.8%	3.1%	13.5%	35.7%	32.0%
	Other non-agrarian	23.3%	30.0%	41.7%	21.9%	35.1%	7.1%	52.0%
	Land labourer	23.3%	6.7%	4.2%	50.0%	8.1%	39.3%	0.0%
	Other farm	63.3%	73.3%	37.5%	40.6%	43.2%	14.3%	12.0%
Income from oil palm	% total income	48.0%	61.5%	70.2%	56.7%	62.8%	53.3%	54.2%

ha in the research area, which tends to exceed what most small farmers are able to pay or borrow (see section 2.4.6 for an analysis of capital sources).

Despite the prominent role of palm in livelihood portfolios, most farmers also derive income from other sources. For example, more than one third of medium-sized migrant and large resident farmers also earn an income from formal employment (especially as civil servants), and more than one third of small farmers do so from menial labour. Almost half of large farmers also own businesses unrelated to palm. Moreover, many farmers, especially the small and medium-sized farmers on mineral soils, are also engaged in the cultivation of other crops, notably rubber and to a lesser extent paddy. Most small and medium-sized farmers were engaged in agriculture prior to adopting oil palm; few, especially local farmers, abandon all their previous crops in favour of oil palm. This suggests that smaller farmers are reluctant to fully specialize in palm production. Large peat farmers in contrast have comparatively low on-farm diversification rates and limited prior farming experience. This suggests that many farmers in peatland areas are not seasoned farmers, but are engaged in palm production strictly as a business venture. This is consistent with observations that the exploitation of peatland requires considerably more entrepreneurialism, as is also evidenced by the comparatively high rate of business ownership amongst peat farmers.

2.4.4.2 Land legality

There are pronounced differences between the different groups with respect to the legality of their oil palm landholdings. Small and medium-sized migrant farmers are, for example, most likely to be located on APL, while large resident and peatland farmers are mostly located within the state

Table 2.5 Land legality

Type of farmer	Small Local Farmers	Medium-sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium-sized Migrant Farmers	Small & medium-Sized Peat Farmers	Large Peat Investors
n	28	30	32	32	39	30	24
No legal registration	39.3%	23.3%	6.3%	9.4%	0.0%	0.0%	0.0%
Village level (SKT)	21.4%	26.7%	21.9%	28.1%	33.3%	50.0%	12.5%
Sub-district level (SKGR)	21.4%	23.3%	40.6%	15.6%	12.8%	46.7%	83.3%
National Land Agency (SHM)	17.9%	26.7%	31.3%	46.9%	53.8%	3.3%	4.2%
State forestland and registered*	3.6%	40.0%	53.1%	18.8%	41.0%	86.7%	66.7%
State forestland and not registered	10.7%	10.0%	3.1%	9.4%	0.0%	0.0%	0.0%
APL and not registered	28.6%	13.3%	3.1%	0.0%	0.0%	0.0%	0.0%
APL and registered	57.1%	36.7%	40.6%	71.9%	59.0%	13.3%	33.3%

* The plots of four of the farmers are located on both state forestland and APL. For the purpose of this analysis, they are classified as being located on state forestland and not APL.

forest domain (see Table 2.5). Accordingly, many small and medium-sized migrant farmers possess nationally recognized land rights (SHM), while peat farmers generally possess village (SKT) and sub-district level (SKGR) land documentation. Local farmers on the other hand are most likely to not possess any land documentation, despite typically being located on APL. This is attributable to the perceived legitimacy and security of historical claims and traditional land access mechanisms. The SKT and SKGR documentation governing many of the land claims of peatland farmers are of questionable legality and cannot be equated with fully secure land ownership, since they cannot be formalized through the National Land Registration Agency (BPN) if they are located in state forestlands. In frontier areas like Bonai, land markets are often shaped by the so-called *Mafia Tanah* ('land mafia'), a complex network of local public and private actors that facilitates access to land that cannot be formally alienated and allocated for palm production (e.g. in the state forest domain). Land documentation in such areas is often obtaining through grey and/or informal legal processes that are a combination of overlapping authorities, weak institutional capacity, corruption and a lack of sanctions when rules are violated (Enrici and Hubacek, 2016). However, if the government does not initiate land reclassification programmes these producers cannot be certified because land ownership documentation on state forestland is not recognized under, for example, ISPO. The lack of such documentation also restricts access to key production inputs such as bank credits and certified planting material. As shown in Table 2.5, it is especially the larger farmers in mineral soil areas and the peatland farmers who tend to possess land documentation that is not recognized by public and private sustainability initiatives such as ISPO and RSPO. Incompliance issues are, however, also prevalent amongst the local farmers, but because they are often located on land that allows for oil palm production, only land formalization support would be required to resolve land legality challenges. However, local farmers often perceive the formalization process as time-consuming and expensive without significantly affecting tenure security[6].

2.4.4.3 Market linkages

There are significant differences between the groups in terms of how they access both off-take and input markets. The two groups of larger farmers are, for example, significantly more likely to sell directly to the mills through their own delivery orders, as they are more likely to deliver FFB that meets the mills' quantity requirements, thereby cutting out middlemen or allowing these farmers to become middlemen as well. All the small and medium-sized farmers groups instead sell their FFB to middlemen who bulk and sort the FFB based on quality. Smaller middlemen often sell to larger middlemen since they are unable to obtain a delivery order from a mill. The smaller peat farmers are especially dependent on small middlemen. This can be attributed to a poorer production infrastructure and higher logistics costs in the peatland areas and the comparatively low quality of FFB of smaller peat farmers.

The medium-sized and large farmers in the mineral soil areas (Types 2, 3 and 5) on average obtain significantly higher FFB prices than the other farmers. This suggests that in an area with a well-developed marketing infrastructure (and therefore more competition among middlemen), higher production volumes increase the farmers' bargaining capacity – despite observations that some middlemen engage in the (legally questionable) practice of price fixing. In peatland areas, where the road network and input and off-take markets are less developed, the FFB purchase price is on average lower than in mineral areas, especially for smaller farmers. This is partly a result of less competitive and mature off-take markets and nearby mills not purchasing smallholder produce due to full processing capacity and perceived poor quality. Regardless, across the board, prices obtained by independent smallholders are between 32% and 53% lower than TIM-POKJA prices, namely the prices that companies, the government and plasma smallholders agree upon during weekly plasma price setting meetings at the provincial level. This is inter alia a result of a lack of collective organization and bargaining, the additional margins absorbed by middlemen, the externalization of transaction costs and the comparatively low quality FFB of independent farmers.

The quality of the planting material strongly shapes the type of fruits produced and hence the oil content and the quality of the produce. For example, two common fruit forms, dura and tenera, differ significantly in their oil content; on average, a tenera fruit contains 30% more oil per FFB than dura due to its large mesocarp (fruit) to endocarp (kernel) ratio (Corley and Tinker, 2016). As a result, in establishing FFB prices many mills and middlemen will evaluate each load individually. Findings show that on average 32% of sampled farmers' oil palms produce fruits with tenera characteristics, with the large farmers and peat farmers having a slightly higher share of tenera than mineral soil small and medium-sized farmers (Table 2.6). This widespread use of sub-standard planting material by independent smallholders is primarily attributable to sourcing mechanisms. Findings show that farmers who procure from certified seedling dealers or directly from commercial seedling producers tend to have a significantly higher proportion of tenera fruits from their plantations than farmers who procure from uncertified (and informal) seedling dealers or use loose fruits. As expected, almost two thirds of the two groups of better capitalized larger farmers procured seedlings from certified dealers or directly from commercial producers, while

6 According to Clarvis and Litovsky (2015) the cost of certifying a plot is approximately 315 US$.

Table 2.6 Input and off-take markets

Type of farmer		Small Local Farmers	Medium-sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium-sized Migrant Farmers	Small to Medium-sized Peat Farmers	Large Peat investors
n		30	31	33	33	40	30	32
Marketing	Middlemen without delivery order	40.0%	29.0%	6.1%	66.7%	38.5%	87.1%	25.0%
	Middlemen with delivery order	56.7%	61.3%	48.5%	30.3%	56.4%	12.9%	34.4%
	Delivery order	3.3%	9.7%	45.5%	3.0%	7.7%	0.0%	46.9%
FFB price	% of TIM-POKJA price	47.6%	50.6%	68.0%	46.9%	56.2%	47.4%	55.5%
Source of capital for plantation development	Private capital	100%	96.7%	96.9%	100%	100%	93.5%	96.2%
	Bank loan	0.0%	16.7%	18.8%	9.1%	17.9%	0.0%	0.0%
	Social fund	0.0%	0.0%	3.1%	0.0%	0.0%	0.0%	3.8%
	Other	0.0%	0.0%	0.0%	0.0%	0.0%	6.5%	0.0%
Planting material suppliers	Official seedling company	6.9%	0.0%	31.3%	3.0%	5.0%	6.7%	34.5%
	Local agent with certificate	17.2%	32.3%	34.4%	12.1%	25.0%	30.0%	31.0%
	Local agent no certificate	51.7%	51.6%	18.8%	54.5%	40.0%	40.0%	20.7%
	Loose fruits	31.0%	25.8%	6.3%	18.2%	12.5%	6.7%	6.9%
	Unknown	3.4%	3.2%	18.8%	15.2%	20.0%	16.7%	20.7%
Fruit types[1]	Dura	75.4%	72.6%	64.1%	83.0%	70.9%	62.9%	53.6%
	Tenera	24.6%	27.4%	35.9%	17.0%	29.1%	37.1%	46.4%
Source chemical fertilizer purchases *	Local vendor	84.9%	81.9%	92.9%	66.7%	90.6%	88.5%	96.7%
	Oil palm company	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%
	Cooperative	4.1%	3.2%	6.1%	4.9%	3.4%	3.8%	0.0%
	Informal farmers group	0.0%	12.8%	1.0%	12.3%	1.7%	1.3%	0.0%
	Government	1.4%	0.0%	0.0%	2.5%	0.0%	0.0%	0.0%
	Middlemen	5.5%	0.0%	0.0%	11.1%	2.6%	5.1%	0.0%
Fertilizers	Quality is good (non-false)	100.0%	100.0%	83.3%	84.4%	91.7%	77.3%	80.0%
	Available on time	92.0%	100.0%	90.0%	90.3%	89.2%	78.3%	85.2%

* Non-chemical fertilizers used were manure and empty fruit bunches. Manure was sometimes used by smaller farmers and usually came from their own chickens and was applied in small quantities. Empty fruit bunches were reported in only seven cases. Data based on 633 chemical fertilizer applications mentioned by farmers.

only 15% and 24% of small migrant and small local farmers, respectively, procured from official sources.

With regard to fertilizers, most farmers (87%) rely on local shops; cooperatives and informal farmers groups supply only a small proportion of farmers. Government and larger oil palm companies play an insignificant role in smallholder fertilizer supply. Many medium-sized and large farmers indicated that because subsidized fertilizers often do not arrive on time and in the desired quantities, they prefer to source from local vendors, which are especially plentiful in the more established agricultural areas. Despite the alleged prevalence of fertilizers that do not meet quality standards, most farmers do not consider this problematic.

With regard to plantation establishment, the overwhelming majority of farmers in all seven groups rely primarily on private capital; only a small proportion rely on formal credits through local banks. The medium-sized and large farmers in the mineral areas (Types 2, 3 and 5) are most likely to obtain credits through formal channels. These capital sources are often inaccessible to small farmers due to a lack of collateral and/or legal land documentation and the absence of formal employment income. Although our data suggest that independent smallholder development is financed primarily through personal savings, the role of informal moneylenders was (unfortunately) not explicitly captured in the survey instruments. Qualitative evidence suggests, however, that middlemen trading FFB also provide short-term loans and fertilizers on credit, which are repaid in FFB. This is a common strategy to lock-in smallholders. Unlike bank credits, these loans rarely cover land purchases or plantation establishment, but rather operational or large consumptive expenses.

2.4.4.4 Production practices

With respect to plantation management, small migrant and local farmers rely primarily on the labour from the nucleus household, while the two large farmers groups rely primarily on hired labour, with medium-sized farmers relying on both. Of the different plantation management activities captured by this research, harvesting tended to involve the largest proportion of hired labour for most groups, as harvesting tends to be the most strenuous, time-consuming and skill-intensive activity. While the size of operations strongly determines household labour participation rates, so too does primary place of residence, thereby confirming our earlier hypothesis on the effects of absenteeism. For example, findings show that 87% of the farmers residing within the sub-district of their plantation involve household labour for fertilizer application, as opposed 53% of those residing outside the sub-district. Obviously, there are strong interaction effects between size, place of residence and location (e.g. frontier (BD) farmers are on average larger and more inclined to reside further from their plantations). Regardless, most of the medium-sized and large farmers do not allocate household labour for plantation management, suggesting that in addition to their size most do not comply with the labour criteria adopted in smallholder definitions.

Of the farmers, 74% had no prior experience with oil palm through working for an oil palm company or for other farmers. Large resident farmers and small to medium-sized peat farmers, the latter frequently working for larger investors, had the most prior experience (50% and 63%, respectively). While prior experience is by no means a guarantee that good management practices are adopted, the general lack of any prior agronomic experience with the crop undoubtedly undermines productivity and adherence to sustainable production practices. The most important sources of information amongst all farmer types appear to be informal farmers groups and input suppliers. Although we cannot evaluate the quality of information originating from those sources, the limited and uneven access to professional sources of information such as oil palm companies and government extension services raises concerns about the effectiveness of knowledge

Table 2.7 Production practices
See Appendix C for productiity graph by Cramb (2016; p. 32).

Type of farmer		Small Local Farmers	Medium-sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium-sized Migrant Farmers	Small & medium-Sized Peat Farmers	Large Peat Investors
n		30	31	33	32	39	30	30
Yield compared to Cramb (2016) productivity graph	Proportion mean yield	100.4%	101.4%	102.9%	103.8%	103.0%	84.2%	80.0%
	Std. dev.	25.3%	35.3%	24.8%	34.8%	24.8%	37.5%	32.0%
Labour: fertilizer application	Household	96.7%	69.0%	21.2%	87.9%	60.0%	51.7%	3.1%
	Extended family	0.0%	13.8%	18.2%	15.2%	32.5%	31.0%	3.1%
	Hired labourers	3.3%	17.2%	66.7%	3.0%	17.5%	17.2%	93.8%
Labour: harvesting	Household	80.0%	45.2%	9.1%	57.6%	17.9%	36.7%	3.1%
	Extended family	10.0%	35.5%	27.3%	39.4%	38.5%	43.3%	3.1%
	Hired labourers	10.0%	29.0%	63.6%	3.0%	43.6%	20.0%	93.8%
Sources of information on plantation management	Shop	11.5%	22.2%	13.8%	28.6%	25.6%	3.7%	4.3%
	Oil palm company	0.0%	3.7%	31.0%	3.6%	10.3%	7.4%	30.4%
	Cooperative	0.0%	0.0%	6.9%	0.0%	0.0%	3.7%	0.0%
	Informal Farmers groups	76.9%	70.4%	37.9%	64.3%	56.4%	77.8%	52.2%
	Government extension	0.0%	3.7%	6.9%	3.6%	5.1%	0.0%	0.0%
	Other, usually middleman, books or internet	11.5%	3.7%	6.9%	3.6%	7.7%	3.7%	13.0%
Organize development of drainage system (where relevant)	n	3	5	13	4	2	22	26
	By farmer	0.0%	60.0%	100.0%	25.0%	50.0%	45.5%	80.8%
	With friends and family	0.0%	0.0%	7.7%	0.0%	0.0%	0.0%	3.8%
	Collectively with other nearby farmers	66.7%	20.0%	0.0%	50.0%	50.0%	27.3%	30.8%
	Government	33.3%	0.0%	0.0%	25.0%	0.0%	0.0%	0.0%

dissemination in the area. Larger producers are most likely to benefit from company information by virtue of their direct access to mills and access to professional networks.

In terms of infrastructure development, peatland farmers in particular were often responsible for developing and maintaining public feeder roads to plantations, reflecting the lack of direct government involvement in opening up and the spatial planning of frontier areas. However, road networks established by logging, corporate oil palm and petroleum companies have greatly contributed to opening up Bonai. Large farmers with large plots often developed road networks individually or with their neighbouring large farmers; smaller farmers often did so collectively. These costs further contribute to the high costs of plantation establishment and management in peatland areas and, therefore, to the greater presence of larger and more capitalized smallholders. With regard to the development of drainage systems, which is especially pertinent in peatland areas, particularly the larger farmers also often coordinate canal development themselves (smaller farmers do so collectively; see Table 2.7), with negligible oversight and contribution from the government. This lack of government involvement is highly problematic, since unplanned and unregulated drainage systems produce a host of undesirable environmental impacts such as the lowering of the entire landscape's water table, peat oxidation, CO^2 emissions and the increased threat of peat fires.

2.5 Discussion: Smallholder certification and upgrading challenges

While this chapter does not fully explore the nature and scope of independent smallholder ISPO and RSPO incompliance, but focuses on unpacking the heterogeneity of smallholder oil palm producers, the results do highlight structural issues that many of the sub-groups face and that present obstacles to upgrading and improving producer adherence to public and private sustainability standards. For example, both ISPO and RSPO have stringent land legality requirements. The findings shows that the majority of the sampled smallholders (54%) are incompliant because they are either (i) located on APL but are not in possession of any land registration documentation (11% of incompliant farmers); (ii) located on state forestland and have no land registration documentation (8.5%); or (iii) located on state forestland and wrongly possess land registration documentation (80%). Most incompliant smallholders fall into the last category, highlighting how extra-legal land registration of state forestland has become common practice in parts of Indonesia. This raises serious questions about appropriate pathways for preventing further disarticulation and criminalization of oil palm smallholders. While land registration initiatives could allow a comparatively small number of smaller farmers to operate on land in compliance with land legality requirements, most incompliant producers will remain incompliant unless the state forestland on which they are operating is reclassified as APL. However, as this research has shown, the smallholders pioneering development in ecologically significant and sensitive peat- and forestlands are often economic and political elites whose operations more closely resemble that of corporate plantations than family farms. Such farms often primarily fulfil investment (and sometimes speculation) purposes rather than basic needs. Regularizing and supporting the upgrading of such farmers is therefore foremost about environmental management and sector competitiveness as opposed to being an inclusive development issue. With increasing demand for ISPO and RSPO compliant oil palm, alienating incompliant farmers is likely to further bifurcate the palm oil market and reduce the capacity of government agencies to disseminate technologies and provide extension support (e.g. because public resources cannot legally be allocated to oil palm cultivation on state forestland). This also applies to corporate technical or financial support, since corporations also increasingly require proof of legal land ownership from their sources. Here the state arguably bears responsibility for addressing legality problems given the past *laissez faire* approach to independent oil palm expansion, conflicting legal frameworks and authorities, and lack of political will to enforce land and forest regulations.

Land reclassification and regularization raises a myriad of political challenges. Despite land use planning being mandated under the 2007 Indonesian Spatial Planning Law, Riau is yet to finalize its spatial plans (Resosudarmo et al., 2014; Susanti, 2016a). Conflicts between the Ministry of Forestry, which has vested interests in retaining control over the national forest estate, and sub-national governments seeking to consolidate their territorial authority have, amongst others, frustrated efforts to develop more coherent land use policies. The extra-legal land markets prevalent in frontier areas also points to rife illicit land trading practices in which local state actors are complicit. This could result in local opposition to efforts to upset the accumulation networks that the status quo has produced and sustained. Nevertheless, emerging political commitment to agrarian reform, the diplomatic fallout from Riau's frequent peatland fires, and lobbying efforts by major oil palm companies to develop territorial sustainability strategies is gradually increasing pressure on the different layers of governments to address the chaotic situation on the ground.

The second major upgrading challenge relates to the mechanisms through which smallholders access credit, production inputs and knowledge. Although not comprehensively assessed in this chapter, the low yields, the use of poor quality planting material and variable inputs, and the failure to adopt best management practices across all groups of the typology certainly undermines smallholder productivity, profitability and environmental performance potential. Findings show that inputs are typically sourced through vendors who are rarely able to guarantee quality and FFB is sold to mills through intermediaries. Direct access to mills is typically restricted to the larger farmers and access to official sources of inputs is limited by virtue of logistical challenges and a lack of land documentation (notably for planting material and bank loans). This not only adversely impacts smallholder productivity and offtake prices, but also results in insufficiently effective knowledge dissemination – with knowledge, especially for the groups with smaller and medium-sized farmers, typically obtained through informal farmers groups and vendors. Improved access to technical and managerial assistance through more formal channels is clearly needed to facilitate certification and upgrading more generally. For example, ISPO and RSPO certification would require organization into farmers groups or cooperatives, especially in the case of smaller farmers. However, cooperatives and official farmers groups in Indonesia have, as in many other places, a chequered history due to political misuse, poor leadership and internal conflict, leading to many farmers expressing apprehension about formal organization (Brandi et al., 2015; Feintrenie et al., 2010). Although there are cases in the oil palm sector where successful collective action by farmers has contributed to comparatively high yields and incomes (see e.g. Jelsma et al., 2017b), such organizations rarely emerge without substantial financial and institutional support. Although such groups could under the right conditions function as important vehicles for accessing formal sources of inputs, disseminating knowledge and collective bargaining, strengthening direct linkages between corporate producers and independent smallholders could lead to a similar effect, whilst alleviating the state cost burden. While some producers are trialing mechanisms to achieve that, viable business models that effectively resolve challenges associated with traceability, side-selling and the high costs of monitoring geographically dispersed smallholders (as opposed to consolidated plasma farmers) are yet to be developed. However, given the vertically integrated and producer-driven nature of the oil palm sector, it is questionable whether lead firms are sufficiently willing to absorb the risks and costs of strengthening backward linkages with independent smallholders. This suggests that effectively upgrading independent smallholders at scale and incentivizing investments to that effect, requires improved collaboration between civil society, the private sector and the state, for example in developing coherent territorial policies and strategies, harmonizing resource allocations, managing risks and exploiting differentiated capabilities. However, pervasive conflicts between and within these stakeholder groups, as well as widely diverging priorities, remain obstacles to developing more effective approaches.

Considering the high opportunity costs of public resources, it is debatable whether large resident and investor farmers should be prioritized for upgrading and compliance support. The findings show that, for example, for many of these farmers oil palm plantations often primarily function as investments, involve exclusively hired labor, and due to a high rate of absenteeism are often not directly managed by their owners. This raises questions about owner willingness to apply improved practices since many are arguably already sufficiently entrepreneurial and resourced to augment performance if so desired. Where interventions could yield tangible results is in preventing these farmers from entering sensitive areas by increased monitoring of these areas and addressing issues that are likely to arise when farmers in these groups are pressured to comply with the full ISPO and/or RSPO standards, which are considerably more comprehensive than the smallholder-specific guidelines. Since this invites greater scrutiny of operations and increases operational costs, farmers could be compelled to pursue opportunities to circumvent existing regulations (e.g. by registering plots in multiple names as is already common practice). Identifying potential incentive mechanisms and pathways to fostering compliance with full standards would therefore need to be more closely examined, as would addressing regulatory loopholes that have long enabled such farmers to operate under the guise of smallholders with impunity.

2.6 Conclusion

This chapter presented a typology of smallholders – comprised of seven unique groups – to demonstrate that smallholder oil palm farmers are not a uniform population. This diversity warrants the adoption of more actor-disaggregated intervention approaches to promote the upgrading of practices and standards compliance. For example, it was shown that the four small and medium-sized farmers groups operating on mineral soils could benefit from technical support in improving production practices, applying for the necessary permits and forming farmers groups for standards purposes, and improving access to formal input markets. Particularly small and medium-sized local farmers without land documentation would benefit from land certification initiatives. The legality and environmental issues posed by the larger smallholders and those operating on peatlands, on the other hand, require improved regulatory oversight, spatial planning and land reclassification programmes; recognizing that for many farmers in these groups – unlike farmers in the other groups – standards incompliance is attributable not to a lack of capacity, but to a lack of incentive.

The findings also show that many of Rokan Hulu's independent oil palm smallholders fit neither the legal nor the popular definition of 'smallholders'. While oil palm clearly plays an important role in rural development in Indonesia, this chapter has shown that the sector may not be as inclusive as is commonly depicted, with a large proportion of farmers who legally should but fail to comply with business regulations being wrongly classified as smallholders. Considering the evident preference of many of these farmers for frontier areas where land is cheap and abundant, genuine smallholders likely play an insignificant role in oil palm expansion into ecologically significant peatland and forestland areas. Rather, the findings point to the prominent role of external risk capital, speculation, informal land markets and a lack of capability and/or the duplicity of local authorities. However, with both national and international market access becoming increasingly conditional on producer compliance with both soft (RSPO) and hard (ISPO) regulations, the increasing risks associated with such operations could in future undermine the viability of further expansions into forest and peatland frontiers. Preventing the bifurcation of the oil palm market along the lines of formality and sustainability will likely prove instrumental in realigning the incentives of these smallholders. This will be fully contingent on the quality of ISPO enforcement, since failure to effectively sanction incompliance will enable mills producing purely for local or Asian markets to continue benefiting from a large unsustainable and/or ISPO incompliant smallholder supply base. Given the political sensitivity of criminalizing smallholders, vested interests, the political leverage of frontier producers, and the need to protect important pathways out of poverty, generating sufficient government commitment and collaboration across scales to enforce ISPO requirements for smallholders will not be an easy feat.

This chapter has shown how smallholders integrated into global agro-commodity chains are increasingly exposed to the effects of changing global environmental norms as expressed by increasingly rigorous public and private sustainability standards. While international standards emerged primarily to fill regulatory vacuums in producer countries, the scope and nature of smallholder incompliance issues demonstrates that with international actors increasingly dictating the terms of trade and production, states are required to play a more prominent role in sector development in order to resolve resultant development consequences. In the Indonesian oil palm sector, this could lead to a gradual shift from a laissez faire approach to independent smallholder expansion, to one where there is an increased commitment to address structural smallholder productivity, sustainability and legality issues in recognition of the fact that smallholder disarticulation from the global palm oil market is not in the interest of national development. It is, however, questionable whether the state is best positioned to resolve (and arguably responsible for resolving) these challenges, considering capacity and resource constraints and a lack of a coherent internal political vision. While corporate palm oil producers are in many respects better placed to resolve some of the challenges facing smallholders, the lack of an imperative and financial burden will likely stifle the innovation needed to build productive backward linkages. This is in large part attributable to the vertically integrated and producer-led structure of the palm oil industry and the lack of opportunities for product differentiation. Similar issues are also emerging in the timber and rubber sectors, which share similar industry structures. This calls for a closer examination of appropriate incentive mechanisms to harmonize stakeholder interests in support of resolving the adverse development implications that certification standards produce.

3 Do wealthy farmers implement better agricultural practices? An assessment of implementation of Good Agricultural Practices among different types of independent oil palm smallholders in Riau, Indonesia

New smallholder plantings in Bonai Darussalam, in the background a last bit of remaining forest (photo taken by the author in March 2015).

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3.1 Introduction

Palm oil has become the world's most produced and traded vegetable oil (USDA, 2016), largely due to its unrivalled land to oil ratio. The largest palm oil producing country is Indonesia, which accounts for 54% of global palm oil production. Palm oil is a key foreign exchange earner for Indonesia, with export earnings of 15.4 billion US$ in 2015, and therefore of crucial importance to the country (DJP, 2017b). The sector provides direct employment for an estimated 4.3 million people and indirect employment for another 12 million (BPDPKS, 2017). Oil palm growers in Indonesia are classified into three categories: privately owned companies, state owned companies and smallholders. Companies usually manage several thousand hectares to feed their mills (Byerlee and Deininger, 2013) and account for an estimated 60% of the oil palm area in Indonesia. The remaining 40% of the oil palm area is cultivated by smallholder farmers, mainly in Sumatra and Kalimantan (DJP, 2017b).

The remarkable expansion of oil palm over the past four decades has been accompanied by controversy. The sector has been associated with deforestation (Abood et al., 2014; Gaveau et al., 2017) and biodiversity loss (Obidzinski, 2012; Sayer et al., 2012). Peat fires and associated smoke, which covered large parts of Indonesia, Malaysia and Singapore in 2015, are a major source of GHG emissions and are often linked to oil palm expansion (Gaveau et al., 2014; Purnomo et al., 2017). The oil palm industry has also frequently been criticized for its negative social impacts on local communities (Afrizal, 2013; Colchester et al., 2006), unfair partnerships between local communities and companies (Cramb, 2013; Gillespie, 2010), and land grabbing (Gellert, 2015). These controversies have led to increased demands for sustainability and transparency in the oil palm sector, mainly due to customer demand in Northern countries (Hidayat et al., 2015). Measures are being taken to improve the performance of the industry, notably through certification schemes.

The Round Table on Sustainable Palm Oil (RSPO), a voluntary certification scheme initiated by major buyers and NGOs, is deemed to be one of the most stringent of numerous certification initiatives (Ivancic and Koh, 2016; Rival et al., 2016). It has pushed for better production standards by developing sustainability principles and criteria. Partially in reaction to this non-state actor initiative, the Indonesian government launched the mandatory Indonesian Sustainable Palm Oil (ISPO) certificate in 2009. The ISPO framework is currently being revised and strengthened in order to increase international recognition. In addition to these initiatives, the Indonesian Palm Oil Association (IPOA), the lobby group of the large-scale oil palm producers, strongly advocates the implementation of good agricultural practices (GAP). Whilst debated in academia (Alcott, 2005; Byerlee et al., 2014; Villoria et al., 2013), these actors promote a narrative in which GAP leads to yield increases per hectare so that less land is required to fulfil the global demand for palm oil. Thereby the environment is spared whilst farmers receive higher incomes. Corley (2009) suggested that the oil palm has a theoretical potential of 18 Mt of oil ha^{-1} $year^{-1}$ and Mathews (2010) reported best yields for whole estates of 8 Mt of oil ha^{-1} $year^{-1}$. Yet the average productivity in Indonesia in 2015 was only 3.6 Mt of oil ha^{-1} $year^{-1}$, with smallholders producing on average 20% less per ha than private companies (DJP, 2017b). While there is large scope for intensification throughout the sector, the smallholders currently are the weakest link in terms of productivity (Molenaar et al. 2013; Lee et al. 2013).

However, the smallholder segment of the sector is likely to continue to expand over the coming years (Euler et al., 2017) as it becomes more difficult for companies to open up large tracts of land. The most suitable lands are already occupied. Other factors that constrain company expansion through concessions include increasing scrutiny of the social and environmental performance of companies and the related impacts on financing (Van Gelder et al., 2017), and the oil palm moratorium, which freezes the issuance of new permits for oil palm plantations (Busch et al., 2015). There is also increased recognition of the rights of indigenous populations (Forest People Program, 2013), increased scrutiny from the anti-corruption agency and tax authorities (KPK, 2016), and new technologies that allow for easy tracing (and potentially sanctioning) of companies (see e.g. https://www.cifor.org/map/atlas/ for an overview of all oil palm concessions and mills in Borneo). The development of roads and mills by large-scale oil palm companies has paved the way for smaller actors to access markets more effectively and to cultivate the remaining patches of available land. This has happened particularly in Sumatra (home to 63% of Indonesia's 11.3 million ha of oil palms in 2015), where the oil palm boom emerged through corporate expansion, although smallholders currently account for 48.8% of the oil palm area (Bissonnette and De Koninck, 2017; DJP, 2017b). In other parts of Indonesia, mostly Kalimantan, large-scale expansion started later and smallholders account for only 26% of the oil palm area (DJP, 2017b). Although it can be expected that the smallholder area and share will increase, smallholders are in a vulnerable position as they are often included in the value chain on disadvantageous terms. These include poor access to certified planting materials and technological know-how, and a poor bargaining position when selling fresh fruit bunches (FFB), leading to low prices and being last in line to sell their FFB when supplies are ample (Cramb and McCarthy, 2016; Hidayat, 2017). The RSPO acknowledges the weak position of smallholders and addresses it by working towards redeveloping the certification approach to better accommodate smallholders and by prioritizing smallholder implementation of GAP above certification itself (RSPO, 2017a). Nevertheless, smallholders are prone to exclusion from value chains due to their large numbers, the high costs associated with certification and the current poor cultivation practices (Brandi et al., 2015).

The thin body of literature on the plantation practices of smallholders (see e.g. Euler et al., 2017; Lee et al., 2013) usually only differentiates between scheme and independent smallholders. Scheme smallholders account for roughly 40% of the smallholder area (Hidayat, 2017; Zen et al., 2015). They are characterized, despite there being a large diversity in these schemes with respect to support and management configurations (Gillespie 2011), by a partnership between farmers and companies, whereby the smallholder plantations are usually planted by the partner companies and bunches are sold to the partners' mills (Hidayat, 2017). Independent smallholder plantations on the other hand are usually developed autonomously, without resources from or commitments to oil palm companies (Hidayat et al., 2015). Scheme smallholders usually perform better than independent farmers as they are better integrated into large company plantation systems and hence often have yields close to corporate actors. Independent smallholder plantations, which account for about 2.8 M ha, are the least productive and it is among these farmers that the promotion of GAP appears most important.

GAP in oil palm have been defined based on extensive research by plantation companies, research institutes and universities, based on basic agronomic principles (see Fairhurst and Härdter (2003) and Corley and Tinker (2016) for an overview). In short, GAP in plantations concern soil and weed cover management, canopy management, harvesting, plant nutrition, and pest and disease management (Rankine and Fairhurst, 1998). At planting, GAP include using high-quality planting materials and planting at the right distance and in the right pattern. Good field management includes the maintenance of a weed cover with soft weeds (particularly *Nephrolepis* ferns, certain grasses and legume cover plants), maintaining good plantation access, proper harvesting and correct palm pruning. Appropriate fertilizer management is crucial for enhancing productivity, reducing negative impacts on the environment and, in certain situations, reducing input costs when fertilizers are inefficiently used (Goh et al., 2003; Soliman et al., 2016). Although smallholders operate in conditions different from those of company plantations (such as having FFB, rather than oil, as their end product, and having more limitations in access to heavy equipment and inputs), the same agronomic principles apply in smallholder fields.

In this chapter we explore the use of GAP by diverse groups of independent oil palm smallholders, including plantations that are on (or beyond) the blurry boundaries between family farms and large scale plantations (Bissonnette and De Koninck, 2017; McCarthy and Zen, 2016). The farmer typology applied is based on the study by Jelsma et al. (2017a), which highlighted that independent smallholders are not a homogenous group. Our objective was to understand the use of GAP among different independent farmer types in Riau, to identify points for improvement, and to support the development of differentiated policies and approaches towards increased productivity. To achieve this, we employed a range of methods such as farmer surveys, field visits, tissue sampling, photo analysis and the analysis of satellite images. Whereas Jelsma et al. (2017a) focused on market linkages, social diversity and legal aspects, this chapter delves into the implementation of GAP given its centrality in current debates surrounding the sustainability of the smallholder oil palm sector and further explores the hypothesis that larger farmers have more capital and therefore implement better agricultural practices than small farmers, who are usually more cash constrained.

3.2 Background

The research was conducted in Sumatra's Riau province, which is the province with the largest oil palm area in Indonesia (2.46 million ha). Approximately 28% of Riau's land area is planted with oil palm, of which 59% is owned by smallholders (DJP, 2015). About 33% of the palm oil processing capacity in Riau comes from independent mills (DIS-BUN Propinsi Riau, 2015), which do not own plantations and usually source from independent smallholders. This indicates the importance of the independent smallholder sector for the Riau oil palm industry. Within Riau our research focused on Rokan Hulu regency (Figure 3.1), which with 39 mills (17 without own plantations) and a total processing capacity of 1,605 Mt of fresh fruit bunches (FFB) per hour, has the largest palm oil processing capacity in the province (DIS-BUN Propinsi Riau, 2015).

The research area consisted of two distinct areas in Rokan Hulu (Figure 3.1), which allowed us to capture a diversity of smallholders and landscapes. The first area was Bonai Darussalam (further referred to as $0^0$52'-$1^0$24' N, $100^0$39'-$101^0$05' E in the northeast, which is a single sub-district, has a flat topography and largely consists of peat soils (histosols). The area has experienced considerable deforestation since the year 2000. It has a low population density and contains a large plantation for pulp and paper. Peat fires associated with oil palm developments were common in BD, where most land officially falls under the forestry domain. Although this implies that de jure the majority of the land cannot be used for oil palm cultivation, much of the oil palm expansion in BD has taken place in the forestry domain. BD can be considered a relative frontier in the Riau context.

The other research area was Central Rokan Hulu (comprised of six sub-districts and further referred to as CRH, $0^0$36'-$1^0$03' N, $100^0$05'-$100^0$45' E), which has a flat to slightly hilly topography in its oil palm growing regions and predominantly consists of mineral soils (mostly acrisols). Since the 1980s the area, which has long been inhabited by indigenous populations, has seen a considerable influx of both government sponsored and spontaneous migrants. Most land is classified for 'other use' (*Areal Penggunaan Lain* (APL) and hence can be legally planted with palm oil. The forest domain largely covers the forested foothills of the Barisan mountains and also includes a plantation for pulp and paper. CRH has a population density of 151 inhabitants per km^2 (BPS Rokan Hulu,

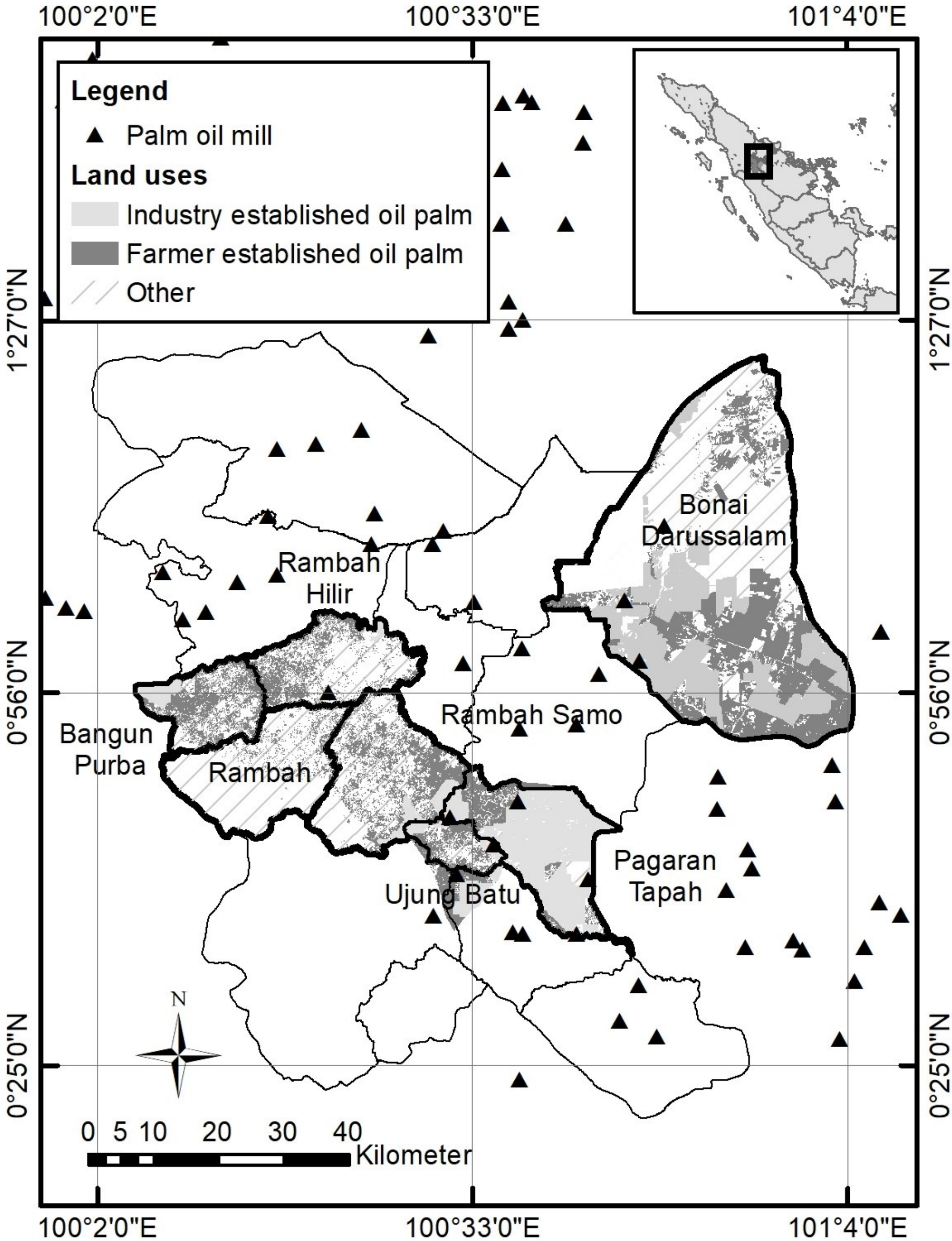

Figure 3.1 Overview research area, oil palm mapping and mills in the area
Sources: CIFOR mill mapping and own data

Table 3.1 Research area characteristics
Sources: own research and (BPS Rokan Hulu, 2015; CIFOR, 2014; MoA, 2011; MoF, 2014)

	Frontier (BD)		Established agricultural area (CRH)		Total (sampled sub-districts)	
Population density (people^{-1} km^{2})	29.5		151		95.1	
Land use	Area (ha)	Share	Area (ha)	Share	Area (ha)	Share
Deforested in 2000 – 13	84,739	61%	6,222	4%	90,961	30%
Forest remaining in 2013	7,379	5%	16,743	10%	24,122	8%
Oil palm	75,275	54%	76,302	46%	151,577	50%
Independent smallholder oil palm	39,252	28%	43,133	26%	82,385	27%
Company developed oil palm	36,023	26%	33,169	20%	69,192	23%
Non-state forest land (APL)	51,399	37%	101,050	62%	152,449	50%
Forest domain	87,538	62%	64,367	38%	151,905	50%
Peatland (>100 cm)	101,635	73%	0	0%	101,635	34%
Total area	138,949	46%	164,321	54%	303,270	100%

2015) and can be regarded as a relatively established agricultural area. Both areas have limited forests left (see Table 3.1 for details on research area).

The smallholder typology was developed by performing a hierarchical clustering analysis (HCA) among 1,728 farmers; it is described in more detail in Jelsma et al. (2017a). The variables used to develop the typology were inspired by the work of McCarthy et al. (2016) on rural differentiation through smallholder oil palm developments in Jambi province (Indonesia), where they contrasted local and migrant smallholders and differentiated between farms of different sizes and resource endowments. The key determinants used in developing the typology were: 1) area of smallholder oil palm (proxy for wealth); 2) origin of farmers (locals or migrants); 3) residence (absentee or resident farmers); 4) peat or mineral soils; and 5) land status (APL or state forest domain). The seven clusters derived by Jelsma et al. (2017a) were subsequently used in this analysis. Table 3.2 provides an excerpt from their study to characterize the different farmer types.

3.3 Methodology

3.3.1 Sampling

The sampling frame is based on spatial sampling using recent high-resolution Google Maps satellite imagery, from which smallholder plantations were mapped. The research area was subsequently divided into 25 ha cells from which a random sample of 5% (287 cells containing 4,451 ha of smallholder plantations) were visited. Small farmers were relatively prevalent in the established agricultural area whereas the frontier was dominated by large farmers. As especially the frontier area contains more large farmers who occupied several sampled cells, the number of farmer surveys is less than the number of cells visited. A total of 231 farmer and farm surveys were used in this study, including 30–40 farmers per farmer type (see Table 3.2 for details on sample sizes per farmer type). For all parameters that included expert photo assessments the sample size was reduced to 220, because for some plantations the photo sets were of insufficient quality to be assessed. For more details on sampling and tools applied see Jelsma et al. (2017a).

Table 3.2 Farm types and characteristics, and sample sizes
*= Sampling bias corrected; see Chapter 2 for more details

	Cluster	Small Local Farmers (SLF)	Medium-sized Local Farmers (MLF)	Large Resident Farmers (LRF)	Small Migrant Farmers (SMF)	Medium-sized Migrant Farmers (MMF)	Small & Medium-sized Peat Farmers (SMPF)	Large Peat Investors (LPI)
Farm size (ha)	Average plot size	1.1	2.9	52.3	1.4	3.4	4.2	179.2
	Average total area under oil palm	1.7	6.9	94.5	2.3	6.8	5.1	241.0
Primary place of residence	Within sub-district	100%	100%	67%	87%	76%	65%	18%
	Outside regency	0%	0%	15%	6%	8%	29%	78%
Origin	Within sub-district	100%	100%	29%	4%	2%	5%	2%
	Outside regency	0%	0%	67%	90%	89%	93%	95%
Ethnicity	Malay	62%	48%	22%	10%	7%	7%	3%
	Batak	21%	31%	41%	17%	24%	40%	54%
	Javanese	17%	20%	29%	72%	66%	52%	15%
	Sino-Indonesian	0%	0%	2%	0%	0%	0%	24%
	Other	0%	1%	6%	1%	3%	1%	3%
Soil type	Peat soil	0%	0%	0%	0%	0%	100%	100%
	Mineral soils	100%	100%	100%	100%	100%	0%	0%
Land classification	Outside Forest domain (APL)	74%	56%	59%	83%	74%	26%	26%
	Forest domain	28%	47%	43%	18%	27%	76%	86%
Location	Central Rokan Hulu	95%	96%	80%	87%	87%	0%	0%
	Bonai Darussalam	5%	4%	20%	13%	13%	100%	100%
Prevalence	Share of total farmers in research area*	19%	11%	6%	29%	20%	13%	2%
	Share of total research area (ha)*	7%	8%	18%	10%	14%	13%	31%
Farmer and farm surveys (231)		30	32	34	33	40	30	32
Valid paired surveys and photo interpretations (220)		29	31	33	31	39	29	28
Tissue samples (118)		13	10	19	15	14	23	24

3.3.2 Surveys and plantation visits for assessing the implementation of good agricultural practices

The fieldwork was conducted in May – June and August – September 2015. The survey instruments consisted of an in-depth farmer survey and visual plantation inspection forms for surveyors (see Appendices D, E and F). Whereas Jelsma et al. (2017a) focussed on developing the typology and their article contains more information on socio-legal and economic aspects such as share of income from oil palm, other sources of income, sources of capital for plantation development and type of land ownership documentation, this chapter utilizes the agricultural practices component of the survey and highlights aspects such as yields, fertilizer application rates, harvesting frequency and planting materials.

Plantation assessments (or 'audits') are common practice in company plantations (Fairhurst and Griffiths, 2014) and were also conducted for this study. GAP indicators were based on a diagnostic smallholder survey instrument develop by Aidenvironment (2013) and a smallholder oil palm handbook produced by Woittiez et al. (2016), both of which are richly illustrated with photographic material and provide an extensive set of inspection criteria and guidelines on how to conduct smallholder plantation assessments. Sections from these documents were, with permission, translated into Bahasa Indonesia, used as training materials and shared with surveyors as reference material. For plant nutrition, we looked for the presence of common nutrient deficiency symptoms (particularly P, K, Mg and B) displayed in the foliage and the trunks; the occurrence of these symptoms signals a lack of GAP implementation. For soil and weed cover management, we looked for a continuous cover of legumes (usually *Mucuna bracteata*) or *Nephrolepis* ferns; the absence of bare soils; signs of weeding (but not clear-weeding); and the absence of woody weeds. For canopy management, surveyors looked at the retention of two or three fronds below the ripening bunches for palms up to four metres tall and one or two fronds for palms taller than four metres; the absence of dead leaves on the palm; and for the recycling of pruned fronds in stacks within the plantation. For harvesting, we checked for circle weeding practices; ease of access for harvesters in the plantation (based on whether harvesting paths were sufficiently clean and wide, without too many holes and generally accessible, e.g. no major waterlogging); and frequency of harvesting. For planting pattern and density, we looked for planting in triangles through satellite images (further explained in section 3.3.3). For planting material, we looked for the presence of thin-shelled tenera (DxP) fruits by cutting open a sample of 20 loose fruits per farmer; GAP would see an occurrence of more than 99% tenera fruits but for this research we used 95% as a cut-off point, allowing one fruit to be dura. Black bunch counts[7] (BBCs) were performed among 20 trees as an alternative method for assessing yields (see section 3.3.4) to allow for triangulation with other tools for yield assessments such as farmer surveys and expert opinion. In addition to GAP indicators, we also collected basic information about the plantation, such as the age of oil palms and the quality of the road to the plantation. Criteria for road quality were limited number of holes in the road and no indications of flooding of roads or damaged bridges or other clear obstacles that hinder FFB transport or increase costs due to likely damage to vehicles, as described and illustrated in Aidenvironment (2013).

Tissue sampling was conducted in 118 farms to determine the nutrient content in the leaves and rachis and to assess the nutritional condition of the plantation. A minimum of four non-randomly selected palms per plantation were compounded into one sample. Selection criteria for palms were location (at least two rows away from the road and preferably at least five palms away from other sampled palms) and absence of visual abnormalities. Sample collection was performed according to the protocol described in Woittiez et al. (2018) and laboratory analyses were carried out by Central Plantations Services in Pekanbaru.

7 Black bunch count refers to counting all bunches that have black fruits. Counting the number of black bunches and multiplying this by the bunch weight can give a yield estimate for the next four months. Ripe bunches should not be counted.

Due to budgetary constraints and the high cost of laboratory testing, we were unable to sample all farms surveyed. Sub-sampling was conducted in a semi-stratified manner in which both CRH and BD sites were proportionally sampled in order to capture both landscapes and soil types. As database analysis or the typology development had not yet commenced during tissue collection, it was impossible to proportionally sample farmer types. During sampling it appeared that especially small and medium-sized farmers in the peatlands, who were expected to form separate categories, were captured only to a very limited extent. It was therefore decided to randomly increase the number of small and medium-sized peat farmers and small farmers at the expense of large farmers, who in absolute numbers still received most tissue sampling (see Table 3.3). The final sample, however, effectively strikes a balance between geographic spread and covering all farmer types and presence in the landscape, with small and medium-sized peat farmers forming one category and hence being slightly oversampled (see Tables 3.2 and 3.3).

3.3.3 Photo interpretation of smallholder plantations by experts

In order to allow for expert assessment of plantations without requiring physical field visits, plantations were photographed during the field audit. On average plantations were captured in eight images[8] that showed different aspects of the plantation floor (circle, stack, overview) and canopy, from different angles (see Appendix G). Three experts audited the plantations based on the sets of photos, and their assessments were used to triangulate the results from the field visits and the survey. The experts estimated oil palm age, bunch weight and yield, and classified plantation condition as poor, reasonable or good. Yield estimates were given in 5 Mt ha^{-1} $year^{-1}$ intervals (0–5, 5–10, etc.), effectively creating a 'yields up to' average. Bunch weight estimates were also provided with 5 kg ripe $bunch^{-1}$ intervals. Interval averages were subsequently used in calculations to account for lower values within these ranges and avoid overtly positive assessments[9]. Plantation age was estimated in years. For maintenance, the third author separately assessed weeding practices and pruning.

The experts were an academic specialized in agronomic practices in smallholder oil palm plantations (second author of this chapter); a farmer from Rokan Hulu who is also a representative of the Serikat Petani Kelapa Sawit (SPKS; Union of Oil Palm Smallholders), a national organization representing independent smallholder farmers); and an experienced oil palm agronomist working at CIRAD (third author). All three experts have extensively visited smallholder oil palm plantations but did not visit smallholder plantations for this research, nor did they have information about farmers or plantations before completing farmer photo assessments.

Planting density and planting pattern (rectangular or triangular) were determined by tracing the palm row diagonals on high-resolution satellite imagery (see Figure 3.2). Average distances between palm crowns were measured in metres using Google Earth from either two or three diagonals depending on whether patterns were rectangular or triangular. From this, planting densities per

8 Instructions were to take pictures of; 1). trunk of a representative palm in the plantation, including crown and fruits; 2). several palms, showing overall condition and weeds; 3). Circle; 4). harvesting path; 5). dead fronds stackings; 6). cut open fruits to determine dura vs. tenera share; 7). Example of leaves with clear nutrient deficiency according to surveyor; 8). Canals and water table if relevant. In some cases however soft and hardware failures limited the amount of pictures that could be taken and assessments were not possible or conducted with less pictures.

9 Bunch weight categories were thus transformed to values of 3 kg $bunch^{-1}$ (as ripe bunches in this category ranged from 1-5 kg), 7.5 kg $bunch^{-1}$, 12.5 kg $bunch^{-1}$, 17.5 kg $bunch^{-1}$ and 22.5 kg $bunch^{-1}$ respectively.

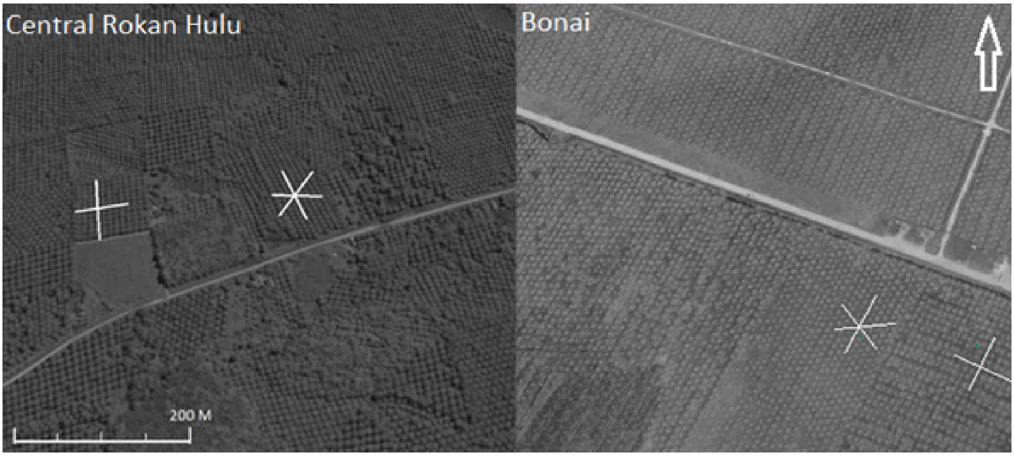

Figure 3.2 Examples of satellite imagery of smallholder plantations in research area
Note the differences in planting patterns between smallholders, demonstrating rectangular planting patterns and triangular patterns. The left picture illustrates typical example of a mosaic of smallholder plantations in Central Rokan Hulu. The right picture illustrates straight plantation patterns and a large smallholder in the north of the picture as is typical in Bonai Darussalam. Source: Google Earth, visited 16-12-2017

hectare were calculated. Measured rows were preferably over 20 palms long, but were shorter in small plantations.

3.3.4 Calculations

Seasonal patterns in yield were derived based on data from a nearby company plantation, which showed that the yields are highest in August and lowest in February (see Appendix H on company plantation yields throughout the year and Appendix I on climatic conditions). To account for these patterns when estimating yields, farmers were asked to estimate the yield per harvest in the peak and the low season of the previous year. These yields were averaged, multiplied by the harvesting frequency and divided by the land size. This approach is justified as most farmers do not maintain yield records. Yields were benchmarked against a 20 Mt ha^{-1} $year^{-1}$ production curve derived from Cramb and McCarthy (2016: p. 32) and presented as the share of the benchmark production curve at a given age.

Because farmers' estimates are not always reliable, expert assessments and BBCs were used to provide additional yield estimates to allow for the triangulation of the results. Yields based on BBC were calculated by first taking the average BBC from 20 palms per plantation and multiplying this by the estimated average ripe bunch weight, to get the total bunch weight per palm. The ripe bunch weight could not be measured as ripe bunches are only available in the field in the short period between harvesting and transport. For this reason, bunch weight estimates were obtained by averaging experts' estimates based on photos with surveyors' estimates based on field observations. Total bunch weights per palm were multiplied by three (assuming that bunches ripen in a four-month period) and by the planting density. Correction factors to compensate for date of surveying were developed based on average productivity curves from monthly yield data provided by three nearby companies (see Appendix H). In order to benchmark yields against the production curve, survey yield estimates were associated with survey oil palm age results and expert yield estimates were associated with expert age assessment. For the BBC yield benchmarking, the average plantation ages derived from the survey and the experts were used (see Appendix G).

In order to determine fertilizer practices, we calculated nutrient requirements and nutrient balances. Ng et al. (1999) indicate that for a mature plantation on tropical soils of poor fertility, the total demand for producing 20 Mt of FFB ha^{-1} $year^{-1}$ is 112.5 kg N, 14.0 kg P, 202.4 kg K, and 33.2 kg Mg, and for 30 Mt of FFB ha^{-1} $year^{-1}$ 145.5 kg N, 19.2 kg P, 247.5 kg K and 44.4 kg Mg. On peat soils, the quantities of nutrients removed in fruit bunches are similar, but the nutrient balance is different with more N and less K available in the soil (Goh, 2005). In order to compensate for this difference, the estimated N and K requirements on peat are set at 84.4 kg (25% less) and 303.6 kg (50% more), respectively, than the requirements for mineral soils (Ng et al., 1990). A nutrient balance was calculated for each plantation using the following equation:

$$B=(Fe+De)-((Y\times c)+Tr+Ru+Er+Le)$$

With B = nutrient balance (kg ha^{-1}), Fe = input through fertilisers, De = deposition in rainwater, Y = reported yield, c = concentration of nutrient in the FFB, Tr = nutrients taken up for trunk growth, Ru = loss through runoff, Er = loss through erosion and Le = loss through leaching (see Appendix J for details).

SPSS version 19 was used to calculate differences among farmer type means, using either one-way analysis of variance (ANOVA; for scalar variables) or the chi-squared test (for categorical variables). Appropriate post hoc tests such as Tukey and Games-Howell were conducted to calculate pairwise differences between farmer types. Matching letters in figures and tables indicate there are no significant differences between types of farmers according to post hoc tests. Where ANOVA revealed statistically significant differences, in some situations the post hoc tests could not indicate where those significant differences were located. This can be attributed to the sample size, a weak global effect and differences between the methods used to deal with Type I errors.

3.4 Results

3.4.1 Age & yields

Yield is the ultimate product of three factors: genotype, management and environment (see Tester and Langridge, 2010). In perennials, yield depends on crop age and can therefore be presented both in absolute terms and in terms of deviation from a reference production curve (%). We used a reference production curve for a full 25-year production cycle, with a peak yield of 20 Mt ha^{-1} $year^{-1}$ as derived from Cramb and McCarthy (2016; see Appendix C).

Yield estimates from surveys, photo analysis by experts and BBC provide a fairly uniform pattern (Figure 3.3). Limited differences were observed among farmer types, with the majority of significant differences observed between farmers on mineral soils compared to farmer types on peat soils. All three yield assessment methods indicate farmers on peat generally have low yields.

3.4.2 Applications of fertilizers and nutrient balances

Smallholder fertilizer applications were in general limited, poorly balanced and variable between farmers and farmer types (see Appendix K for a detailed overview). Nitrogen application rates were on average below the expected demand at 20 Mt of FFB ha^{-1} $year^{-1}$, with the exception of migrant and large resident farmers (see Figure 3.4). Average P applications appeared sufficient among most farmer types, with small local farmers and large peat investors applying too little on average to

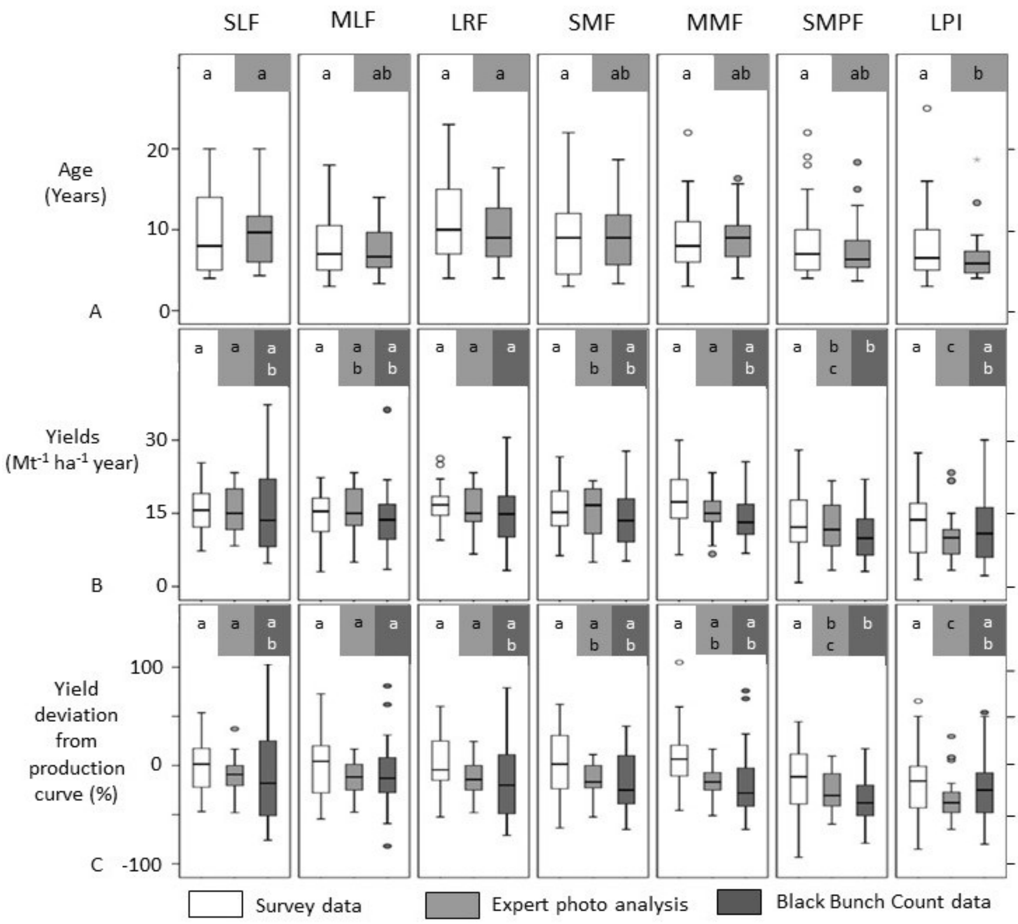

Figure 3.3 Age and yield differences between farmer types using three different methods
SLF=Small Local Farmers, MLF=Medium-sized Local Farmers, LRF=Large Resident Farmers, SMF=Small Migrant Farmers, MMF=Medium-sized Migrant Farmers, SMPF=Small & Medium-sized Peat Farmers, LPI=Large Peat Investors. Whiskers show the minimum and maximum values; the box shows the 1st and 3rd quartiles; the line shows the median. Values of >1.5 interquartile range (IQR) are shown as circles, and >3.0 IQR are shown as asterisks. Significance level p<.05. Pairwise significant differences are indicated per method only and not between methods.

reach 20 Mt of FFB ha^{-1} $year^{-1}$. Average K applications were limited among all farmer types, with small local farmers applying only 32.1 kg ha^{-1} $year^{-1}$ on average. Fewer than 25% of farmers applied enough K to meet the demand for producing 20 Mt of FFB ha^{-1} $year^{-1}$. Average Mg applications were generally insufficient, especially among farmers on mineral soils. Small local farmers were most likely to not to apply any fertilizers but differences between farmer types were not significant (see Figures 3.4, 3.6 and Appendix K).

Whereas Figure 3.4 highlights the nutrient requirement for producing 20 Mt of FFB ha^{-1} $year^{-1}$ and the actual nutrient applications of farmer types, Figure 3.5 provides a nutrient balance, using

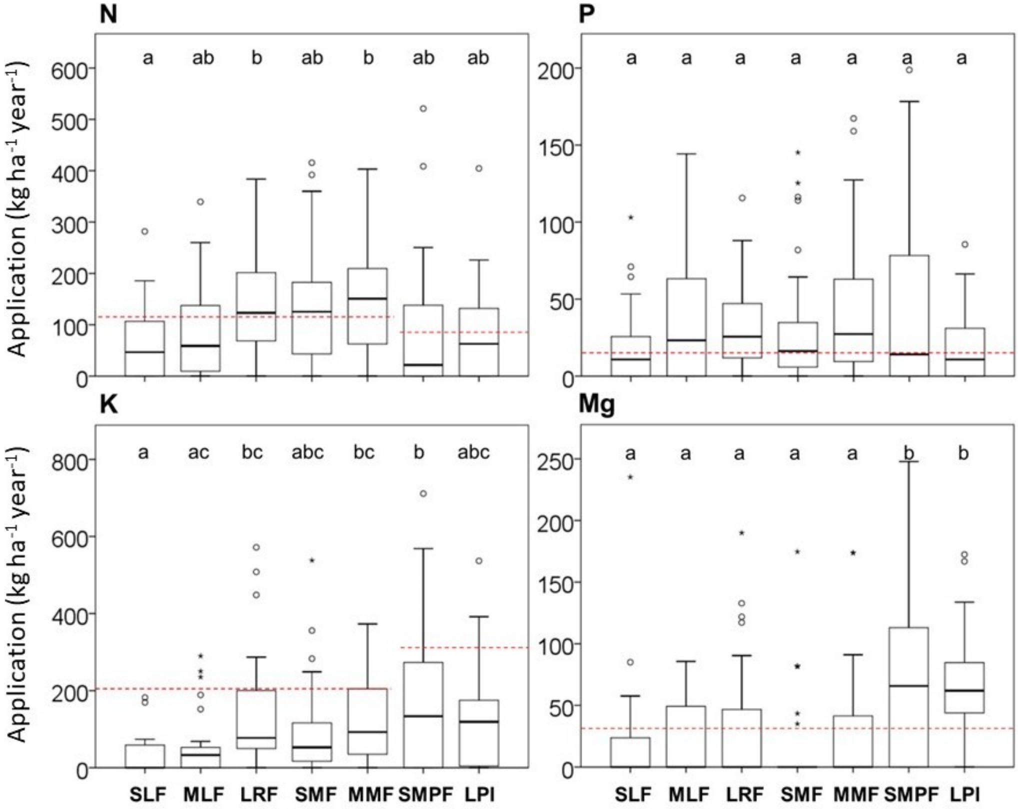

Figure 3.4 Nutrient application rates per farmer type
SLF=Small Local Farmers, MLF=Medium-sized Local Farmers, LRF=Large Resident Farmers, SMF=Small Migrant Farmers, MMF=Medium-sized Migrant Farmers, SMPF=Small & Medium-sized Peat Farmers, LPI=Large Peat Investors. Whiskers show the minimum and maximum values; the box shows the 1st and 3rd quartiles; the line shows the median. Values of >1.5 interquartile range (IQR) are shown as circles, and >3.0 IQR are shown as asterisks. Nutrient application outliers with values >3.0 IQR in both combined sample and farmer groups were removed from further analysis. Horizontal lines indicate requirements at 20 Mt of FFB ha^{-1} $year^{-1}$ for mineral soils (first five types) and separately for peat soils (last two types) where N and K requirements are different. Significance level $p<.05$.

yields reported by farmers and the estimated offtake rates from Ng et al. (1999) to calculate the nutrient requirement. The nutrient balances presented in Figure 3.5 indicate that especially small local farmers had negative N, P and especially K balances. Potassium shortages were common among all farmer types, and fewer than 75% of farmers applied enough K to sustain their estimated production levels. Peat farmers applied more Mg, mostly in the form of dolomite, which is a cheap fertilizer that many farmers believe neutralizes the acidic peat soils. However, the effectiveness of such a practice is probably limited, considering the high buffering capacity of peat soils (Bonneau et al., 1993).

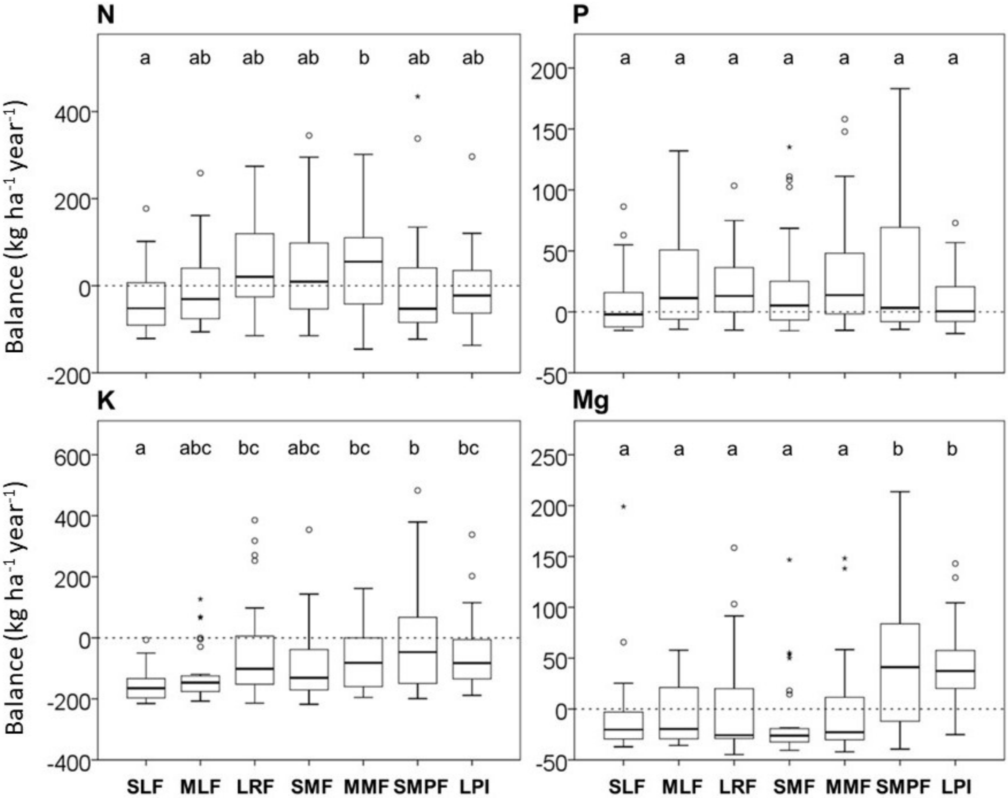

Figure 3.5 Nutrient balances based on yield data provided by farmers per farmer type
SLF=Small Local Farmers, MLF=Medium-sized Local Farmers, LRF=Large Resident Farmers, SMF=Small Migrant Farmers, MMF=Medium-sized Migrant Farmers, SMPF=Small & Medium-sized Peat Farmers, LPI=Large Peat Investors. Whiskers show the minimum and maximum values; the box shows the 1st and 3rd quartiles; the line shows the median. Values of >1.5 interquartile range (IQR) are shown as circles, and >3.0 IQR are shown as asterisks. Nutrient application outliers with values >3.0 IQR in both combined sample and farmer groups were removed from further analysis. Significance level $p < .05$

3.4.3 Leaf and rachis analysis

Leaf and rachis samples from 118 plantations were analysed to assess nutrient deficiencies (Table 3.3). Although there are some significant differences, our results indicate that the tissue concentrations of the different macro-nutrients (apart from Mg) were below the critical leaf and rachis concentrations on average for all sampled smallholder types, with especially K concentrations in leaf and rachis appearing very low. Peat farmers performed relatively well, and differences among farmers on mineral soils were minimal. Concentrations of micro-nutrients such as copper and boron were on average above critical values, except for copper in the plantations of large peat investors.

Table 3.3 Leaf and rachis analysis results and planting density per farmer type
Critical nutrient levels are from Fairhurst and Mutert (1999) for leaves and from Foster and Prabowo (2006) for rachis. The critical values are for palms >6 year after planting; they are slightly higher for younger oil palms. DM=dry matter

		Critical Value	Small Local Farmers	Medium-sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium-sized Migrant Farmers	Small & medium-Sized Peat Farmers	Large Peat Investors	F Values (ANOVA)
Leaf N	% DM	2.3	2.14a	2.13a	2.17a	2.19a	2.17a	2.22a	2.24a	$2.620_{(6,111)}$*
	Std.dev.		0.09	0.08	0.11	0.11	0.08	0.11	0.12	
Leaf P	% DM	0.14	0.13a	0.14ab	0.14ab	0.13ab	0.14ab	0.15bc	0.15c	$7.063_{(6,111)}$**
	Std.dev.		.01	.01	.02	.01	.02	.02	.01	
Leaf K	% DM	0.75	0.71a	0.60a	0.66a	0.63a	0.66a	0.71a	0.79a	$1.864_{(6,111)}$
	Std.dev.		.28	.18	.12	.10	.07	.13	.01	
Leaf Mg	% DM	0.20	0.26a	0.37ab	0.29a	0.34ab	0.33ab	0.39b	0.42b	$5.460_{(6,111)}$**
	Std.dev.		.11	.09	.12	.10	.07	.12	.11	
Leaf B	(mg/kg)	8.0	10.3ab	10.4ab	12.2ab	10.0a	10.6ab	13.4b	13.0ab	$3.102_{(6,111)}$**
	Std.dev.		1.7	2	3.5	1.5	2.2	6.8	3.1	
Leaf Cu	(mg/kg)	3.0	3.9a	4.7a	3.9a	4.0a	4.3a	4.0a	2.8b	$5.914_{(6,111)}$**
	Std.dev.		1.1	1.1	0.8	1	1.1	1.2	0.7	
Rachis P	% DM	0.09	0.07ab	0.06a	0.06a	0.05a	0.07a	0.08ab	0.13b	$5.673_{(6,111)}$**
	Std.dev.		0.07	0.03	0.03	0.02	0.03	0.05	0.07	
Rachis K	% DM	1.1	0.63a	0.57a	0.58a	0.57a	0.65a	0.61a	0.89a	$1.833_{(6,111)}$
	Std.dev.		0.36	0.23	0.28	0.2	0.29	0.37	0.46	
Planting density	Mean		143.2a	136.6ab	134.0b	142.6ab	140.2ab	137.3ab	135.9ab	$2.643_{(6,224)}$ *
	Std.dev.		14.9	11.6	13.1	11.1	12.5	12.5	9.9	

3.4.4 Good agricultural practices within smallholder plantations

In company plantations, the layout usually entails a harvesting path between every two rows of palms followed by a *pasir mati* (a row with pruned dead leaves), which may be stacked as a row or in a u-shape around the palms, with the open end towards the harvesting paths. Neat rows or u-shapes facilitate easy access, increase nutrient recycling and provide ground cover. Neat stacks were encountered more frequently in plantations on mineral soils than on peat soils, but differencesbetween farmer types were not significant (χ^2=10.911, df=6, p=.091) (see Figure 3.6 for details on the implementation of GAP).

Significant differences among farmer types were observed regarding the presence of harvesting paths every second row (χ^2=13.317, df=6, p=.038), with small and medium-sized local and medium-

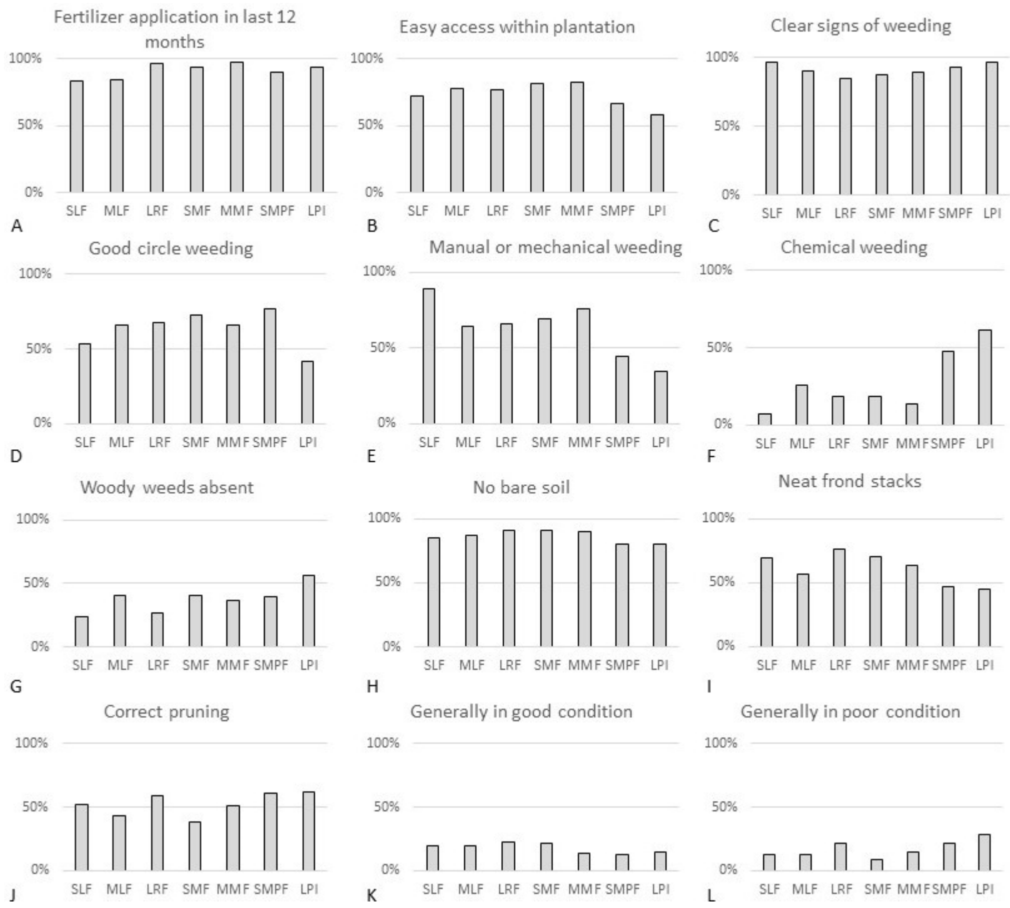

Figure 3.6 Share of farmers per farmer type that implement flexible GAP
SLF=Small Local Farmers, MLF=Medium-sized Local Farmers, LRF=Large Resident Farmers, SMF=Small Migrant Farmers, MMF=Medium-sized Migrant Farmers, SMPF=Small & Medium-sized Peat Farmers, LPI=Large Peat Investors. Sub-figures 3.6 K and L refer to expert photo assessments of management practices. Y-axis indicate share of farmers, x-axis shows farmer types.

sized migrant farmers less likely to have harvesting paths every second row especially compared to small to medium-sized peat farmers and large resident farmers. Although some palms may be less accessible due to a lack of structured paths, access for harvesting within the plantations was generally good and there were no significant differences among farmer types (χ^2=7.743, df=6, p=.258). Farmers on mineral soils had slightly better access within their plantations compared to peat farmers (see Figure 3.7). This was mostly due to problems with waterlogging and excessive weed growth in plantations on peat.

Survey data indicated that bare soils, which are prone to erosion and fertilizer run-off, were not present in 80%–91% of the plots, without significant differences among farmer types (χ^2=3.369, df=6, p=.761). This was in line with expert photo interpretations. Legume cover crops, which can fix nitrogen and suppress undesirable weeds such as *Imperata* and *Chromolaena*, were observed only in one farm (large resident farmer). Weeding was common practice among all smallholder types (χ^2=4.357, df=6, p=.629). There were differences in weeding methods between farmer types: manual or mechanical weeding were preferred by especially small local farmers and to a lesser extent by the other farmer types on the mineral soils (χ^2=16.647, df=1, p=.000), whilst peatland farmers were significantly more likely to implement chemical weeding (χ^2=26.327, df=1, p=.000). The absence of woody shrubs was used as an indicator of good weeding practices, but most plantations did contain woody weeds (χ^2=8.996, df=6, p=.174). The most commonly infested plantations were small local plantations: only 24% did not have woody shrubs in their fields. In some large peat farms, woody shrubs were difficult to spot as non-woody weeds covered everything. Circle weeding was common, and while small local farmers and large peat farmers were the least likely to establish weeded circles, the differences among farmer types were not significant (χ^2=11.292, df=6, p=.080). Similarly, there were no significant differences in pruning practices among farmer types (χ^2=5.825, df=6, p=.443).

Regarding harvesting, we observed significant differences among farmer types, with large resident farmers and large peat farmers appearing more likely to adhere to harvesting cycles of 10 days or less compared with all other types (<7%). Although more frequent harvesting cycles can be an indicator of high yields (see e.g. Lee et al., 2013), we did not find significantly better yields among the larger farmer types. It may be that the harvesting frequencies of large farmers were inflated because of misinterpretations, as larger farmers usually harvest more frequently due to their larger area, while in fact they are not harvesting the same palms more than once every two weeks. Excluding the large farmers, harvesting frequencies appeared very similar among the remaining farmer types, with 97-100% indicating that they harvested every 14 days or twice per month.

Holistic plantation assessments by experts indicated only limited differences in plantation conditions between farmer types (see Figure 3.6). When averaging the assessments of all three experts for all farmer types, 17% of plantations were assessed to be in a poor condition, 65% in a reasonable condition and 18% in a good condition. Whereas large resident farmers had the highest share of plantations in good condition (22%), they also had the second highest score on plantations in poor condition (21%). Large peat investors were assessed worst, with on average 29% of plantations being assessed as in poor condition. Wilcoxon signed ranks tests indicate no significant differences among expert assessments, and two of the three experts did not see significant differences amongst farmer types (χ^2=9.186, df=12, p=.687 and χ^2=12.205, df=12, p=.439, respectively). Only the farmer expert indicated significant differences between farmer types (χ^2=27.290, df=12, p=.007), with conditions in large peat farmers' plantations being assessed significantly poorer compared with other farmer types (see Appendix L).

There are also conditions that are more difficult and costly for individual farmers to correct once a plantation has been established. These conditions and differences amongst smallholder types are shown in Figure 3.7. With regard to topography, the sampled smallholder plantations were fairly similar: most were flat or slightly hilly, with only a few large resident farmers and medium-sized migrant farmers partially operating on steeper slopes. Terraces or other soil conservation measures were not present in the few plantations on steep slopes. Sub-figures 3.7 C and D show that feeder roads (linking plantations to main roads) and main roads in the peatlands are of significantly poorer quality than the roads on mineral soils (χ^2=7.204, df=6, p=.302 and χ^2=45.842, df=6, p=.000 respectively).

There were significant differences in planting patterns between farmer types. The vast majority of large peat farmers implemented correct triangular patterns, compared with only 33.3% of the small local and small migrant farmers (χ2=31.908, df=6, p=.000). With 143.2 palms ha^{-1} on average,

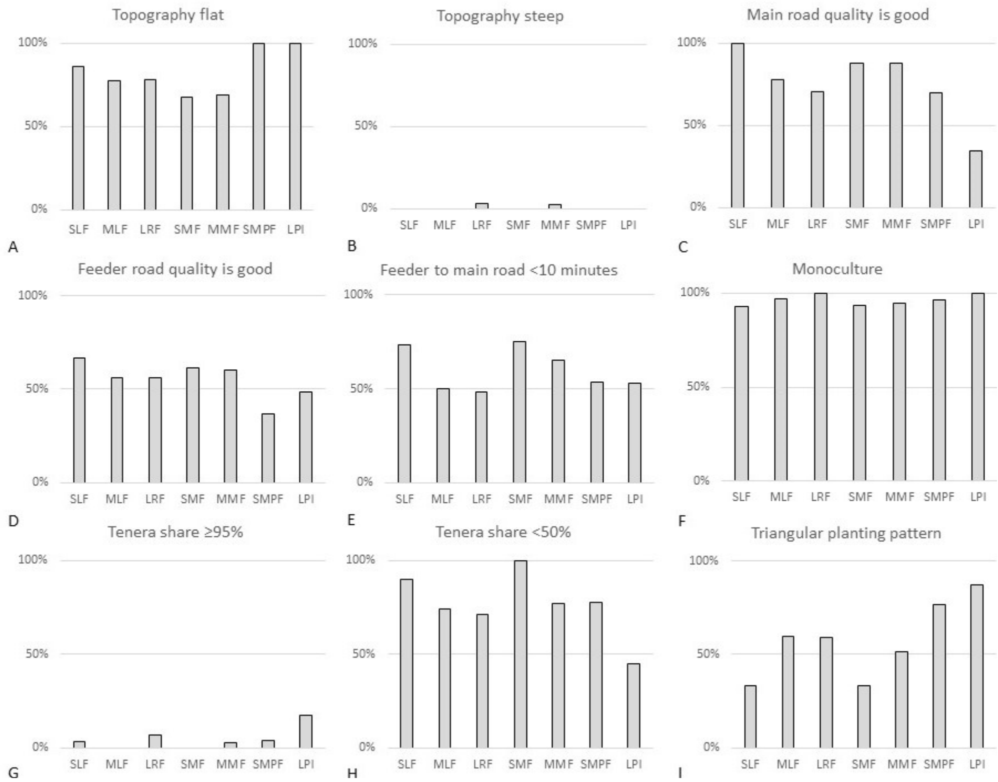

Figure 3.7 Semi-permanent plantation conditions among different farmer types
SLF=Small Local Farmers, MLF=Medium-sized Local Farmers, LRF=Large Resident Farmers, SMF=Small Migrant Farmers, MMF=Medium-sized Migrant Farmers, SMPF=Small & Medium-sized Peat Farmers, LPI=Large Peat Investors. Y-axis in sub-figures indicate share of farmers with plantation condition, x-axis shows farmer types.

small local farmers tended to plant fairly densely and significantly denser than large resident farmers, who had the lowest average density with 134.0 palms ha^{-1} (see Table 3.3). Although we observed some variation in planting densities within farmer types, average planting densities per farmer type were quite similar and in line with commonly recommended planting densities of 136–143 palms per hectare (Uexküll, 2003). Mono-cropping was standard practice among all smallholder farmer types ($\chi 2=4.381$, df=6, p=.625), but with some pineapple cultivation observed in peatlands and rubber and cocoa intercropping observed on mineral soils.

Planting material data highlight that dura palms were common among all farmer types. Most plantations had more than 50% dura palms on average. Smaller and medium-sized farmers on several occasions mentioned that dura fruits are desirable, as the large kernels are heavy and farmers are paid per kilo by the middlemen, rather than for fruit quality. However, on mineral soils only a linear regression model indicated that bunch numbers significantly increase with share of tenera in plantings (see Appendix M for details). The share of farms with >95% tenera fruits was low among all farmer types but there were significant differences: 17% of larger peat farmers and

7% of large resident farmers had >95% tenera, while medium-sized local or small migrant farmers never had >95% tenera fruits (χ^2=14.025, df=6, p=.029). A share of >50% dura palms was common among especially small local and small migrant farmers and differences among farmer types were significant, with large farmers performing better (χ^2=28.283, df=6, p=.000).

3.5 Discussion

Our results have shown, through fertilizer application practices, nutrient balances and tissue nutrient concentrations, that fertilizer application rates among the various farmer types were limited, particularly for K. Potassium deficiencies were common in our sample, and have been observed in samples from independent smallholder plantations in Jambi and West Kalimantan (Woittiez et al., 2018). Active knowledge dissemination on the importance and necessity of balanced nutrition for good productivity in oil palm, combined with efforts to make the required fertilisers accessible to and affordable for independent smallholders, are important measures to improve the nutritional status and productivity of smallholder plantations. Training in the specific nutrient requirements of plantations on peat would be an example of a targeted measure to increase the efficient use of fertilizers. The application of empty fruit bunches (EFB) was uncommon among all smallholder types, indicating that there is room to improve nutrient cycling and reduce nutrient outflow from smallholder plantations. Besides educating farmers about the well documented advantages of EFB application (Comte et al., 2013; Woittiez et al., 2018), improving linkages between mills and farmers and promoting the return of EFB to smallholders appears a worthwhile strategy to improve their nutrient balances and soil management. We found it striking that five of the seven farmers who do use EFB were large farmers, who have better direct access to mills compared to small and medium-sized farmers, who usually sell to middlemen and have no direct link with mills (Jelsma et al., 2017a). Whereas Soliman (2016) claims that fertilizer usage does not need to increase, based on N application only, the results of this study show that N rates on average indeed appear sufficient for large resident and migrant farmers to produce 20 Mt of FFB ha^{-1} year^{-1}, but that in general the quantities of nutrients provided are too limited to produce and sustain large yields.

Planting materials were often of substandard quality, limiting the potential for yield increases through the implementation of GAP. Besides limiting FFB yield potential, dura bunches also contain around 30% less oil (Corley and Tinker, 2016), thereby reducing oil yields substantially and partially explaining low FFB prices for farmers, as middlemen generally do not differentiate in prices for quality or variety differences for individual farmers (Jelsma et al., 2017a). Dura palms were particularly prevalent in the plantations of small local and small migrant farmers, often in combination with square planting patterns. These farmers often use uncertified planting materials, which are easily available as either loose fruits or via illicit seedling traders who are not hindered in their activities by the local authorities, whilst large farmers appear to have better access to official seedling producers and have more capital available for planting material. During discussions with leading seed producing companies during the 2018 annual GAPKI meeting, we were informed that the efforts of companies to reach out to independent smallholders are limited to providing seeds at a reduced price, while the crucial aspect of easy and local access, including administrative requirements and costs, remains a key obstacle for smallholders to purchase certified planting materials. Only the Indonesian Oil Palm Research Institute regularly went to villages with three cars and sold seeds in Sumatra (interviews, 1-3 November 2017). Industrial oil palm producers, banks and the government of Indonesia, through the CPO fund (DJP, 2017a), do support replanting efforts for smallholders and we recommend increasing awareness campaigns that demonstrate the potential yield losses due to poor planting material, demonstrate correct planting patterns and point out the relatively limited costs of high-quality planting materials, and increasing the number of distribution centres with high-quality planting materials in combination with banning non-certified seedling sellers and possibly subsidize proper planting material. However, impacts on current farmers will be limited as palm stands are often young and especially smaller and poorer farmers are unlikely to cut their young palms and accept an additional three years without income until their palms yield again. The negative effects of square planting patterns, which significantly reduce the growth and yield potential of the palms due to reduced sunlight, can be reduced however by selective thinning (Uexküll et al., 2003) and rigorous pruning. Although there is support through the CPO fund, the chairman of the union of smallholder oil palm farmers has expressed his fear of the 'plasmafication' of independent smallholders (SPKS, 2018), referring to being locked into undesirable relations with companies, banks and the bureaucracy; this is a key reason why the previous *Revitalization* policy aimed at supporting smallholder with replanting failed (Zen et al., 2016).

Good planting and nutrient application practices need to be accompanied by other GAP if intensification of the smallholder sector is to be achieved. Our results show that pruning, weeding, the use of legume cover crops and frond stacking practices are similar among all farmer types, and generally require improvement. Knowledge transfer to smallholders on good practices in oil palm cultivation has been limited in our research areas, with farmers receiving very little formal training, and with most knowledge coming from their input suppliers and their fellow farmers (Jelsma et al., 2017a; Woittiez et al., 2018). Although the organization of smallholders into cooperatives or groups is a key condition for RSPO or ISPO certification, and there is evidence that organized oil palm smallholders can maintain high-input, high-output systems (Jelsma et al., 2017b), there are many barriers to improving practices. In Indonesia, the extension services are weak, knowledge on GAP and certification is not widely available, and strong institutional structures through which knowledge can be readily distributed among smallholder farmers are rarely in place (Brandi et al., 2015; Hidayat, 2017). To add to this complexity, strategies need to be tailored to specific types of farmers in order to be effective. Ideally, this would constitute easy access to quality information via local farmer training centres run by companies in collaboration with the government to support small and medium-sized farmers who mostly reside locally. Large peat investors might require a different approach as the scale of their activities is much larger and their environment poses different challenges. Yields in peat plantations were significantly less, which may be attributable to higher degrees of absenteeism, speculative investment decisions, difficulties in collecting FFB due to flooding in the rainy season and other agro-ecological difficulties related to peat soils relative to mineral soils for cultivating oil palm.

Although a straight comparison is difficult due to different methodologies, there are clear similarities in the types of farmers identified by McCarthy and Zen (2016) and the types used in our study. The 'prosperous farmers' identified by McCarthy and Zen (2016) appear similar to the large farmer types identified in Jelsma et al. (2017a), as they have considerable land holdings and considerable capital but still use poor planting materials as they lack access to proper planting materials. The poor farmers mentioned by McCarthy are mainly local Melayu farmers who are '*… trapped between their on-farm activities and work as labourers, with little time to invest in improving their plots*', and indeed especially small local farmers appear to use the least fertilizers or herbicides. Medium-sized local and medium-sized migrant farmers could be associated with progressive farmers mentioned by McCarthy and Zen (2016), as they have larger oil palm holdings than poor farmers, frequently have other jobs as, for example, civil servants, and hardly work as labourers

(Jelsma, et al. 2017a). However, although McCarthy claims that prosperous farmers invest more in fertilizers and labour, and thus have relatively better yields than poor or progressive farmers, we did not find evidence for this. We therefore believe that improving enabling conditions for the implementation of GAP is relevant for all farmer types.

The lack of technical and institutional support regarding the management of smallholder plantations needs to be placed in a broader framework of constraints hindering the implementation of GAP and yield intensification. Poorly developed and maintained infrastructure such as roads and waterworks hamper intensification. Among large peat farmers the lack of coordinated drainage systems was problematic. For the more remote farmers, and especially those on hilly mineral soils, the infrastructure was usually of poor quality. These areas were relatively often occupied by larger farmers and during surveys and interviews, caretakers indicated that during the rainy season not all fruits were harvested due to the poor accessibility of parts of their plantations. Besides flooding, the frequent occurrence of fire in peatlands increases the risk that farmers will lose their investments (Gaveau et al., 2014; Purnomo et al., 2017). Such major risks do not provide a conducive environment for investments in GAP. Measures such as infrastructure development and fire prevention are relevant prerequisites for the implementation of GAP and for yield intensification.

Labour is known as a key constraint in intensive smallholder oil palm cultivation (Soliman et al., 2016) and appears to be a key reason why farmers prefer oil palm over rubber (Euler et al., 2017; Feintrenie et al., 2010). Whereas a sufficient well-trained labour force is a requirement for the implementation of GAP, labour issues are also a concern for companies, with rising labour costs being the 'silent killers' of profitability as productivity has barely increased over the past 20 years (Liwang, 2017). Labour costs are relevant for smallholder oil palm farming as many of the surveyed farmers also employed labourers (Jelsma et al., 2017a). As workers are paid at a piecemeal rate, their interest is in harvesting or pruning as many palms as possible as quickly as possible, rather than in performing activities well. For this reason, the implementation of GAP would require considerable monitoring by farmers. Benefits associated with smallholder farming, such as ease of monitoring the fields and having a direct interest in production (Bissonnette and De Koninck, 2017; Hayami, 2010; Hazell et al., 2010), appear to be of only limited relevance for certain smallholder oil palm farmer types. This highlights the grey area between smallholders as family farmers and smallholdings that operate like company plantations (Bissonnette and De Koninck, 2017). The grey area was strongly observed in the peatlands, where the managers of large farmers often complained about the limited number of workers (mostly migrants, who were housed in barracks on the plantation). With peat farmers often residing outside the district (Jelsma et al., 2017a), labour and monitoring appear to be issues in the frontier areas, complicating the implementation of GAP.

We believe that further research is required to determine the extent to which smallholder oil palm is cultivated for income from yields or for speculative purposes, as transforming 'empty' lands into oil palm plantations provides profits for many actors (see e.g. Prabowo et al., 2017; Purnomo et al., 2017). Many plantations in the peatlands are located within the forestry domain and neither companies nor government are legally allowed to support farmers in these illegally obtained lands. Land documentation among especially peat farmers and local farmers, and to a lesser extent migrant farmers, is often not fully recognized by the state (Jelsma et al., 2017a). This creates risks for the owners and reduces the interest in yield intensification measures, which take time before the investments pay off. Intensification is especially relevant when populations are increasing and land is scarce, but this is not the case in large parts of the Indonesian outer islands. In Rokan Hulu, logging and oil palm companies recently developed the infrastructure necessary to open new lands, and land is now more easily available than labour (Feintrenie et al., 2010). Although for large companies opportunities for expansion are limited nowadays, there still are plenty of smaller 'empty' lands that appear to be grabbed by relatively small-scale investors (Bissonnette and De Koninck, 2017; Susanti and Maryudi, 2016). Whilst the goal of intensification for land saving appears worthwhile, a Jevon's paradox lurks as intensification makes it more interesting to transform land into oil palm plantations. Intensification programmes therefore need to be accompanied by proper land use regulations, monitoring and enforcement, if the aim is to improve sustainability of the sector.

In this research, multiple methods were used to assess the performance of the different types of smallholders. Uncertainties associated with surveys are that farmers often do not maintain farm records, and true plantation sizes are often slightly different compared to what smallholders mention. Yield estimates based on BBC are prone to errors in field assessments (it is known that ripe bunches were included, slightly inflating yields), and other assumptions, all impacting yield calculations. Nutrient balances and leaf and rachis analysis are common methods to assess nutrient conditions in company oil palm plantations. However, although the single critical values can provide indicators for the nutritional status of palms, in fact these thresholds are not static as nutrient concentrations vary with palm age, weather conditions and their environment. Commonly used critical values are often developed in older planting materials and should therefore be taken as indicative only and interpreted together with yield and fertiliser application data and visual symptoms in the field (Corley and Tinker, 2016; Fairhurst and Mutert, 1999). However, as the main objective of this study was to compare the performance of different types of smallholders and not to develop targeted fertilizer regimes, the values provided are sufficient to use as a benchmark. Photo interpretations allowed different experts to share their expertise and assess plantations, but such interpretations cannot replace field visits. The diversity of tools applied in this study proved sensitive enough to detect differences among a broad range of smallholder types and landscapes in which they operate and provide a fairly consistent overview of smallholder plantation conditions. The results indicate that there is lots of room for improvements in independent smallholder practices and are in line with previous publications (Molenaar et al., 2013; Soliman et al., 2016; Woittiez et al., 2018).

3.6 Conclusion

The independent smallholder oil palm sector can be portrayed as the Achilles heel for the sustainability of the oil palm sector. Although our research included a wide variety of farmer types, differences between farmer types in the adoption of GAP was limited, and we observed poor yields among all independent smallholder types in this study. Our results suggest that the notion that larger, more capitalized farmers are significantly more likely to invest in GAP does not hold. The underlying reasons are plentiful. Small local and migrant farmers are locked in a system that is not amenable to investment and can have limited yield potential due to poor planting patterns and materials. Recent programmes aimed at increasing access to finance for purchasing proper planting materials or fertilizers could increase yield potential for these groups. However, seeing that larger farmers for whom financial capital is comparatively accessible are not more likely to invest in GAP than smaller less capitalized farmers, it is uncertain whether enhancing access to finance will lead to significant changes in practice. Farmers' choices are informed by a complex amalgam of factors including, but not limited to, access to labour and knowledge, alternative crops and livelihoods, quality of infrastructure, fire threats, legal status of plantations, land markets, government policies and changes therein, market access and price uncertainty of produce, and other risk assessments farmers make. While we acknowledge the limitations of our research (e.g. sample size, limited geographical coverage), our results show that under current conditions smallholders across the board prefer a low-input, low-output strategy, for various reasons. This poses a significant challenge for initiatives such as ISPO, RSPO and other promotors of GAP, and could result in the increased marginalization of independent smallholders if sustainability thresholds are raised. In order to support further GAP implementation, we recommend future research to identify and quantify farmers' aspirations and strategies as they relate to intensification, and to employ approaches that acknowledge farmers' diversity and the environments in which they operate, but also to acknowledge that certain types of 'farmers', for example poorly performing peat farmers who operate in the forestry domain on recently deforested land, might have to be excluded from the value chain to improve sector sustainability. Linking performance to land reclassification and legalization in peatlands might also be a pathway to increase sector sustainability. Meanwhile, policymakers should increase their efforts to make proper planting materials and knowledge on GAP available to smallholders, as a first requirement for intensification. Government bodies and NGOs should look for support from industry partners that have the technical expertise and that can be important sources of investment into the sub-sector. If the sustainability of the sector is to be improved, it is imperative, however, to look beyond implementation of GAP, as there is a clear need to acknowledge the broader context in which farmers operate.

4 Collective action in a smallholder oil palm production system in Indonesia: The key to sustainable and inclusive smallholder palm oil?

Opening up of land in the early halve of the 20th century at the current Ophir plantation location, in the background Mount Talamau and the forest frontier (Unknown, 1929-1935).

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4.1 Introduction

Annual global demand for vegetable oil will double from 120 to 240 million tons by 2050, driven by increasing per capita incomes and population growth (Alexandratos and Bruinsma, 2012; Corley, 2009). Palm oil will play a major role in meeting this demand: it is projected that a further 7 – 25 million ha of oil palm will be required over the next 40 years (Corley, 2009). The prominent role of oil palm is due to its versatility in food and non-food uses, and its unparalleled ability to convert solar radiation, water and nutrients into vegetable oil under proper management (Corley, 2006; de Vries et al., 2010). With a combined 38% share of global vegetable oil production, palm oil and palm kernel oil are already the most traded vegetable oils in the world (USDA, 2016). Expansion of palm oil production, particularly in low-income countries, is regarded as crucial for meeting the future demand for affordable edible oil (Corley, 2009; Shean, 2010).

Indonesia is the world's largest producer of palm oil: in 2015/16 it produced 33 M metric tons of palm oil and had a global market share of 54% (USDA, 2016). Nearly 75% of this was exported in 2014 (USDA, 2016), generating 22.9 billion US$ in export earnings (DJP, 2015). The oil palm complex has contributed substantially to both national and local economic development (Budidarsono et al., 2013; McCarthy and Zen, 2016; Rist et al., 2010). Zen (2015) estimates that, based on current trends, oil palm expansion will continue to grow from 10.6 million hectares in 2013 to 13.7 million hectares in 2020.

Expansion of oil palm has had major impacts on land use (Brockhaus et al., 2012; Sayer et al., 2012; Wicke et al., 2011), deforestation and loss of biodiversity (Fitzherbert et al., 2008; Koh and Wilcove, 2007), and the emission of greenhouse gases (Fargione et al., 2008; Pye and Bhattacharya, 2012; Zen et al., 2015). It is also associated with adverse socioeconomic effects due to the displacement of local populations (Colchester et al., 2006; McCarthy, 2010) and inclusion in oil palm value chains under unclear and disadvantageous terms, leaving smallholders vulnerable to manipulation by companies and government officials (Cramb, 2013; Gillespie 2011; McCarthy, 2010). Yet, oil palm is a suitable crop for smallholder farmers and can provide high returns to land, labour and capital, and has improved the livelihoods of many smallholder farmers (Budidarsono et al., 2013; Feintrenie et al., 2010; Susila, 2004). Smallholder oil palm cultivation also has the potential to stimulate rural development (Budidarsono et al., 2013; Hayami, 2010; Wiggins et al., 2010), particularly when compared with companies that transfer profits to urban shareholders, whilst migrant company workers contribute only marginally to the local economy, as they transfer their savings to their places of origin (Sinaga, 2013). Smallholders have vigorously embraced oil palm and in 2015 roughly 40% of the oil palm area in Indonesia was cultivated by smallholders (DJP, 2015). Government statistics and multiple studies on smallholder oil palm production, however, show that smallholder oil palm farming is inefficient in land use and has sub-standard yields (DJP, 2015; Zen et al., 2016).

In this chapter we analyse a highly successful smallholder plantation scheme, called Ophir, that involves 2,400 smallholders managing 4,800 ha of oil palm, to show that smallholders are not always poorly productive. This smallholder plantation has by far outperformed the national average for smallholders and many nucleus estates. By analysing the Ophir plantation, we seek to identify factors that could lead to more efficient smallholder production, and thereby address current sustainability challenges in smallholder oil palm cultivation. These include increasing productivity (Lee et al., 2013) and allowing smallholders to participate in oil palm cultivation on preferential terms (McCarthy and Zen). In conjunction with proper land use planning, increased production of smallholder systems can spare land for food, forest or other purposes (Baudron and Giller, 2014).

Smallholder production systems and corporate plantation systems have their distinct advantages and disadvantages. The strengths of corporate plantation agriculture lie in the use of clear hierarchical structures (Goldthorpe, 1994; Mintzberg, 1979), low transaction costs due to scale, access to capital and market knowledge (Hayami, 2010; Hazell et al., 2010). Hierarchical structures allow for centralized coordination and control, the formal assignment of tasks, the standardization of production methods and the specialization of the workforce (Grandori, 1997). On the other hand, smallholder production has the advantages of efficient use of family labour, strong incentives to produce high yields due to the direct relationship between effort and reward, high level of commitment and the low cost of monitoring workers (Poulton et al., 2010). Agency costs are an inherent disadvantage for corporate plantations because the idiosyncratic nature of agricultural production prevents the easy measuring the result of hired labour (Byerlee, 2014; Hayami, 2010; Poulton et al., 2010). Yet the yields of smallholders are usually much less than those obtained by corporate plantations (DJP, 2015; Molenaar et al., 2013).

In this chapter we explain how in Ophir, through effective collective action, the advantages of plantation agriculture were combined with the advantages of smallholder agriculture. We use the design principles framework developed by Ostrom (1990) and updated by Cox et al. (2010) to analyse how this was achieved. On the basis of original data, we demonstrate that smallholder oil palm farming can be highly efficient in terms of yield and farmer income when the correct institutions are in place. Support for institutional development and facilitating collective action could provide an alternative to the current unbridled expansion of poor-yielding individual smallholder oil palm production systems, or corporate plantations with relatively high costs and limited benefits for local communities.

The remainder of this chapter is structured as follows. After the methodology section, a description of the Ophir plantation and the achievements of the Ophir smallholders is provided. Subsequently, design principles for successful collective action are introduced. We use this framework to analyse how collective action was achieved in the smallholder plantation and how this allowed smallholders to both capitalize on the advantages of small-scale agriculture and reap the benefits of a large-scale plantation. In the final section, we discuss our findings and the insights the analysis of the Ophir smallholder institutional set-up has given us regarding collective action in smallholder production systems and the usefulness of the design principles. Thereby we identify potentially useful components for including smallholders on preferential terms in modern agro-supply chains and specifically within the oil palm sector.

4.2 Methods

Data for this chapter are primarily based on a six-week field visit in 2009, in which 34 semi-structured interviews were conducted with 1) the leaders of the supra-cooperative, 2) the leaders of the five cooperatives and 3) leaders of *kelompoks*, the local term for farmers groups. A kelompok meeting in one of the cooperatives was attended. Interviews were held with the managers of the nucleus estate, local and international academics who performed research in the area, and three retired staff of the German development organization GTZ (which is now known as GIZ) who were involved in establishing the plantation. Multiple Ophir smallholders were interviewed, as were three workers in the Ophir plantation and local community members not involved in the project. Further, a survey (see Appendix N) was conducted amongst 105 randomly selected farmers in a stratified kelompok sample framework, providing a proportional distribution of farmers from the different cooperatives. Former GTZ staff shared documentation on the support they gave to farmers in setting up the plantation. Long-term yield data was provided by the cooperatives and supra-cooperative. An introductory letter from former GTZ staff and a visit of former GTZ staff facilitated trust and engagement among the smallholders. In 2011, 2014 and 2016 the lead author revisited Ophir and interviewed farmers, current and former cooperative and supra-cooperative staff.

4.3 History of the NES/PIR schemes

Oil palm has been cultivated on a commercial scale in Indonesia since 1911. Production stagnated during World War II, but was revived by the New Order regime, which came to power in the late 1960s (Badrun, 2011; McCarthy et al., 2012). A major goal of the New Order regime was to revitalize the plantation sector to increase export earnings, capitalize on the availability of land and create job opportunities on the country's outer islands (Badrun, 2011; McCarthy et al., 2012; Zen et al., 2016). The government created state-owned plantation companies that focused on the cultivation of export crops such as coffee, coconut, rubber and oil palm. With the support of the World Bank and the Asian Development Bank, the Nucleus Estate Smallholder/Perkebunan Inti Rakyat (NES/PIR) schemes were introduced in the late 1970s. The first wave of NES/PIR projects started in the 1980s, consisting of 31 schemes and a total of 213,011 ha of oil palms, with smallholders accounting for 148,590 ha (70%) and nucleus estates 64,421 ha (30%). First plantings with the NES/PIR schemes usually took place in fairly remote areas and ceased in 1994 (Badrun, 2011). Later waves of NES/PIR projects included PIR-Trans schemes and the PIR-KKPA (Kredit Kooperasi Primer Anggota) schemes, in which the state-owned companies were replaced by the private sector. When the New Order regime collapsed, the models changed again under the influence of a powerful oil palm industry, which argued that smallholder cultivation was inefficient (Gillespie 2011). Smallholder schemes therefore further developed towards giving smallholders less responsibility in plantation management, less compulsory smallholder area and an increase in company management (Budidarsono et al., 2013; McCarthy, 2010).

In NES/PIR schemes, the nucleus estate and associated processing factory were typically sufficiently large to allow the appointment of professional managers. The smallholders produced under contract with the nucleus estate facing monopsonistic market conditions. The nucleus estate set standards for crop management, and provided farmers with agronomic, managerial and credit services. The smallholders, who were locals or trans-migrants, were usually organized in cooperatives. These cooperatives offered services not provided by the nucleus estate. In the ideal situation the nucleus estate provided physical infrastructure such as roads, housing, market centres, schools and medical facilities; the management of crop nurseries with high quality planting material for the plantation's own use and for the smallholders; forest clearing and the block planting of the perennial crop, and maintenance to maturity before handing each plot over to the smallholders; inspection and advisory services; the training of farmers; the collection, processing and marketing of produce; the bulk buying, storage and sale to farmers of inputs such as fertilisers and pesticides; and credit. Participating smallholders usually received a two ha plot with oil palm, a house and a 0.5 ha home garden plot, which was crucial for food production during the first three to four years before the oil palms began to produce. In these first years, the nucleus estate was responsible for management, including fertiliser application, maintenance and weeding. The plantation was subsequently transferred from the state-owned company to the cooperative and the individual smallholders, who had signed a contract to repay the costs incurred during the establishment phase plus interest on the loan from the Indonesian government. After the loan was repaid, the land title was transferred to the individual landowner. In the contract it was stated that smallholders should reside in the settler area (Badrun, 2011). As projects were usually initiated in fairly remote areas, this condition proved difficult to fulfil.

By the mid-1980s, state-owned companies and their smallholders accounted for 70% of oil palm cultivation in Indonesia, the private sector started to revive and independent oil palm smallholders were virtually unheard of. Although the NES/PIR projects are now generally regarded as successful, in the mid-1980s many of these projects experienced serious problems leading to their abandonment. Causes given were the complete dependence of smallholders on state-owned companies and these companies' lack of technical and financial capacity (BMZ, 1992; Zen et al., 2016).

4.4 The Ophir plantation: Structure and performance

The Ophir plantation (0º 1.66'N, 99º 51.64'E) is located in the District of West-Pasaman (0º 30'-0º 11' N, 99º 10'-100º 04' E) in West Sumatra, Indonesia (see Figure 4.1). The topography is characterized by flat lowlands around 60 meter above sea level (masl) in the west to more hilly and dissected terraces at elevations of up to 400 masl in the east. The environment in Ophir is ideal for oil palm. Yield potential varies along an east – west gradient, with a greatest yield potential on the flat, fine textured soils with less rainfall (3,000 mm year^{-1}) and less cloud cover in the west to lower yield potential in the undulating to hilly, coarser textured soils with rainfall of up to 5,000 mm year^{-1} in the east.

The first plantation was established in 1926 by the Cultuurmaatschappij Ophir NV, which bought 8,600 ha for the cultivation of coffee and rubber. Oil palm was first planted in 1937 but abandoned during the Japanese occupation in 1941 (Rosenquist and Anderson, 1975; see Figure 4.2 for Ophir palm oil mill in 1941). After independence, the area was given to the military for retired staff and only in 1979 became state land again. Already in the 1970s the project area was ethnically mixed: most inhabitants were Minangkabau (55.8%) followed by Batak (35.4%) and Javanese (8.8%). In 1991, the participants in the Ophir plantation comprised Minangkabau (55%), Javanese (30%) and Batak (15%), meaning that the share of Javanese was slightly overrepresented compared with the general population in the project area. Although many participants were settlers, most had already resided in West Sumatra before the project commenced (Bergschneider, 1990).

Figure 4.2 Ophir mill in 1941 (Unknown, 1941)

Our 2009 survey indicated that, although 69% of the farmers were first-generation farmers and 31% were second-generation farmers, the ethnic composition of plot owners had remained stable, indicating that there had been limited sales of plots or limited ethnic diversification or concentration within the plantation. Interviews in 2009, 2014 and 2016 suggest that most smallholders still reside in the area.

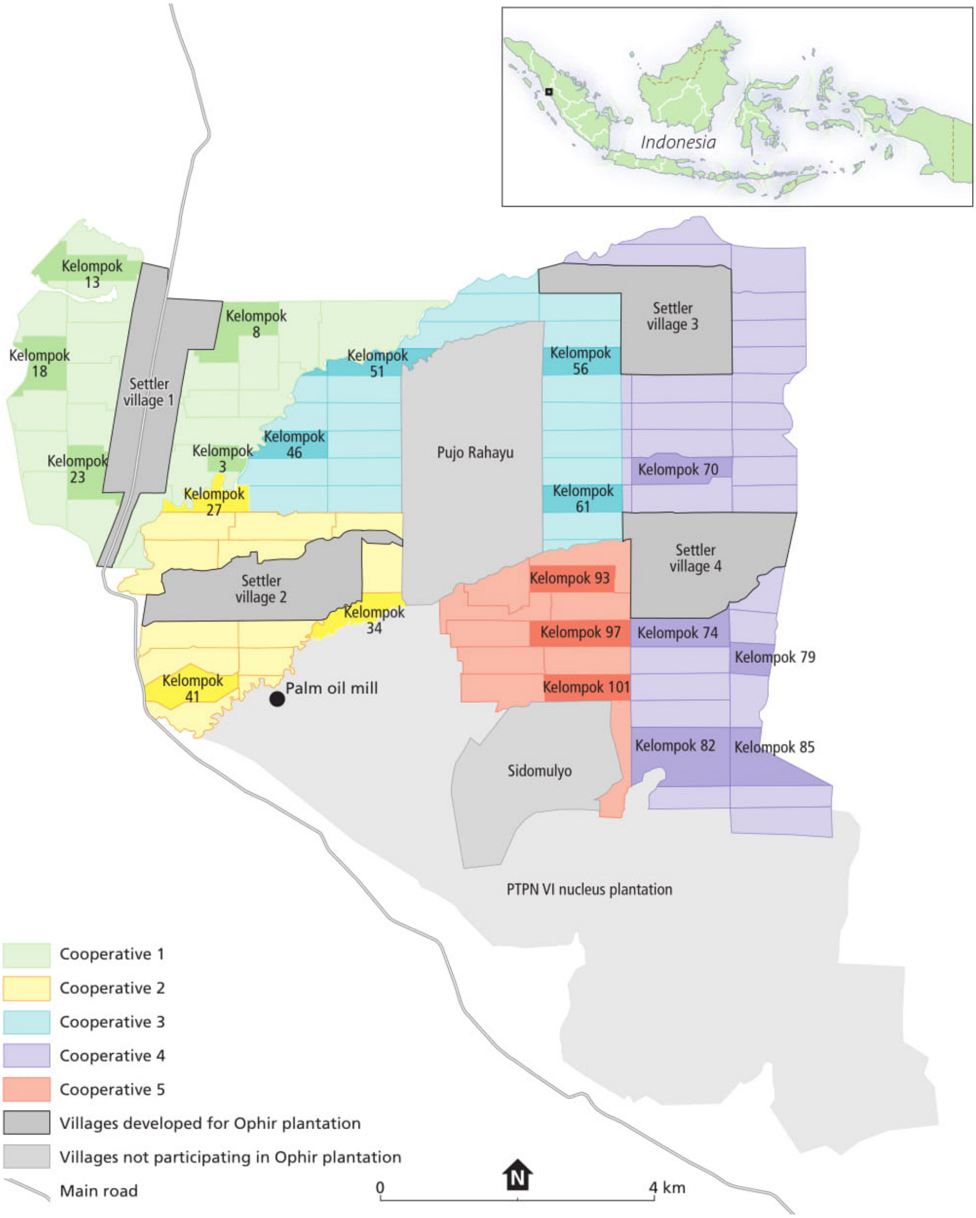


Figure 4.1 Location and layout of the Ophir oil palm plantations.
Approximate positions of sampled kelompoks are highlighted but may not represent exact kelompok size.

The area was one of West Sumatra' 'pockets of poverty' and was included in the Area Development Plan developed by the governments of Indonesia and West Germany in the late 1970s (Kievelitz, 1985). In this plan, the Ophir plantation was designed to function as an engine for rural development and, in principle, had the same characteristics as the other NES/PIR projects. A major difference was the technical support funded by the German government in addition to support from the state-owned company, PTPN 6. The German government was adamant that smallholders should participate in the creation of management structures, become self-reliant and have a sense of ownership in the project to avoid dependency on PTPN 6 and to strengthen their commitment to the project. The NES/PIR Ophir project started in 1982 with the establishment of Cooperative Plantation I, which would be followed by the establishment of four more cooperative plantations (see Table 4.1). Technical assistance provided by GTZ continued until 1993 with an additional three years for knowledge transfer to other projects, amounting to 11 years of smallholder guidance (BMZ, 1986, 2004; Jahn et al., 1999).

Ophir was a great success in terms of the yields achieved and the quick repayment of credit. Figure 4.3 shows that both Ophir smallholders and its nucleus estate achieved yields considerably above the national averages. Ophir smallholders obtained nearly double the average yield of other smallholders.

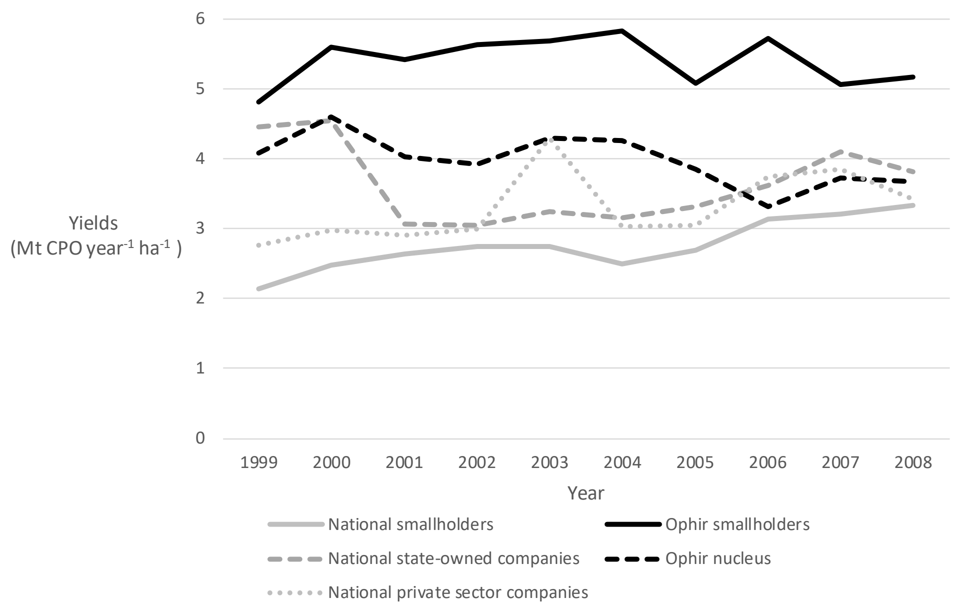


Figure 4.3 Comparison of national average crude palm oil production for private companies, state-owned companies, smallholders in Indonesia and the Ophir plantations

Sources: DJP 2000-2010, PTPN 6 and Ophir smallholder cooperatives. In calculating the yields ha^{-1} from DJP data, only the area of mature plantations were included. In order to convert yields in Ophir into CPO yields ha^{-1} , a 21% extraction rate was applied. This is te oil extraction rate provided by the mill which processed the FFB, hence most likely a conservative estimation in order to reduce payments to farmers.

Credit repayment, an issue frequently mentioned as a cause of failure of smallholder projects (McCarthy, 2010; Zen et al., 2016), was quickly achieved in Ophir. Credit for the establishment of the oil palm plots, infrastructure, house and garden was repaid in a relatively short period of 6–7 years instead of the expected 15-17 years (see Table 4.1).

The Ophir plantation also benefitted from favourable natural conditions and good quality planting material; the latter is often lacking in independent smallholder oil palm production (Boer et al., 2012; Molenaar et al., 2013). But good natural conditions and planting material were not sufficient conditions for high yields. Even the nucleus estate, which is located adjacent to the smallholder cooperatives and thus benefitted from similar natural conditions and planting material, was outperformed considerably for more than 20 years (see Figure 4.4). As yields are a result of genotype x environment x management interactions, and the first two were similar, the difference can be attributed to better management by the smallholders.

Although no quantitative information is available, Ophir smallholders and a local resident of a village surrounded by the Ophir plantation indicated that the Ophir cooperative plots deliver more fruits than oil palm plots outside the Ophir plantation (interview April 2009 with wife of the head of Kelompok 23; interview with a villager within the plantation area but not part of Ophir, April 2009).

Respondents indicated better maintenance and fertilization application as explanations for the differences, as well as peer pressure in the kelompok and the lack of a monitoring and sanctioning system in their individually managed plots.

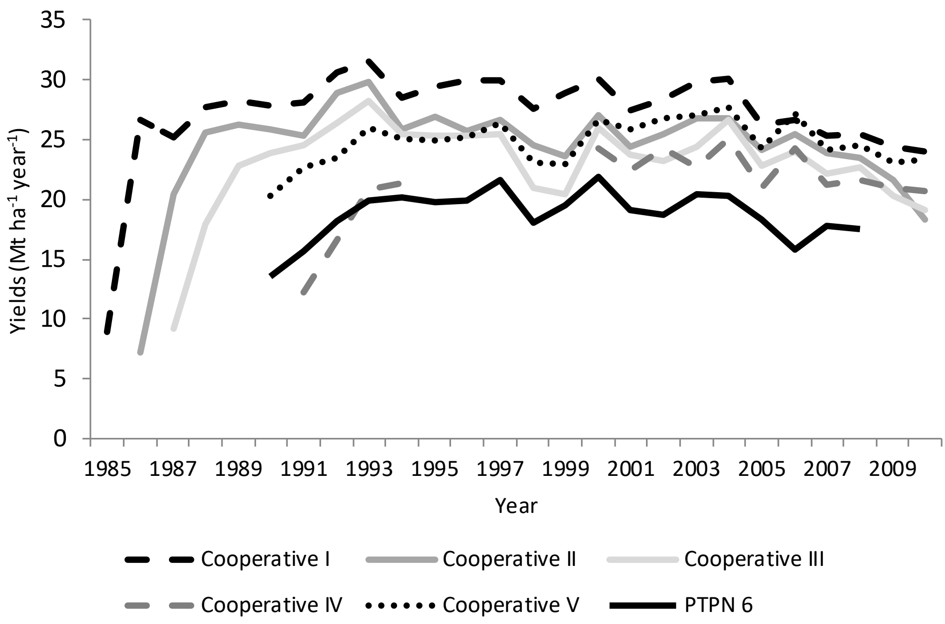


Figure 4.4 Fresh fruit bunches yields at the five cooperatives and the nucleus estate in Ophir from 1985 to 2010
Sources: cooperative managements + PTPN 6 nucleus estate

Table 4.1 Overview establishment Ophir plantation, number of members and repayment of establishment credit Sources: Cooperatives 1 to 5 and KfW, 2000)

Cooperative	Start				2009	2013	Repayment		
	Year of planting	Year of first harvest	Area (ha)	No of members	No of members	No of members	Actual com-pletion	Predicted	No of years
1	1982	1985	1180	591	590	526	1991/2	2002	6-7
2	1982/3	1986	677	334	354	190	1992	2003	7
3	1983/4/5	1987	987	500	612	418	1993/4	2004	6
4	1985/6	1991	1331	667	539	530	1997	2007	6
5	1984	1989	623	306	306	233	1995	2005	6
Total			4797	2398	2401	1897			

4.5 The design principles

The achievements of Ophir demonstrate that smallholders were able to manage their oil palm plantation efficiently over a prolonged period of time. To analyse the institutional setup of Ophir and the farmers' remarkable achievement, we use the design principles for effective collective action in common pool resources developed by Ostrom (1990). These design principles were initially developed in reaction to two dominant ideas on the limitations of collective action (Acheson, 2011; Blaikie, 2006; Ostrom, 1990). Hardin's (1968) famous 'Tragedy of the Commons' provided an example of the collapse of a common pool resource. The author saw the solution in strong autocratic governance. Olson (1965), in 'The Logic of Collective Action', claimed that people coordinate their activities mainly based on their individual benefit and not for the common good per se, emphasizing free-rider behaviour and the consequent demise of collective action. These arguments led to policy prescriptions that promote either state regulation or private ownership as solutions to the challenges of managing common pool resources (Agrawal, 2003; Ostrom, 1990; Saunders, 2014). However, Ostrom (1990) demonstrated that many natural resources, usually commons such as fisheries, grazing grounds and forests, can be managed and maintained by communities for prolonged periods without privatization or strong state regulation. Drawing on 14 empirical cases and guided by game theory, Ostrom developed a set of design principles for successful long-term collective action in managing natural resources (Ostrom, 1990; Robson et al., 2014; Saunders, 2014). These design principles have been taken up widely by policymakers, donors and NGOs in community-based natural resource management (Blaikie, 2006; Saunders, 2014; Shackleton et al., 2010). They have also been broadly embraced by academics, with the Ostrom's (1990) seminal work having been cited 27,734 times (Google Scholar, as of 09-04-2017). Over the last two decades, the design principles have proven to be a valid heuristic tool for the analysis of collective action (Cox, 2010; Robson et al., 2014; Wilson et al., 2013) and therefore as a relevant framework for analysis.

However, the design principles have also been criticized by both practitioners and scholars. One the main criticisms refers to its lack of acknowledgement of the heterogeneity of communities and related multiple uses of resources (Agrawal, 2003; Blaikie, 2006; Saunders, 2014). Another criticism refers to the emphasis on efficiency and functionality in the theory behind the design principles, which, once applied to common pool projects, does not sufficiently acknowledge social mechanisms like participation, social capital, social learning and empowerment. In section 4.7, we will elaborate on these limitations of the design principles and discuss the extent to which the criticism applies to the Ophir case.

As the design principles were initially developed in the late 1980s and much research has been conducted since, we use the revised design principles as presented by Cox (2010). The adapted design principles are: 1a) Clear user boundaries; 1b) Clear resource boundaries; 2a) Appropriation and provision rules are congruent with local social and environmental conditions; 2b) Appropriation and provision rules are proportional to the input required; 3) Collective choice arrangements; 4a) Monitoring of users; 4b) Monitoring the resource; 5) Graduated sanctions; 6) Conflict resolution mechanisms; 7) Minimal recognition of rights; and 8) Nested enterprises.

4.6 Analysing the institutional set-up of Ophir with the design principles framework

Our analysis starts with the eighth principle – 'nested enterprises' – as it provides an overview the structure of the smallholder organization and the plantation as a whole (recapitulated in Figure 4.5).

4.6.1 Nested enterprises

Ostrom (1990) claims that when a system exceeds a certain size, responsibilities and activities can be more efficiently managed in sub-organizations. Smallholders in Ophir were organized at three levels: first the kelompok or group level, second the cooperative level and third the supra-cooperative level (see Figure 4.6) The kelompok and cooperative levels were created first. Once the organizations at these levels were functioning and had control mechanisms in place, the supra-cooperative was established. The roll-out of organizational structures, procedures and plantation management proceeded from Cooperative 1, which set the bar for the whole project. A stepwise approach was used in setting up the smallholder organizations, starting with training sessions at the kelompok level and working upwards.

Ostrom (2005) emphasizes the importance of polycentric organizations. With polycentric decision-making, there is space for experimentation and the adaptation of rules and regulations, which is necessary as conditions change. Having multiple decision-making centres allows rules and regulations to be adapted to the interests and needs of sub-groups. In Ophir different kelompoks and cooperatives have slightly different operational rules whilst having the same basic rules, crafted under the guidance of GTZ. In the following sections, the activities and responsibilities of the different levels in the smallholder plantation are discussed.

4.6.1.1 Individural farmer

The Ophir plantation consisted of 2,400 farmers, each of whom received a 2 ha plot planted with oil palm and incurred a debt, which was paid off through deductions made automatically through the cooperative. After repaying the debt, the farmer became the legal holder of the land. Initially the land title certificates were kept at the cooperative level. This changed over time among the cooperatives and had considerable implications for the future collective management of the plantation. Smallholders were responsible for tending the plantation, including applying fertilisers, weeding, harvesting, transporting fruits to pickup points and maintaining these pickup points; managing their individual home plot; electing kelompok leaders; and for informally monitoring the effort and performance of other kelompok members and the labourers smallholders employed.

4.6.1.2 Kelompok

There were 102 kelompoks in the plantation, which on average covered 50 ha and had 25 smallholder members. A key feature of the Ophir scheme was the introduction of a group income in which proceeds from sale of fresh fruit bunches were divided equally among the individual kelompok members, with only small premiums for individual performance. This approach combined group and individual responsibility and had a crucial impact on the functioning of the kelompoks. First, individual income could only increase if all members managed their plots properly. Second, shared income generated peer pressure amongst farmers to ensure that individual farmers did not fall behind on important tasks in plantation management, leading to uniform standards. Third, each kelompok decided on its own rules and penalties for non-compliance with group standards for harvesting, fertiliser application and attendance at kelompok meetings. Penalties were imposed after discussion at monthly kelompok meetings. Fourth, it was in the interest of all farmers to assist members who could not harvest or apply fertiliser due to illness or absence. In such cases, other farmers in the kelompok (or labourers arranged by the head of the kelompok) would manage the member's crop and charge the member for the services rendered. Fifth, the key tasks like fertiliser application and harvesting were checked by the kelompok leadership so that individual farmers were less tempted to side-sell fertilisers or fresh fruit bunches (FFB).

The kelompok was a grassroots organization with leaders elected from among the members. The kelompok leadership consisted of a kelompok leader, vice-kelompok leader, treasurer, secretary and technical manager who checked and reported on compliance with the kelompok rules to the members in monthly meetings. They received a salary for doing this from the proceeds from selling FFB and the interest farmers paid on the credit provided by the cooperative. Issues that could not be solved at kelompok level were reported to the cooperative.

4.6.1.3 Cooperative

There were five cooperatives in Ophir, each comprising about 500 farmers, 1,000 ha and 20 kelompoks. Cooperatives had a technical unit and a general manager that provided services that could not be arranged effectively at individual or kelompok level due to scale, associated costs and professional requirements. The technical units performed regular checks on pests and diseases, road condition, maintenance of crop collection points, and arranged the storage and distribution of fertilisers to all the kelompoks in the cooperative. The activities of the management were the procurement of fertiliser, which involved large sums of money, developing harvesting schemes, transporting FFB from the farmer's plot to a mill, financial services, road maintenance and the quality control of produce. The cooperatives made annual plans, which were subject to approval by representatives of all kelompoks during the annual meetings. At the annual meetings kelompok representatives discuss financial reports, maintenance plans for the cooperative and proposals for optimizing production. These topics clearly indicate a business-orientated approach. All cooperatives had their own administrative offices. Cooperatives covered the costs for their services by making deductions from the revenues from smallholder FFB sales and interest on credit provided to members.

4.6.1.4 Supra-cooperative

While the cooperatives bore most of the responsibilities for providing services to the smallholders and their kelompoks, the supra-cooperative provided services which were more efficiently organized at this top level. The responsibilities of the supra-cooperative included: 1) representing all members to outside organizations, including mills; 2) maintaining road maintenance vehicles; 3) administering the farmers' payments (e.g. operation of a digital payment system) including printed reports; and 4) managing the farmers' bank, which was established in the 1990s to deal with smallholder, kelompok and cooperative finances.

The supra-cooperative also facilitated communication among cooperatives and between cooperatives and third parties, expressing the shared goals and providing a single desk for problem solving. Smallholders did not directly control the supra-cooperative as this was done through the cooperative leaders. As a consequence, this organizational level was only indirectly accountable to smallholders. Costs were covered by deductions from FFB sales and interest on credit provided to members.

Ophir smallholder oil palm producer organization		
Levels		Responsibilities
Farmer	Husband & wife 2 ha plot 0.5 ha home plot	• Tend the plantation area; apply fertilizers, weed, harvest, transport fruits to pickup points and maintain these pickup points; • Manage their home plot individually; • Elect head of group, secretary and treasurer; • Informally check the performance other members.
Group	Average: 25 families per group 50 ha plantation	• Members pursue social and commercial activities jointly; • Organise frequent meetings to discuss progress in group; • Discipline members; • Group management checks the performance of members and reports on this during monthly meetings; • Group spokespersons elect the plasma board and represent their groups at plasma assemblies; • Communicate matters from cooperative level to members and vice versa; • Lead the drawing up, revising and approval of group statutes.
Co-operative	Average: 20 groups per Plasma 1,000 ha plantation	• Organize the transport of FFB from plantation to factory; • Procure and distribute production inputs; • Sell day-to-day items and items needed for individuals to farm their plots efficiently; • Organize crop protection measures and road maintenance; • Grant credits to members; • Coordinate social and commercial activities of the group. • Plasma board elects supra-cooperative board and is represented in this board; • Develop long-term strategies and training sessions.
Supra-cooperative	5 Cooperatives 4,800 ha plantation	• Coordinate plasma activities and represent the plasmas in dealings with the nucleus and third parties; • Arrange harvest accounts at the nucleus and bank and provide computer print-outs on these activities to coops; • Own business activities (incl. bank and crushing unit for road maintenance).

Figure 4.5 Overview of the smallholder organization in Ophir
Adapted from Peeters (1995)

4.6.2 Clear boundaries

4.6.2.1 Clear user boundaries

The legitimate users of the plantation resources were smallholders who were registered as members in Ophir. All members had their own 2 ha plot, which could not be subdivided. The responsibilities of all actors within the smallholder plantation were collectively agreed upon.

As the Ophir plantation was in essence a settler project and although most settlers were from within West Sumatra but ethnically diverse (see section 4.4), there was no initial sense of community, hence trust and belief in the possibilities for effective cooperation had to be created. A sense of community and increased interaction among members was facilitated by the creation of four villages so that people lived near their section of the plantation. By living in close proximity, visiting the same mosques and churches, and sending their children to the same schools, people interacted with each other on a day-to-day basis, creating ties beyond managing the plantation. Project facilitators acknowledged sensitive issues such as the keeping of pigs, and therefore clustered Christians and Muslims within villages. People of different ethnicities and religions who formerly engaged in different livelihood activities, lived in the same villages and worked together, and as a farmer in Plasma 2 indicated during an interview in March 2016, assisted one another in constructing a church or mosque. Multiple ties between participants supported reciprocity and mutual interest in sustaining the resource. Although living together in villages close to the plantation was common in NES/PIR schemes, in Ophir community building was nurtured by GTZ through the continuous training of farmers in managerial and technological skills, as well as in dealing with group dynamics (Heering, 1993). This training was also intended to develop a sense of pride and success, demonstrating that they were not just farmers waiting for company hand-outs, but a collective that was determined to successfully manage an oil palm plantation.

Overall, general exit and entry requirements for NES/PIR schemes were determined by the Indonesian developers of these schemes. Kievelitz (1985) mentions that recruitment of smallholders was from rural families of peasant origin within the project area or the project vicinity with small, uneconomic lands or tenancy rights, and retired army personnel who fulfilled the same general standards for selection. Other entry requirements mentioned by former GTZ staff (interview Peters April 2009; interview Heering, March 2009) were that smallholders should be married, have no communist association and be able to provide labour. Former GTZ staff indicated it was difficult to attract smallholders in the early phases as it was unclear whether the plantation would be a success, whilst at a later stage it was getting difficult to keep people out who did not meet the criteria but were attracted by the success of the plantation.

Many smallholders left PIR schemes due to poor support from the state-owned companies, with papers still in their names. This currently leads to many difficulties with replanting, as land certificates are officially held by people who can no longer be traced (Budidarsono et al., 2013). In Ophir, this problem was avoided, partly due to the concerted efforts by GTZ and other stakeholders to sustain the engagement of smallholders in the plantation and the quickly obtained financial benefits (interviews former GTZ staff 2009 and 2016). Entry and exit rules for membership once the plantation was running varied slightly among kelompoks due to decision making at kelompok and cooperative level. The 'husband, wife, children' system was the underlying basis, as it was in other PIR schemes. In this system, the spouse and later the children of the owner inherit the plot when the owner passes away, allowing the plot to remain in family hands and hence within the community. In order to keep ownership clear the general rule amongst cooperative and kelompok leaders was that the plot itself could not be subdivided and remained registered under one name but profits could be divided amongst family members. Jahn (1999) mentions that in practice this was not always adhered to. Although in the early stages land certificates were held at the cooperative level at all cooperatives, members in cooperatives 2, 3, 4 and 5 demanded that these be returned to the individual members. In the case of sales to outsiders, it was up to the kelompok whether to accept the change in ownership. Certainly in the early years, when there were few opportunities to operate independently, good relations within kelompok were crucial for farmers, but also this rule undoubtedly had different levels of adherence among the kelompoks. By maintaining property within the kelompok and cooperative, a sense of community is maintained and members remain aware of how the kelompok functions. Reasons for this choice of rules were to secure possibilities for future generations of the current smallholders and to prevent the entry of outsiders. With outsiders the risk of rent seeking was perceived to be higher, as the community had fewer means to enforce regulations.

4.6.2.2 Clear resource boundaries

The boundaries of the resource – the smallholder oil palm plantation – were clearly defined. For the entire smallholder plantation of 4,800 ha, the cooperatives ranged from 612 ha to 1,238 ha, the kelompoks from 32 ha to 60 ha and each smallholder was responsible for their own 2 ha plot. As indicated above, subdivision of the 2 ha plots was not allowed, and although theoretically it was possible to add extra hectares, people or even kelompoks to the cooperatives, this did not happen except when several kelompoks moved from one cooperative to another. The boundaries remained stable until 2010, when replanting became a critical issue. All oil palms and infrastructure in the smallholder plantation were developed by PTPN 6, setting clear boundaries in the landscape.

The 'resource', however, is not simply the palms and the physical infrastructure. The real resource was the 4,800 ha of high yielding oil palm plantation. Although good planting material ensured that a high performing genotype was present throughout the plantation and the environment was favourable for oil palm, good management is essential to cultivate and maintain the 'resource'. Management includes knowledge of and skills in agronomy – such as timely and adequate weeding, pruning, fertilization and harvesting – as well as operational aspects, such as the transport of FFB, the procurement and distribution of fertilisers, marketing, road repair teams, pest and disease control teams, and mechanisms for monitoring and sanctioning.

4.6.3 Appropriation and provision rules

4.6.3.1 Rules congruent with local social and environmental conditions

The physical environmental conditions in Ophir were clearly favourable for the cultivation of oil palm, which provided the opportunity for high yields and profits (appropriation by smallholders) when the right inputs were provided (provision by smallholders). Water shortages due to natural conditions were not relevant. However, during times of low oil palm prices, the rules for savings and credit could be altered by members through their organizations.

Harvesting was arranged through schemes developed at the cooperative level, which also arranged transport to the mill. Smallholders were obliged to follow the scheme of the cooperatives but arranged harvesting individually, whilst maintaining standards. Appropriation of income was arranged through a shared income based on the kelompok produce with deductions for services. Cooperatives, supra-cooperatives and smallholders were not allowed to market produce individually. Basically the smallholders appropriated income and services from the kelompok, cooperative and supra-cooperative, and provided plot management, the implementation of kelompok and cooperative recommendations and participation in meetings at different organizational levels. Transparency within the organizations was a key requirement for members to develop trust; for instance, the cost of services rendered was revealed at monthly kelompok meetings, and from 1987 onwards a computerized payment system was used.

Besides the ethnic diversity described in Section 4.4, the professional backgrounds of smallholders were also diverse, consisting of former lower level military staff, some civil servants and former employees, and many local farmers. This diversity enhanced social conditions, which allowed for an efficient development of the institutions required and uptake of the knowledge provided by facilitators as settlers brought previously attained skills to the project (Heering, 1993; Peeters, 1995). Convincing members of the benefits of a relatively complex high-input, high-output system was done through numerous meetings between members, cooperative leaders, government officials and project implementers, during which calculations were made and shared with the members, who subsequently had to approve (or disapprove) the plans of the kelompoks and cooperative. Although GTZ and their Indonesian partners advised smallholders, they had no sanction to force smallholders to implement measures. The decision to implement measures to enhance oil palm yields rested entirely with the smallholder organizations.

4.6.3.2 Rules proportional to the input required

Above we mentioned the importance of convincing members of the need to implement certain measures. An example of the clear understanding between input requirements (provision) and yields, and hence income, is reflected in the upkeep of inputs even at times when prices for farmers were low. During times of low market prices, smallholders are often tempted to reduce fertiliser inputs. This translates into decreased yields months later when prices may have recovered, leading to permanently reduced fertiliser inputs due to reduced income (Samosir, 2013; Zen et al., 2016). The rules related to appropriation and provision, and the long-term planning by cooperatives, appear to have prevented such a situation from arising, as fertilizer was ordered in advance and yields remained high from the start of production until 2010, after which systematic yield data could no longer be obtained.

Until at least 2010, almost all of the smallholders remained members of the cooperatives and maintained a highly profitable, high-input (of fertilisers and management), high-output (of high yields and income) system. The technical and logistical support provided in the Ophir plantations was critical to their success, and the smallholder organizations paid for these services. The overall running costs of smallholder organization in Ophir10, namely 19% of gross revenues in 1991 and 13% in 2008 (BMZ, 1992; own survey 2009), were clearly outweighed by the income generated, and in line with the suggestion of Zen et al. (2016) that in most smallholder situations increased input supply benefits profitability.

4.6.4 Collective choice arrangements

Rules and regulations were created from the bottom up, starting at the kelompok level. Kelompok meetings were held each month and attended by smallholders or their representatives. During annual meetings the cooperative leaders presented plans, which were then presented by the kelompok leaders at kelompok meetings and discussed by the members. If needed, adjustments to the plans were proposed at these kelompok meetings (Bauer, 1991; Heering, 1993). Smallholders

10 This includes fertilizers, pest and disease control, supervisory costs/management fee, road maintenance, crop transport and other physical repairs but exclude plantation labour and land tax.

could also visit the cooperative or supra-cooperative office to discuss pressing issues or obtain information about decisions and practices.

Having the freedom to experiment with local rules and regulations provided smallholders with the opportunity to adapt these to fit decentralized conditions. Locally crafted rules can often best deal with 'local realities'. In addition, having a voice in determining the rules is known to increase the ease of implementing them. Such a collective choice arrangement is strongly linked to the appropriation and provision rules and their congruence with local conditions as mentioned above.

At the project inception, as members were grouped together for the first time, it was important to have a facilitator to guide the need for the quick establishment of constitutional rules, and of operational rules which could later be adapted. Clear guidelines were established to avoid misunderstanding and confusion about rights and responsibilities and this was a core tenet of technical cooperation provided by GTZ (Bauer, 1991, Heering, 1993).

4.6.5 Monitoring

4.6.5.1 Monitoring of users

As Ophir smallholders received a joint income based on the output of the kelompok, there was a strong incentive for members to monitor the performance of their fellow kelompok members. In Ophir, each kelompok had between 16 and 30 members, which meant that members could get to know each other. Costs for monitoring were low, as 'hiding in anonymity' was not easily possible due to social control and the limited size of kelompoks. The primary responsibility for the monitoring of plots was with the farmers, who were responsible for maintaining high standards on their own plot and for monitoring their neighbours. Farmers were also responsible for the labourers they hired. The kelompok leadership, however, had to monitor whether the members performed their work properly and had to hire extra labour if work was not performed according to standards.

Monitoring of the hired labourers became increasingly relevant as over time a strong shift occurred from family labour to hired labour. Whereas in 1990, 60% of labour activities were performed by the smallholder household members, by 2009 on average only 23% of labour activities were performed by the households themselves (survey results). This shift is attributed to increases in the wealth of the smallholders, the availability of cheap labour, and the absence of younger family members who were at school or preferred to find work outside the plantation. Participants moved away from the more remote areas and often spent more time in the local town, spending less time in the plantation to monitor activities and leaving more responsibilities to the kelompok leaders (interviews with farmers and leaders, August 2009). These observations are also reflected in the lowest household participation in labour activities in the more remote cooperatives 3, 4 and 5 in 2009 (survey results).

4.6.5.2 Monitoring the resource

The responsibility for managing individual oil palm plots rested with the smallholder. Yet the kelompok manager had to follow up when activities were not up to standard. Problems due to absenteeism were solved by deducting money from the income of the absentee owner to cover the costs incurred for maintaining high standards. Side-selling of FFB was not accepted as it would reduce the income of all other kelompok members. Some kelompoks organized monthly walks together through their land, whilst other kelompoks left it to the kelompok managers to report on field conditions during the monthly meetings. Individual members were free to walk throughout the whole plantation, check for themselves and report during kelompok meetings. Whenever activities within the plantation were not done to the satisfaction of kelompok members or their leadership, this was reported to the responsible person. The cooperative leaders were responsible for monitoring road conditions, nutrient deficiencies, and pests and diseases, but required input from the kelompok leaders to perform their tasks efficiently.

The monitoring of the finances and plantation activities was also facilitated by the implementation of a clear accounting system with monthly print-outs distributed to all members, and bank accounts for all members. These sheets provided clear and transparent records of yields, FFB prices, costs, loans by smallholders and deductions. Allowing smallholders to check the numbers and calculations strengthened their trust in the leadership of the plantation.

4.6.6 Graduated sanctions

Rules can only be upheld if there are sanctions that can be invoked in the case of non-compliance. The kelompok leaders were most directly involved in sanctioning members, although the social mechanism of shame and blame within the local community supported adherence to agreed standards. The first formal level of sanctions was the mentioning of non-compliance during meetings, while stronger sanctions involved fines, for example a 50,000 IDR (5 US$) fine for not attending the monthly kelompok meetings. Although this might have been a reasonable amount in the early phases of the project, nowadays this would not even cover the costs of fuel to come from Padang, let alone the opportunity cost. The ultimate sanction, exclusion from the kelompok, was never invoked.

4.6.7 Conflict resolution mechanism

Conflict resolution mechanisms were organized at different levels. At the kelompok level, issues among individual members and with the kelompok management were mostly resolved during monthly meetings or informal gatherings at the house of the farmer or head of the kelompok, with a possibility of cooperative managers providing assistance if a solution could not be reached between kelompok leaders and an individual farmer. The leaders of different kelompoks discussed among themselves and with cooperative managers in the case of a conflict that affected more than one kelompok. If there was a conflict with a third party, the cooperative leaders directly contacted the third party or worked with the supra-cooperative to resolve the issue. Meetings in the early phases of the project were facilitated by GTZ staff, but as experience grew GTZ was no longer needed.

4.6.8 Minimal recognition of rights

The project was initiated by the government of Indonesia, with a clear recognition of land rights of participants and regulations associated with the NES/PIR schemes. What distinguished Ophir from other schemes was the institutional arrangement designed to create self-reliance, a sense of ownership and smallholder commitment. Interviews with former GTZ project staff (2009) revealed that there was frequent tension with PTPN VI concerning the institutional arrangement proposed by GTZ and the smallholders. An important actor regarding preventing and resolving conflicts was the Provincial Coordinating Committee (PCC), which supervised and coordinated the responsibilities of the relevant government organizations and nucleus estate and negotiated in cases of conflicts of interests (Bauer, 1991; Heering, 1993). Even within the Indonesian government there were individuals who were proponents and opponents of the Ophir approach. The external assistance provided by GTZ and the collaboration with higher levels of authority within the Indonesian government provided extra opportunity for experimentation (interview with Peters March 2009; interview with Heering, March 2009).

4.7 Discussion

Collective action allowed smallholders to combine the advantages of large-scale agriculture – being capitalized on at the cooperative and the supra-cooperative level – with the advantages of smallholder farming, being capitalized on at the kelompok and the individual level, with farmers having a direct interest in the production of their own plot as well as the plots of their group members due to their shared income. Sutton (1989) highlights that a shared income had also been tried in the FELDA schemes in Malaysia, but that the perceived free-riding of non-performing members, a major threat to collective action (Olson, 1965), rendered this system unpopular. The Ophir case, however, shows that institutions can be developed to address the free-riding problem. The kelompok structure, with its leaders and active members keen on maintaining high incomes, monitored the activities in the plantation, and through a system of collectively defined rules, regulations and monitoring ensured that free-riders were disciplined. In line with the findings of Baldassarri (2015) that cooperation is induced by patterns of reciprocity that emerge through repeated interaction, farmers in Ophir had multiple levels of interactions, both socially and while managing the plantation, which supported reciprocity and mutual interest in sustaining the resource.

Regarding the unfavourable and dependent position of farmers in outgrower schemes, frequently involving limited transparency concerning the costs companies charge to smallholders (Cramb, 2013), in Ophir dependency on the nucleus estate (PTPN 6) ended with the repayment of debts (Table 4.1). Already during the maturing of the plantation, the cooperatives and the supra-cooperative provided the services that are usually arranged by the nucleus estate, for example road maintenance, the purchase of fertilizers, the marketing of FFB, providing access to technology and pest and disease control, and in the case of Cooperative 1, replanting with high quality planting materials, reducing transaction costs for individual smallholders. The Ophir project moved from what McCarthy (2016) terms exogenous oil palm development, instigated and led by outsiders, towards endogenous oil palm development, in which farmers lead. This is most obvious in Cooperative 1, which has guided collective replanting without outside assistance. The key to inclusion is that smallholders participate in decision making, obtain reasonable compensation, and have access to services and inputs such as capital, good quality planting material, fertilizers and marketing networks. This was achieved through collective action in Ophir and thereby confirms Poulton's (2013) claim that collective action can reduce the transaction costs smallholders usually face.

The design principles provide a systematic tool to analyse complex systems in which large numbers of social and natural variables and their interactions at different levels determine outcomes (Cox et al., 2010). Managing a resource such as a collective smallholder plantation clearly fits the description of such a complex system. A frequent criticism of the design principles is that they are incomplete, and for successful collective action there are many other relevant criteria (Agrawal, 2003; Cox, 2010; Saunders, 2014). Agrawal (2003) estimates there are 30 to 40 relevant criteria and, as also Ostrom indicates in later works (Ostrom, 2009), it is the correlations and balances between criteria that determine successful collective action in the management of commons. Cox (2008) claims that in developing the principles, Ostrom (1990) has suppressed '…detail of variations between units (rules) at one level by aggregating them into a higher-level unit (design principle) based on important common features'. Due to this aggregation, the design principles became container concepts to a certain extent. Although all design principles are present in our case study, it is most likely that there are many more relevant enabling conditions present in Ophir that were not mentioned. However, a key point we take from the design principles is the holistic view, which emphasizes that successful collective action consists of many interacting components some of which might fit in different contexts. We therefore agree with the literature (e.g. Agrawal and Ribbot, 2014; Ostrom, 1990) that finds the design principles useful in highlighting the key components required for collective action and how these can take shape, but that the design principles should not be used as a blueprint for successful collective action as they only provide aggregated theoretical components rather than guidance on how to deal with the dynamic complexity of the multitude of relevant enabling conditions and their relations.

Another frequent criticism of the Ostrom design principles is that they do not pay attention to power relations and the position of powerless groups. Saunders (2014) explains that the lack of acknowledgment of politics is due to the theoretical findings of the design principles, which emphasize that collective action is the result of the rational choices of individuals, in which it becomes clear that working together generates more benefits than working alone. We propose that power relations are implicitly acknowledged in the design principles, as weaker actors always have agency and will protest if they are not sufficiently acknowledged, potentially threatening the resource (Latour, 2005; Scott, 1985). Examples of principles that needed to incorporate power issues are: Principles 2a and 2b, appropriation and provision rules, where the balance between what farmers put in and receive from the system are determined, hence whether it is interesting for a farmer to comply or whether the farmer will resist; Principle 3, collective choice arrangements, in which farmers demand answers from their managements, for example during annual meetings; Principle 7, the minimal recognition of rights, which highlights the importance of for example GTZ and PCC and related lobbying power at higher levels; Principle 8, the relations between the nested enterprises, indicating relations between layers. All of these principles inherently need to deal with politics that threaten the functioning of the resource, and during practical implementation clearly the politics cannot be left out, as GTZ staff regularly emphasized. As the plantation was managed efficiently for over 25 years, it is clear that overall political tensions were dealt with sufficiently. However, by including the power relations component in the design principles, the principles become even more the aforementioned container concepts, again lacking clear guidance on how to develop collective action.

Linking Ostrom's design principles to practice in the field, a frequent criticism is that the design principles often do not work for new projects for the community-based management of natural resources (Blaikie, 2006; Saunders, 2014). Saunders (2014) claims that while the design principles are based on multiple cases of the successful community-based management of natural resources, they only address part of the complexity of such community-based management of a natural resource. Particularly the norms, values and customs that have developed over long periods of time and are crucial for directing human interaction in those communities, are insufficiently captured by the design principles. This becomes particularly problematic when outside supporters, such as NGOs or governmental agencies, impose the design principles on the community and prioritize project objectives above community needs. However, as Ophir was a settler project and the resource was newly established, the sense of community with shared norms, values and customs within the plantation was limited and had to be developed. This relatively 'clean sheet' allowed the project implementers to emphasize their vision; to develop an efficient oil palm plantation that allows independent smallholders to capitalize optimally from their 2 ha oil palm plot, whilst only modestly having to deal with conflicting local norms, values or other traditional uses of the resource. The role of capable and long-term external facilitators in Ophir has been crucial in providing concerted training in technical and managerial aspects, leading to good yields and thereby creating trust amongst smallholder to co-develop their institutions, obtain the political clout to counterbalance the position of the nucleus estate and eventually leading to smallholder independence. Although Vollan (2012) highlights the threats of externally imposed collective action, often providing opportunities for elite capture, this did not undermine collective action in Ophir. Instead of the heterogeneity of resource users being an obstacle, with ethnicity being an acknowledged factor in politics and development (Aspinall and Sukmajati, 2016) and also a relevant issue in smallholder oil palm developments in Indonesia where migrants appear to benefit more than locals (McCarthy and Zen, 2016), ethnic diversity, with attributed cultural characteristics, and especially professional backgrounds provided valuable assets to the project according to project implementers. The diversity of the participants allowed the willing and capable to join the management and lead, whilst participants with less skills participated as members and voted for change when not convinced by the management. Although Ophir clearly provides a particular case regarding the resource being newly developed by project implementers, there are clear links between the efficient management of an oil palm plantation such as Ophir and CBNRM. Thus, this Ophir case study contributes to the literature on CBNRM, and the CBNRM literature, with all its cases and reasons for successes and failures, can also provide relevant inspiration to policy developers and implementers for improving collective action amongst farmers.

However, the development of institutions such as in Ophir did not fit in the laissez-faire phase of smallholder development policies in Indonesia that started in the late 1990s. Since then smallholder farmers receive little support from the government or companies, which leads to an environment with limited opportunities for many smallholders to cultivate under advantageous conditions and explaining their frequently poor yields (Cramb and McCarthy, 2016). The role of outside support appears to have been crucial in Ophir, providing farmers with good planting material and state-of-the-art plantation science. Institution building was the responsibility of GTZ, which proved capable and successful but at substantial costs. These costs were estimated at 7.6 million US$, or 1,588 US$ ha^{-1} (3,175 US$ per farmer), or 16.8% of total expenditures (BMZ, 1992)[11]. The expense of the Ophir approach is likely one of the main reasons why it has not been implemented elsewhere in Indonesia. However, Figure 4.2 shows that the higher yields from the Ophir farmers compared with the nucleus estate was on average 1.3 Mt of CPO ha^{-1} $year^{-1}$ from 1999 till 2008[12]. Considering the average CPO price from 1999 till 2008 of 452.0 US$ Mt^{-1} (Index Mundi, 2017), and an estimated average production costs of Ophir farmers of 20–25% of gross sales (BMZ, 1992; Peeters, 1995), it appears the 1,588 US$ ha^{-1} investments for institution building were earned back over a 25-year period. If Ophir smallholders are compared to the national averages for smallholders for the same period (2.8 vs. 5.3 Mt of CPO $year^{-1}$ ha^{-1}), the results are even more spectacular, although a straight comparison is complicated by differences in the average age of oil palm stands.

11 Amounts mentioned in BMZ, 1992 are 12.7 M Deutsch Mark, an US$-Deutsch Mark exchange rate of 1-1.67 was applied as exchange rate for 1993, based on GTZ 1995 data. This 7.62 million US$ includes the salaries of GTZ experts present in the field for 11 years, computers for cooperatives, motorbikes, a stone crusher for road maintenance, and much more hardware used by smallholders and project implementers.

12 An average oil extraction rate of 21% is used.

4.8 Conclusion

There is debate amongst policymakers about smallholder agriculture in modern agricultural value chains, with claims that smallholders are excluded from global value chains or are only included on adverse terms (du Toit, 2009; McCarthy and Zen, 2016; Poulton et al., 2010). In the near future, certification for oil palm smallholders will be mandatory in Indonesia. Certification initiatives pay attention to implementation of best management practices, socioeconomic development and decision rights for smallholders. Ophir, with its nested structures, internal control systems and high yields, provides an example of how these threats can be countered and shows that oil palm smallholders can be at least as efficient as oil palm companies. Ophir has shown that with well-designed collective action rules, smallholders can participate in value chains that face increasingly strict traceability and quality requirements, and can maintain good yields that can benefit efficient land use.

The Ostrom design principles highlighted the enabling conditions that need to be in place for successful collective action and provided a useful framework for illustrating how these enabling conditions took shape in Ophir. Collective institutions such as shared income, training in cultivation and administrative management, four levels of rights and responsibilities, transparency by using computerized systems and print-outs, regular meetings of members and the multiple relations amongst farmers, demonstrated their relevance in Ophir and can provide inspiration for achieving collective action in other situations. However, neither the design principles nor Ophir are a blueprint for successful collective action or a high yielding smallholder oil palm plantation. Clearly every project has its particular conditions that need to be acknowledged, delicate balances between wide range of enabling conditions need to be found and in some cases collective action might not be achievable.

Since 2010, even in Ophir members have left the cooperatives (Table 4.1) and although the need for replanting appears to be an underlying cause, further research is required to understand farmers' reasons for leaving. Nevertheless, Cooperative 1 successfully replanted collectively and maintained nearly 90% of its members (data obtained during fieldwork in 2016). With the other cooperatives encountering more difficulties but having also produced intensively for over 25 years, Ophir provides an interesting case study that demonstrates that smallholder oil palm farming has great potential for rural development, intensive land use and shows that smallholders can participate in modern supply chains on advantageous terms.

5 Grinding collective action? Analysing nearly 40 years of collective action in the Ophir smallholder oil palm plantation

Ophir smallholder plantation in 2018, after first cycle of smallholder oil palm cultivation, in the background Mount Talamau (photo taken by the author in March 2018)

This Chapter has been submitted as:

Jelsma, I., Karyanto, O,. Grinding collective action? Analyzing nearly 40 years of collective action in the Ophir smallholder oil palm plantation.

5.1 Introduction

Smallholders have played a major role in the expansion of the oil palm sector in Indonesia: in 2017, they occupied an estimated 5.6 million ha, representing 46% of the total Indonesian oil palm area (BPS, 2018). Although providing incomes for millions in rural areas and serving as an important tool for rural development, smallholders generally have a low productivity per hectare compared to corporate oil palm cultivation (BPS, 2018; Jelsma et al., 2017a; Woittiez et al., 2018). Smallholders are therefore often portrayed as the Achilles heel of the oil palm sector. Although debated in academia (Alcott, 2005; Byerlee et al., 2014), current narratives on improving the performance and sustainability of the smallholder oil palm sector emphasize increasing the productivity of smallholders, which is to increase farmer incomes, contribute to more efficient land use and thereby land sparing (Pacheco et al., 2018; RSPO, 2017a; Teoh, 2010).

It is clear, however, that oil palm smallholders are not a homogenous group (Hidayat, 2017; Jelsma et al., 2017a). The most common division between smallholders is tied smallholders versus independent smallholders (see e.g. Euler et al., 2017; Hidayat et al., 2015; Molenaar et al., 2013). Acknowledging the diversity of the partnership agreements between smallholders and companies (Gillespie, 2007; Johnston et al., 2018), tied smallholders receive support from either private-sector or state-owned plantation companies. From the beginning they are integrated into their partner-company production system. Although conflicts in partnerships are common (Cramb, 2013; Gellert, 2015; Gillespie 2011), tied smallholders usually have yields close to company yields due to company support. Independent smallholders on the other hand usually have considerably lower yields (Hidayat et al., 2015; Molenaar et al., 2013). This can be attributed to lack of government or private sector support in, for example, obtaining good quality planting materials, limited access to technical support and no direct link to mills, and thus vulnerability to market exclusion. Independent farmers are therefore included in the oil palm value chain on the most adverse terms (Cramb and McCarthy, 2016; Jelsma et al., 2017a).

Leading sustainability initiatives such as the Round Table for Sustainable Development and the Indonesian Sustainable Palm Oil are developing strategies to support smallholders. A core tenet in their strategies is the obligatory organization of smallholders (DJP, 2017a; Hidayat, 2017; RSPO, 2017a), arguing general principles that the organization of smallholder farmers is a precondition for the easier distribution of technical knowledge, scale advantages in the procurement of services and goods, including certification, and a better position for the marketing of produce and the monitoring of the implementation of good agricultural practices (Brandi et al., 2015; Hazell et al., 2010; Poulton et al., 2010). The low yields in the independent smallholder oil palm sector and the desire to modernize these farmers requires insights into how collective action and farmers organizations are viable. This chapter provides such insights and thereby contributes to debates on oil palm smallholder organization and collective action.

In this study we trace developments in the Ophir plantation (0^{0}2’30”N, 99^{0} 52’0”E) in West Pasaman, West Sumatra, which was established in the early 1980s as part of the NES/PIR programme. A PIR/NES project entailed a tied smallholder business model that linked smallholders with state-owned plantation companies and was a partnership between the government of Indonesia and a foreign donor. The objectives of these schemes were to reduce rural poverty, facilitate knowledge transfer from plantation companies to smallholders, intensify agriculture, and develop Indonesia’s outer islands and an export-oriented agriculture (Badrun, 2011; BMZ, 1986; McCarthy, 2010). Although environmental conditions were often overlooked in NES/PIR projects, as they were usually established in remote areas and replaced forests (Pramudya et al., 2017), other objectives such as intensive production and linking smallholders with corporate R&D resemble current policy on smallholder oil palm development, in which productivity and the organization of smallholders are core tenets.

The Ophir NES/PIR smallholder scheme involved 2,400 smallholders and 4,800 ha of collectively managed smallholder oil palm (see Figure 5.1). The nucleus estate operated a 3,200 ha plantation and a mill. State-owned company PTPN 6 planted the whole Ophir estate and provided agro-inputs and technical support, and farmers were obliged to be organized and sell their produce to the nucleus estate to pay off the debts incurred for plantation establishment. Collective action was organized at a group, cooperative and supra-cooperative level; the last-mentioned had links with the nucleus estate management. For more details about the NES/PIR programme and sub-models see, for example, Badrun (2011) or Molenaar (2013); for specific details about the Ophir smallholder plantation, see Jelsma et al. (2017b).

Collective action among Ophir smallholders through their institutional setup proved very successful in maintaining an intensive production system, outperforming their nucleus estate for more than 25 years and obtaining yields far above national smallholder averages (Jelsma et al., 2017b). However, Jelsma et al. (2017b) indicate that from approximately 2009 onwards the production model has been under pressure. Whereas current governance initiatives emphasize the need for farmers to organize, the Ophir case highlights an opposite trend in which farmers started to abandon their smallholder organizations and operate independently. The advantages associated with the Ophir business model include scale advantages in the transport and marketing of fresh fruit bunches (FFB), the purchasing of inputs, infrastructure maintenance, avoiding bunch theft and arranging collective replanting are clearly challenged.

Although the Ophir model is clearly part of the tied smallholder business models, this chapter explores the partial transformation into an independent smallholder model and demonstrates the dynamics within an operational business model. The deviations from previously successful collective action thereby provide a relevant case for investigating the threats to and the relevance of farmers organizations, as well as what enabling conditions for collective action might be.

This chapter borrows from actor-network theory (ANT) to describe nearly 40 years of collective action in a smallholder plantation and its transformations. The institutional setup and achievements of the Ophir smallholder plantation till about 2009 have been described in detail by Jelsma et al. (2017b). However, their analysis provides a rather static overview of the smallholder collectives that lacks insights into the continuous struggles associated with maintaining smallholder collectives and the continuous reassembling of the humans and non-humans relevant to the smallholder oil palm plantation. ANT focusses on tracing associations, alliances and the temporary stabilization of actor networks (Latour, 2004, 2005; Müller, 2015), and thereby provides a promising tools to explore the dynamics of the collective Ophir smallholder plantation and the partial disintegration of its farmers organizations. Thereby, this study provides an alternative lens through which to look at the broad range of economic (see e.g. Ruben and Lerman, 2005) or institutional analyses of cooperatives or collective action in general (see e.g. Jelsma et al., 2017b).

5.2 Methods

This chapter builds on a literature study and interviews with former German Agency for Technical Cooperation (GTZ) project implementers and five weeks of fieldwork in West Sumatra carried out by the lead author in 2009. During this period, farmers, farmers' leaders, a nucleus estate manager and academics were interviewed and a survey was conducted among 108 farmers using a stratified

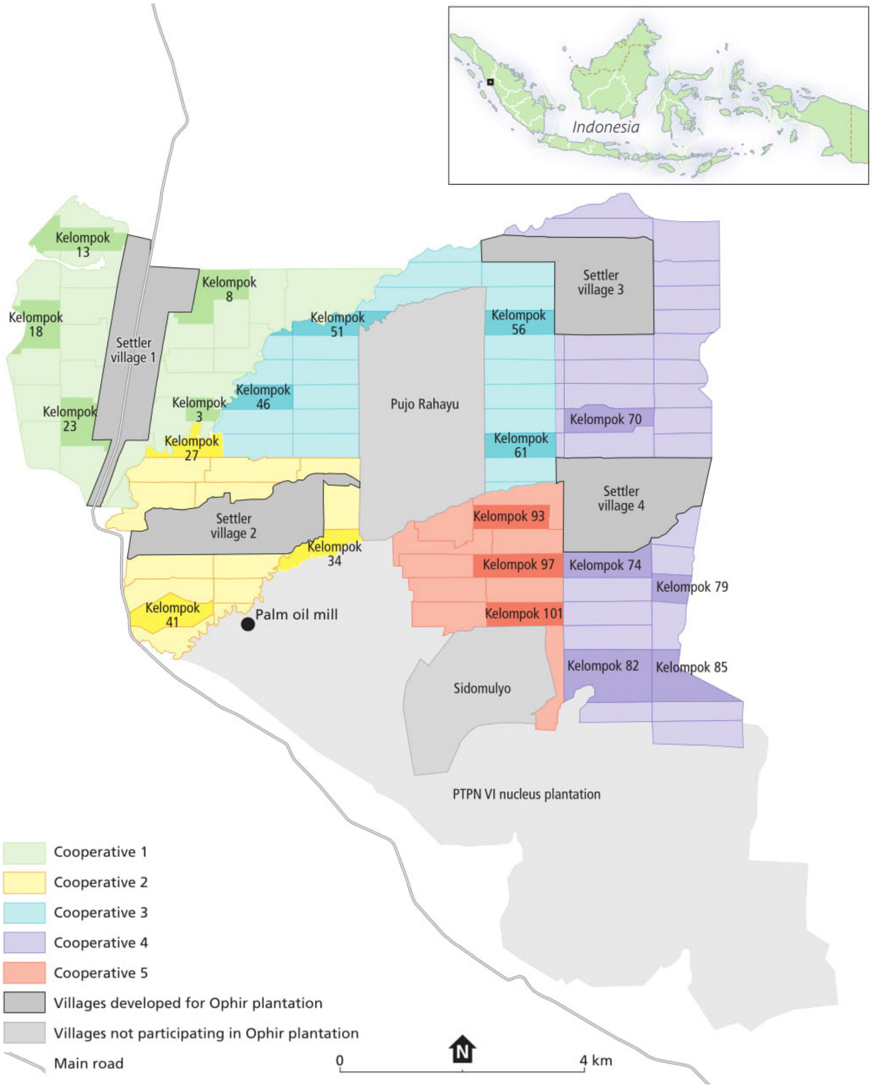


Figure 5.1 Map of the Ophir plantation
Approximate positions of sampled kelompoks are highlighted but may not represent exact kelompok size.

sampling frame capturing the number of farmers in the cooperatives proportionally. Further field visits were conducted in July 2011, February 2014 and March 2016, during which yield data and cooperatives' member numbers were updated and cooperatives' leaders were interviewed. From 2014 onwards, replanting activities were observed and in 2016 also farmers and banks representatives were interviewed. In March 2018, a final 14-day fieldtrip was conducted during which another 38 interviews were held with farmers, farmers' leaders, a nucleus estate manager and local government representatives. Over these years, 108 semi-structured interviews were recorded. Data on 489 farmers' plots regarding current and previous smallholder characteristics were obtained from the farmers organizations.

5.3 An actor-network theory lens

Authors who explain ANT often start with the difficulty of capturing what ANT actually is (see e.g.Cressman, 2009; Mol, 2010). That one of the founding fathers of ANT, Bruno Latour, stated that there are four things wrong with 'actor-network-theory' – being actor, network, theory and the hyphens (Latour, 1999) – makes it clear that ANT is not a straightforward framework or theory, but rather a method. It is acknowledged that ANT has slightly different meanings for different people (Mol, 2010; Müller and Schurr, 2016), with some understanding it in a way that is far from its original intentions (Latour, 1999). Latour (2005), however, provides a summary of what according to him are the key notions in ANT and offers tools for producing a good account of actor-network theory. A good ANT account continuously traces associations and the reassembling of the social, with the social being the connections between actants (Czarniawska, 2006; Latour, 2005).

ANT acknowledges the difficulty of identifying exactly who, what and how entities act, as all entities are actor-networks themselves as well (Czarniawska, 2006; Latour, 2005). This is solved by introducing the term 'actant', defined as that which modifies another entity. It is these actants and their actions that should be traced and that are the network's lines and knots, respectively (Latour, 2004, 2005). In tracing associations it is important to acknowledge that groups, which are actor networks, are not static but constantly explore their boundaries and reconfigure. As Czarniawska (2006) summarizes, 'It is not groups that need to be studied but the work of group making and unmaking'. This implies that mere group description is not enough and it is the elements that indicate the controversies about the groups, and its anti-groups (enemies), that need to be described (Latour, 2005; p 31). However, today's enemies can turn into tomorrow's allies when the collective is renegotiated (Latour, 2004). In order to highlight group making and unmaking, we provide three constellations of the Ophir smallholder oil palm plantation. These constellations highlight group making and unmaking and anti-groups, and identify key events and how these shape the assemblies of actants in Ophir. Thereby it guides this analysis in demonstrating that smallholder business models in practice are highly dynamic and continuously reassessed and reassembled.

Latour's (2004, 2005) statement that 'Objects too have agency' removes the artificial division between objects (things, Nature, other sciences) and subjects (humans, Society; traditional sociology) and emphasizes the unremitting interdependency of objects and humans in forming actor networks (Czarniawska, 2006; Latour, 2005). These interdependencies are made explicit throughout the analysis of the three constellations of the Ophir smallholder collective and prove fundamental in understanding the functioning of smallholder organizations.

5.4 Findings

5.4.1 Getting started: A broad actor-network develops a collective smallholder oil palm plantation

Through its five-year planning strategies, the Indonesian government proposed several strategies to improve the position of smallholders involved in plantation crops, as these smallholders were considered the backbone of the plantation economy but they were inefficient and therefore had to be supported by plantation companies (BMZ, 1986). One of the strategies to achieve this was the NES/PIR programme, in which greenfield plantations were established and a mutual dependency between farmers and nucleus estates was developed. These objectives were documented in policies, laws and regulations, and a special team in the Ministry of Agriculture was established to implement a programme to achieve this. These plans also reached civil servants in West Sumatra and the

German Ministry of Economic Cooperation (BMZ), who collaborated on an Area Development Plan (ADP) for one of the 'pockets of poverty' in Pasaman regency, an isolated area in northern West Sumatra (BMZ, 2004; Kievelitz, 1985).

In 1975, a consultancy report concluded that a colonial oil palm plantation that had been abandoned during the Japanese invasion in 1941 and that since independence had been taken over by the Indonesian military, had very favourable natural conditions for oil palm cultivation and good potential for revitalization (Kievelitz, 1985; Rosenquist and Anderson, 1975). In negotiations between the actants involved in the PIR/NES scheme and the ADP, the plantation was to serve as a flywheel for integrated regional development (BMZ, 2004). A hybrid of people, offices and things, such as consultancy reports and policy documents, which linked Eschborn, Bonn, West Sumatra and Jakarta with one another, formed a collective that subsequently led to the establishment of a new actant: the Ophir PIR/NES oil palm plantation.

A state-owned company, PTPN 6, was responsible for developing the Ophir PIR/NES scheme. This company developed the whole plantation area, which included the purchase and planting of quality planting materials, the development of infrastructure, the construction of houses for settlers, the provision of 0.5 ha home gardens and estate management training, the purchasing and processing of FFB and marketing the produce, and acting as the collecting agent for the creditor bank until the credits for plantation establishment had been repaid by the smallholders (BMZ, 1986, 1992). Mutual obligations between smallholders, the company and credit institutions were laid down in smallholder development agreements, bankers' agreements and project participant agreements. Agreements were signed with individual farmers and the credit was expected to be repaid within roughly 25 years, which is the lifecycle of an oil palm (Hadiputranto et al., 1988).

The Ministry of Agriculture was responsible for agricultural extension services. In the 1980s it had up to 40 extension officers in the field in Ophir; in 1992 it had five and from 1997 onwards it had none (interview with supra-cooperative head, 07-04-2009). The local government developed a Provincial Planning Committee (PCC) directly under the governor of West Sumatra. Its members – representatives of all the relevant local government offices – coordinated their activities in Ophir. These activities included developing schools, health centres and infrastructure between the newly developed settler villages; leading discussions with the provincial bank to set up a banking system to handle payments between PTPN 6, the cooperatives, farmers groups and individual farmers; and negotiating in conflicts between the company and farmers (Bauer, 1991). BMZ mobilized KfW (German Bank for Reconstruction and Development) to finance the scheme and GTZ to provide non-credit technical assistance for developing farmers organizations through hiring both long-term and short-term consultants (BMZ, 1992).

In July 1980, the governor of West Sumatra reserved 12,000 ha in the project area; a year later, PTPN 6 planted the first section of its nucleus estate (KfW, 1981). Plantings for smallholders commenced in plasma 1[13] in 1982. Eventually five plasma sections and four settler villages were developed, with the last plasma section being established in 1986 (see Table 5.1). Settler villagers were usually next to the plasma so that farmers were close to their plantations. Because the farmers also lived close to one another, community formation was stimulated (Jelsma et al., 2017b; KfW, 1981).

The selection criteria for farmers were based on the NES/PIR objectives, in line with the poverty reduction objectives of the German government and captured in Governor's Decree No.ll/GSB/1983

13 Plasma is a common term for plantation sections developed by a plantation company for tied smallholders. Although there are several small exceptions in Ophir, plasmas and cooperatives generally cover the same area.

(Bergschneider, 1990). The criteria were: farmers should not possess more than 1 ha of land, should be aged between 20 and 40 years (55 for former military personnel), be married, have enough family labour to manage the plantation, be prepared to live in the plantation area and become a member of the farmers organization, and have no affiliation with communism (Bergschneider, 1990; interviews with GTZ experts). Although local families, and especially those who lived in the project area, were to be prioritized, half of the settler population was to be made up of retired military personnel or retired civil servants.

A stepwise approach was taken in which farmers were first organized into groups (*kelompoks*) consisting of 16–30 members, covering 32–60 ha (2 ha per farmer). All farmers received basic training on project philosophy, rights and obligations, leadership, plantation maintenance and management, quality control and the weighing of FFB (for details on trainings see Annex 8 in Heering, 1993; Jelsma et al., 2009). Farmer groups were the lowest level of farmer organization. and farmer income was based on shared group income, and thus the collective performance. This created mutual dependency and ensured that the plantations of all group members were properly maintained. Other group members, but especially elected group leaders, monitored performance. Group leaders warned members if plantation maintenance was substandard and hired labourers to perform plantation maintenance for a fee in the case of underperformance. Statutes were drafted at the group level and group meetings were usually held once a month to discuss relevant issues. Farmers could obtain loans at the kelompok level, which were repaid with FFB income. Interest partially financed kelompok activities.

Kelompoks were subsequently organized into larger entities comprising 12 – 26 kelompoks. These entities were transformed into cooperatives in the early 1990s and arranged activities that were difficult to achieve at group level. These activities include maintaining a technical team for pest and disease control (kelompok leaders reported the presence of pests and diseases), fertilizer procurement and distribution (recommended by the cooperative, ordered by the kelompok leaders), strategic planning, training for smallholders, road maintenance, truck armada maintenance, logistics for transporting FFB to mill, and marketing. Non-productive activities included operating a cooperative shop where farmers could purchase essential commodities, providing loans to smallholders (based on group leader's recommendation), organizing saving for replanting and other activities such as mosque and church construction, as well as a burial insurance scheme. Cooperatives were financed with deductions from FFB sales, which were channelled through each farmer's compulsory bank account and interest on loans. Cooperatives produced annual reports, which were checked by external accountants. These were provided to members before annual meetings, during which the cooperative management proposed strategies that were subsequently voted on by kelompok representatives.

A supra-cooperative represented the Ophir smallholders vis-à-vis third parties (e.g. mills or the government) and capitalized on scale advantages for such activities as road maintenance. The supra-cooperative provided farmers with monthly overview print-outs on the FFB sales and the deductions made by the supra-cooperative, cooperatives, kelompoks and the final payment to farmers. Fertilizers were not purchased at supra-cooperative level due to the large funds involved and fear of corruption (interview with THF, 07-04-2009). Farmers organizations were often led by individuals who had previously worked as civil servants or in the military, but other farmers could and did also become leaders. Group, cooperative and supra-cooperative members received additional training relevant to the performance of their tasks.

Although the institutional setup was similar among all five plasmas there were considerable differences in the physical development of plantations, ethnic and occupational backgrounds, and the development and implementation of rules and regulations among farmers (see Table 5.1).

In 1981 it was difficult for the promotion expert of the participants' group to find farmers willing to participate in collectively growing a crop they were unfamiliar with, be and confined to one company and engage in a programme that initially led them into debt. This changed dramatically when it became clear that farms were profitable. In 1987, the Indonesian rupiah was devalued by more than 60% and as PTPN 6 paid prices based on the international market (US$), farmer incomes rocketed whilst costs increased only slightly; farmer incomes were good (see Table 5.1). With increased interest in becoming plot owners, the GTZ expert charged with organizational development was accused of being a communist, which resulted in a shift from the recruitment of participants with qualities desired by the GTZ expert towards participant selection at the discretion of the regional head (interviews with THF, 20-04-2009, and RHJ, 18-03-2009).

The membership of cooperatives 1, 2 and 4 had a relatively large share of former military personnel, whilst Cooperative 5 had a relatively large share of former PTPN 6 staff and civil servants. Former military personnel were relatively old, received a military pension and were therefore comparatively rich, making it relatively easy to survive the first years waiting for the palms to mature. The inclusion of these richer populations, who had already worked in hierarchical organizations, lead Bergschneider (1990) to conclude that whereas these farmers might have been facilitated the establishment of efficient farmers organizations, the goal of poverty alleviation for the poorest may have been sacrificed by project implementors.

Cooperative 3 had a much lower number of former military personnel and an increase in the share of local Minang (see Table 5.1), a people known for their entrepreneurial skills rather than their farming skills. Former GTZ consultants mentioned that from early on it was more difficult to get these farmers to attend training sessions (interviews with THF, 20-04-2009, and RHJ 18-03-2009). Whereas the members of Cooperatives 1 and 2 received training from 1981 onwards, cooperatives that were developed later received less intense training from GTZ and extension officers. Cooperative 3 farmers were largely settled in village 3, which was more remote than villages 1 and 2 but less remote than village 4. The more remote villages eventually had a higher share of plot owners who lived more than 10 km from their plantations (see Table 5.3).

Cooperative 5 farmers benefitted from the failure of project management to convert an area north of the current project area. This was compensated for by transferring part of the PTPN plantation to smallholders. Therefore Cooperative 5 farmers, although they received guidance for relatively few years, had a relatively easy start compared with the other cooperatives as their palms were already yielding. A large share of these farmers had experience with oil palm as former PTPN staff or working for the plantation services, and there was less uncertainty about making a profit from the plantation. Plasma 4 was developed last and again had a high share of Javanese and relatively older former military farmers (see Table 5.1) but was located in hillier and slightly more complex terrain.

Table 5.1 Smallholder plantation ownership data first constellation
Sources: Bergschneider, 1990; cooperatives

Cooperative	Kelompok	Year of planting	Farmers per kel.pok.	Year farmers settled	Year of repayment credit	Ethnicity: Javanese (%)	Ethnicity: Minang (%)	Ethnicity: Batak (%)	Owner background: Military or police (%)	Owner background: Civil servant or PTPN (%)	Owner background: General population (%)	Average age farmer in years (Std. dev)	Average monthly income from oil palm in IDR in 1990 (total income)	Oil palm income over minimuml wage in West Sumatra in 1990 (total income over 1990 minimum wage)	Hired labour, excluding children of farmers (%)
1	3	'82	19	'85	'91 & '92	63	26	11	5	0	95	47 (11)	185,494 (356,116)	4.0 (7.7)	48
	8		28			75	21	4	4	0	96				
	13		22			52	48	0	100	0	0				
	18		26			19	81	0	12	0	88				
	23		25			58	38	4	92	0	8				
2	27	'83	21	'86	'92	67	29	5	38	0	62	45 (13)	161,590 (264,296)	3.5 (5.7)	49
	34		20			55	40	5	50	0	50				
	41	'82	20			45	45	1	45	0	55				
3	46	'83	19	'87	'93 & '94	32	58	5	47	0	53	42 (12)	132,535 (173,915)	2.9 (3.4)	36
	51		21			0	100	0	0	10	90				
	56	'84	24			17	71	13	0	17	83				
	61		24			4	87	9	4	21	75				
	67	'86	26			16	79	0	28	20	52				
4	70	'85	26	'90	'98	44	40	12	96	0	4	Not available as settlers had just arrived			
	74	'86	23			26	43	30	43	9	48				
	79		24			13	67	21	42	17	42				
	82		25			33	50	8	52	0	48				
	85		18			44	50	8	72	0	28				
5	93	'84	26	'89	'95	8	77	15	0	27	73	39 (12)	149,584 (190,923)	3.2 (4.1)	26
	97		30			7	77	13	0	36	64				
	101		27			20	80	0	0	28	72				
Total plantation (Bergschneider, 1990)						30	55	15	33	21	46		159,829 (258,285)	3.4 (5.6)	40
Total plantation (sampled kelompoks)						34	58	8	35	9	56				

The first constellation highlights the broad range of actants involved in the formation of the Ophir NES/PIR plantation. They included, for example, an ADP, local Indonesian government officials, Jakarta policymakers, BMZ, KfW, local farmers, PTPN 6 personnel, consultants, former military staff and the governor of West Sumatra. It also highlights the important role of things in these collectives, as the fertile soils, GTZ, good agricultural practices, farmers organization statutes, trucks, roads, a provincial bank and bank accounts, smallholder development agreements, credit agreements and many others all had a part in assembling an inclusive plantation that intensively cultivated oil palms.

5.4.2 On the road: A shrinking collective but rapidly expanding external actor networks

By the early 2000s, the Ophir plantation collective had undergone considerable changes. The extension services provided by the Ministry of Agriculture were mostly dissolved and GTZ and KfW support ended in 1993. Although links between Ophir farmers and their organizations with the provincial and regency remained, the formal collaboration as stipulated in the smallholder development agreement ended in 1998 when Cooperative 4 farmers had repaid their plantation development credit (see Table 5.1). This resulted in the transfer of land certificates to the smallholder cooperatives and coincided with the downfall of the Suharto regime and the subsequent increase in momentum for the laissez-faire approach of the Indonesian government regarding the development of the oil palm sector (McCarthy, 2010).

The second constellation of the Ophir smallholder plantation reflects the shrinking of actants directly involved in the oil palm plantation, but one in which farmer institutions were still in place and the palms had matured. Project farmers now owned the plantations and with their supra-cooperative, cooperatives and kelompoks were able of to manage their plantations intensively (see Table 5.2 for average yields till 2009). Although the new business model seemed well established, the Ophir smallholder environment proved highly dynamic and actants around and within the plantation were continuously reassessing their situation, forging new alliances, creating new actants and abandoning old ones.

External conditions to the Ophir smallholder plantation were changing rapidly. Whereas in the early 1980s there was no oil palm in West Pasaman, or for that matter in West Sumatra, smallholder oil palm developments boomed in West Pasaman from the early 1990s onwards. The regency became the province's hotspot for oil palm development. In 2005, two years after West Pasaman seceded from Pasaman regency, and the first year for which there are oil palm statistics specifically on West Pasaman, oil palm covered 126,327 ha in West Pasaman. Of this, 86,870 ha were owned by smallholders (DJP, 2006), equivalent to 32.5% of the regency. These developments increased opportunities for Ophir farmers to market their FFB. However, prices for individual farmers are much lower. Based on price data from 2015 till 2018, average prices on the free market were 61% of the prices for FFB from 10- to 20-year-old oil palms under plasma as agreed upon at provincial price setting meetings[14] (DIS-BUN Kabupaten Pasaman Barat, 2018). PTPN 6 remained the preferred partner as they were obliged to pay plasma prices, were close to the Ophir smallholder plots and a familiar partner. Farmers' incomes were good and it was rare for farmers to leave the smallholder organization (see Table 5.2). The emerging new actor network of the independent smallholder oil palm sector, which was booming as independent farmers saw plasma farmers prosper, did not appear a threat to the Ophir smallholder collective. Oil palm smallholders became key drivers of local development and whilst Ophir smallholders opened their own cooperative bank in 1997 to manage payments and develop an additional source of income, many major Indonesian banks opened branches in the project area. As elsewhere, plasma smallholders were an interesting target for banks when production was in full swing (Pramudya et al., 2017).

14 As free market prices are farmgate whilst provincial price setting is at the mill, a 100 IDR kg^{-1} transport and handling costs were deducted from the provincial price setting mechanism.

Table 5.2 Smallholder organization characteristics at the end of oil palm lifecycle

Sources; own survey 2009, interviews and documents from cooperatives and kelompoks, 2010. Exchange rate in 2010; 1 US$= 9,000 IDR

Cooperative	Kelompok	Plots receiving collective management (%)	Share plots with absent land lords in % (fully managed by kelompok)	Ethnicity plot owners (2009 survey)			Average yields from first harvests till 2009 (Mt year^{-1} ha^{-1})	Plot sold before 2009 (source 2018 interviews)	Average age farmer in 2009 (std. dev)	Share first generation farmers in 2009 (%)	Share female plot owners in 2009 (%)	Income after cooperative production costs and obligatory savings in 2010 (in million IDR)	Income after cooperative production costs and obligatory savings over West Sumatran minimal wage in 2010	Production costs at cooperative as of Ophir oil palm income (2010)	Share hired labour man-days* in 2009 in % (excluding labour from farmers'children)
				Javanese (%)	Minang (%)	Batak (%)									
1	3	100	42				27.9	0							
	8	100	23				26.6	0							
	13	100	32	36	57	4	28.0	5	61.4 (15.5)	79	54	4.7	5.0	20	49
	18	100	25				28.3	8							
	23	100	42				29.3	12							
2	27	100	19				25.4	10							
	34	100	50	47	53	0	24.7	5	51.1 (13.6)	40	40	3.4	3.6	31	78
	41	100	21				25.2	5							
3	46	100	36				24.2	5							
	51	100	48				23.0	0							
	56	100	39	8	64	28	21.8	0	52.6 (13.7)	68	8	3.3	3.5	22	82
	61	100	29				22.7	0							
	67	100	38				18.0	4							
4	70	100	43				22.1	20							
	74	100	46				22.2	9							
	79	100	23	36	40	24	21.7	13	51.4 (12.1)	68	24	3.9	4.1	25	93
	82	100	27				23.6	0							
	85	100	46				23.1	0							
5	93	100	34				25.4	0							
	97	100	36	14	64	21	24.8	4	45.9 (12.2)	87	27	3.9	4.1	26	97
	101	93	19				23.6	0							
Total				29	55	15	24.3	5	53.5 (14.3)	31	31	3.9	4.1	24	78

* Labour requirement is estimated at 68 man-days per year and includes harvesting, fertilizer application, weeding and pruning

A critical event was the demand for land certificates by individual smallholders in Cooperative 3 in the late 1990s, which until then were kept in their cooperative bank (interviews with all cooperative leaders in 2014, 2016, and with Ophir and other banks in 2016). Although farmers could borrow from the supra-cooperative, cooperatives and kelompoks – and some farmers reported that they had borrowed as much as possible as it was the easiest and cheapest way to obtain credit – external entities seemed to provide larger loans but demanded land certificates as collateral (interview with farmer, 06-03-2018; interview with Ophir bank representative 2016, 21-03-2016).

The issue of land certificates became a discussion point at all cooperatives' annual meetings, but the outcomes differed. In Cooperative 3 the demand for land certificates was granted quickly as management could not convince the farmers to keep their certificates at the cooperative. Also in Cooperatives 2, 4 and 5, certificates were returned to kelompoks and in most cases to the individual farmers. In Cooperative 1, leaders and members agreed that in order to maintain the collective spirit and have enough collateral when replanting was due, land certificates would be kept under the auspices of the cooperative. Also among kelompoks there were differences. Whereas land certificates were generally returned to the farmers, the statutes of kelompok 70 (Cooperative 4) provided that land certificates were to be kept in the kelompok safe and could not be sold to outsiders. As a result, five plots were now collectively owned by the kelompok (interview with head of Cooperative 4 and head of Kelompok 70, 12-03-2018).

It remains unclear why exactly land certificates were first reclaimed in Cooperative 3. However, weak institutional development compared to the first two cooperatives appears to have played a role. Former project implementers and farmers ascribed this to the inclusion of more Minang farmers, farmers without a military or civil service background, less training compared to members of Cooperatives 1 and 2, as well as a perceived lack of interest in plantation activities. The reduced involvement of GTZ with the selection criteria may have led to the selection of smallholders with different attitudes. It may also have been a single association and not collective characteristics that lead to the demise of collective action. A manager may have provided irresponsible loans to a single farmer and thereby reduced the farmers' trust in their organization, leading farmers to demand their certificates. Although tracing all actants relevant in the negotiations concerning the return of land certificates to farmers in Cooperative 3 is beyond the scope of this research, this event itself had severe impacts for smallholder organizations.

At this point we see that objects have agency as well and that they behaved differently than expected. Whereas land certificates were intended to provide farmers with ownership of their plantations and security, and served as such for a while, they transformed into liabilities. Lending practices at most cooperatives and kelompoks were now no longer backed with collateral in the form of from land certificates but only by expected yields and compulsory collective savings. Although contributions varied slightly per kelompok and cooperative, replanting funds and compulsory savings were standard practice (see Figure 5.2 on cooperative deductions per sampled kelompok). Encouraged by the success of their oil palm activities, farmers and their organizations were confident enough to engage in a number of other activities. Besides the Ophir Bank and through their managements, farmers also established a stone crushing facility for road management and a fertilizer factory to produce their own fertilizers. As farmers realized replanting was inevitable, all cooperatives also engaged in making collective investments in land for oil palm plantation development elsewhere. Although the cooperative shops and Ophir Bank delivered profits for the smallholder organizations, the fertilizer factory, the stone crushing facility and land investments failed. Losses drained the finances of cooperatives and kelompoks and the confidence of smallholders, whilst suspicions of corruption grew. At this stage, however, this did not result in

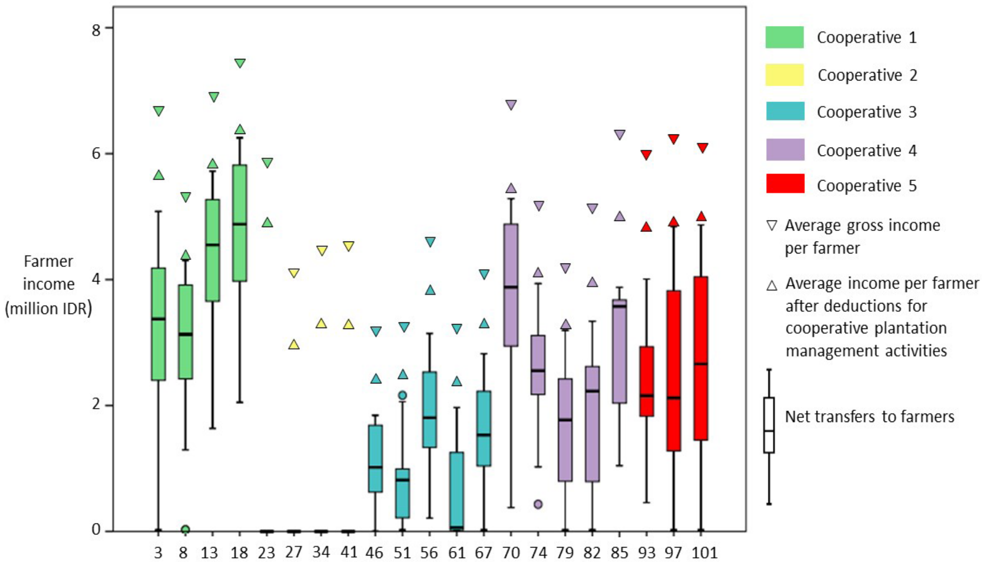


Figure 5.2 Oil palm incomes and deductions in Ophir plantations in December 2010.
Net transfers to smallholders is average income per farmer after deductions for cooperative plantation management services and compulsory savings minus debt repayments at kelompok, cooperative, supra-cooperative accounts, cooperative shop, and banks (source: cooperative managements). Whiskers show the minimum and maximum values; the box shows the 1st and 3rd quartiles; the line shows the median. Values of >1.5 interquartile range (IQR) are shown as circles. Data on net transfers to individual farmers in kelompoks 23, 27, 34 and 41 were not available.

major changes in the organizational setup of the smallholder plantation. Smallholders generally still considered the benefits of their organization to outweigh its harms.

5.4.3 Replanting: Income reductions and shifting alliances

Well-maintained oil palms generally have yield increases in the first seven years, maintain a production plateau till about 20 years after planting and subsequently gradually lose productivity and oil content (Woittiez et al., 2017). As harvesting costs increase due to height increments of palms, the economic lifespan of oil palms in company plantations is usually 25 years (Woittiez et al., 2017). In 2009, the productivity of palms in all cooperatives had already been in decline for some years (for details see Jelsma et al., 2017b). In accordance with provincial price setting agreements for plasma farmers, prices for Ophir smallholder fruits were lowered each year by PTPN 6 as oil content decreased. Farmers thus encountered reduced yields and prices, whilst kelompoks, cooperatives, the supra-cooperative and banks kept making deductions (see Figure 5.2), partially in an attempt to save for upcoming replanting. This resulted in tension among farmers regarding replanting strategy. Progressive and wealthier farmers usually wanted to replant sooner whilst poorer farmers were generally unprepared for a three-year wait without income and thus favoured postponing replanting. Discontent led some farmers to side-sell to avoid deductions, which further undermined the finances of and trust in the farmer organizations. From 2010 onwards, FFB sales outside the

Table 5.3 Collective management, plot and ownership characteristics in March 2018

Cooperative	Kelompok	Ethnicity last known owner of plot (2018): Javanese (%)		Minang (%)		Batak (%)		Plots involving kelompok management in 2009	Share plots still member of kelompok compared to (2018 over 2009 in %)	Kelompok management performs activities (March 2018, 1=yes; 0=no))	Generation owning plot and plot sales (%): Share 1st generation (all original members)	Share 2nd generation (all original members)	Share plot sold before 2009 (all original members)	Share olots sold after 2009 (all original members)	Share (%) last known owners in direct vicinity of plantation (< 10 km)
1	3	63		26		11		19	89	1	47	47	0	5	100
	8	79		18		4		28	100	1	54	36	0	11	96
	13	40	48	60	48	0	3	21	90	1	19	67	5	10	81
	18	0		100		0		26	77	1	77	15	8	0	100
	23	60		36		4		25	88	1	28	40	8	20	92
2	27	67		29		5		21	0	0	33	48	14	10	80
	34	44	48	50	44	6	8	20	0	0	25	45	5	30	80
	41	25		58		17		20	0	0	15	50	5	35	65
3	46	27		67		0		19	0	0	53	26	5	16	89
	51	0		100		0		21	90	1	43	48	0	10	81
	56	20	13	65	79	15	6	24	71	0	42	33	0	25	63
	61	0		80		20		24	0	0	38	0	9	57	46
	67	14		81		0		25	40	0	65	12	4	16	60
4	70	40		45		15		25	100	1	32	48	20	0	60
	74	32		50		18		23	48	0	39	39	9	26	52
	79	8	29	67	52	25	18	24	71	1	33	42	17	8	33
	82	32		48		16		25	96	1	60	12	16	12	56
	85	38		50		13		18	94	1	28	56	0	22	33
5	93	8		75		17		26	0	0	54	31	8	8	81
	97	10	14	71	74	19	12	28	0	0	55	10	10	27	52
	101	25		75		0		25	0	0	52	24	4	24	56
Total		31		59		9		487	51		44	33	7	17	69

Ophir structures was no longer incidental and larger numbers of farmers left the organizations (see Tables 5.2 and 5.3).

These conflicts were relevant at all cooperatives but again played out differently throughout the smallholder plantation. This third constellation of the Ophir smallholder plantation highlights the partial disintegration of the Ophir smallholder business model and the different outcomes with the same business model. Whereas in 2008 there were negotiations between PTPN and the supra-cooperative on replanting, and separately a former GTZ project agronomist provided a workshop on replanting for farmers, these plans did not become part of any relevant collective. The supra-cooperative got involved in missing funds and it became clear that solutions for revitalizing the plantations were to be handled by cooperatives, kelompoks and individual farmers.

By 2017 West Pasaman provided plenty of opportunities for smallholders to procure inputs and market their produce individually. The number of mills had risen to 15, of which nine did not have their own plantations and mainly depended on independent farmers for input. Oil palm covered 157,839 ha, equivalent to 41% of the total West Pasaman area. Smallholdings covered 62% of this (see Figure 5.3 for an example of change between the 1980s and 2016). From a remote pocket of poverty the regency had transformed into a vibrant plantation economy. There were now more than 200 distributors of subsidized fertilizers in West Pasaman (DIS-BUN Kabupaten Pasaman Barat, 2018), and middlemen and fresh fruit bunch ramps were common, some located even within the project area and owned by former project farmers.

5.4.3.1 Diverting paths of collective action at cooperative and supra-cooperative levels

A former Cooperative 1 leader and former GTZ project implementer stated that the supra-cooperative only posed unnecessary risks to the farmer organizations, implying that there were many opportunities for collusion between cooperative leaders and the supra-cooperative. Whilst only Cooperative 1 left the supra-cooperative (in 2010, when it also started to sell FFB to other mills), the supra-cooperative closed in 2014. Other cooperative leaders indicated that cooperatives still have credit at the supra-cooperative, funds that most likely cannot be recovered.

Although membership dropped from the original 591 members to 510 members in 2018, Cooperative 1 not only achieved the highest average yields over a 30-year period (see Table 5.2) but also proved most successful in maintaining their institutions and organizing replanting collectively and most professionally. The cooperative managed to accumulate savings for replanting and maintain land certificates to serve as collateral for replanting (interviews with Cooperative 1 leaders, 2011, 2014, 2016, 2018; former supra-cooperative leader, 2018; Ophir Bank, Bank BRI and Bank Muamalat, 2016). Although Cooperative 1 had a well-maintained administration and a good track record, and they had both savings and political clout (the cooperative leader was also regency vice-head), finding a bank to finance replanting proved very difficult and collective replanting nearly failed (interviews with BRI, Bank Ophir, Cooperative leaders, 2014, 2016).

The Cooperative 1 management's replanting plan included a 5,333 US$ credit at an interest rate of 9% year^{-1} for the mechanical clearcutting and chipping of old oil palms, procurement and planting of quality hybrid seedlings, a fertilizer regime for immature palms and continued technical support from the cooperative's technical unit. During the three-year immature and non-yielding period, farmers received about 63 US$ month^{-1} from their replanting savings to support their livelihoods. Farmers cultivated corn between their palms to further bridge their three-year income gap. Legume cover crops were therefore not planted, as would be good practice in corporate plantations. Cooperative 1 and kelompok managements assisted farmers in purchasing seeds and transporting, drying and marketing corn.

Detailed replanting plans were discussed at the 2012 annual meeting in the cooperative building and farmers were given the option to take the full loan, pay the loan in full immediately (for rich farmers) or opt out of the cooperative within two months and take their replanting savings of roughly 2,250 US$ at once. The vast majority of farmers opted for replanting on credit. Kelompoks 1 and 2, which had relatively unfavourable conditions as they were next to the river, saw more than 50% of their members opt out, whilst the vast majority of kelompoks in Cooperative 1 had only

Figure 5.3 Southern tip of the plantation managed by Cooperative 1
Left picture in the early 1980s, right picture on February 2nd, 2016. Replanted palms are visible as are independently planted palms not yet present in the 1980s in lower left corner. Sources RHJ and Google Earth, visited 10 February 2019.

a few members opting out (see Table 5.3). The reasons often given by kelompok and cooperative leaders and farmers who left, were a lack of confidence that the cooperative could arrange replanting and thus intended to replant individually, fear of getting indebted again, confidence in their individual skills after 30 years of collective management, no longer wanting to work together with the others group members (private conflicts) or wanted the payment of their 2,250 US$ replanting savings at once. Although investments in infrastructure had been minor just before and during replanting, the leadership of Cooperative 1 successfully managed to replant with technically reasonable standards and, in general, appears to continue in a similar way as before replanting.

In 2014, the management of Cooperative 2 was able to re-collect the majority of land certificates for replanting but not all (interviews with Cooperative 2 leaders, 2014, 2016, 2018). By then several farmers had left the smallholder organization and had started to replant individually, as in their opinion the cooperative had not been able to provide solid replanting plans in time. Savings in the cooperative for replanting were roughly 500 US$, which together with the majority of land certificates appeared enough to secure a credit programme with a bank; technical support for collective replanting had been discussed with PTPN 6. In February 2014, a contractor was hired to mechanically chop and rudimentarily chip the oil palms for the majority of Cooperative 2 farmers. However, although the contractor started work, the collaboration between the bank and the cooperative did not materialize. A bank representative and the cooperative leader blamed changes in government policy regarding finance for farmers as a main reason for not providing the loan (interviews with bank representative, 21-03-2016; Cooperative 2 leader, 23-03-2016). Although Pramudya (2017) mentions changing government regulations concerning smallholder plantation finance around 2014, it is clear that yields, incomes and savings in these plantations were lower than in Cooperative 1 as well. With the deal not materializing there were not enough funds to finance replanting or pay the contractor, who had already finished cutting oil palms. In order for farmers to reclaim their land certificates, they had to pay 1,000 US$ to the cooperative so that the cooperative could pay the contractor for its services. Although the cooperative leader arranged collaboration with a company to replant in 2016, this plan failed as members and former members protested as they feared losing ownership of their land (interview with Cooperative 2 leader, 2016 and 2018).

In the other cooperatives, replanting funds were even lower available as these had often been used even more than in Cooperative 2 to cover members' immediate needs, compensate for reductions in plantation incomes and cover bad loans that could not be recovered due to a lack of collateral.

The disintegration of collective action at the cooperative level first became evident in Cooperative 3. During the 2009 annual meeting, the leaders of three kelompoks indicated that they no longer trusted the cooperative's bookkeeping or the management's ability to provide a feasible replanting strategy, and left the cooperative together with about 150 members. The leadership of Cooperative 3 indicated that from 2011 onwards there were no more funds to perform services beyond providing letters of recommendation (interviews, 2014; 2016). According to the cooperative secretary, they still had 336 of their initial 608 members in 2018 (interview, 2018). The cooperative did not have a replanting strategy.

With 165 of its 306 members officially resigning between November 2011 and December 2015 and the cooperative no longer providing any services such as fertilizer procurement, road maintenance, training and the marketing of FFB since 2015 (interview with Cooperative 5 leader, 23-03-2016), Cooperative 5 can be considered dormant. Lending practices in Cooperative 5, as in Cooperative 3, were perceived as lacking transparency and being nepotistic (interviews with farmers, 2016, 2018). This cooperative's 2017 financial report stated there were farmers with debts to the cooperative of up to 8,000 US$, whilst these farmers had already sold their plantations in 2015 (2017 Financial Report Cooperative 5, 2018; interview with Cooperative 5 staff, March 2018). The cooperative still maintained an administration, provided members with basic information on replanting and developed a nursery where farmers could purchase hybrid seedlings.

Whilst the secretary of Cooperative 4 mentioned 108 members had left the cooperative, the head of the Cooperative indicated 75 departures, for similar reasons as in Cooperative 1. As in Cooperatives 2, 3 and 5, land certificates were not held by the cooperative and farmers who purchased plots after 2009 usually opted out of the collective system. From 2012 onwards, fertilizers were no longer provided and farmers and kelompoks increasingly started to sell outside the cooperative, which by now was purchasing from outsiders as well, and thus also functioned as a regular middleman.

Savings for replanting had been collected at cooperative and kelompok level and hence the savings available varied per kelompok. During the 2012 annual meeting, many kelompoks demanded the replanting funds to be transferred to farmers in order to finance the daily needs of the farmers, and by 2016 Cooperative 4 had 300 - 500 US$ available per farmer for replanting (interview with secretary of cooperative, 10-03-2018). Hybrid seeds were purchased collectively by cooperatives (65%) and kelompoks (28%) and with donation from the regency plantation office (7%). Although the cooperative assisted in setting up a nursery in Kelompok 82, it was up to the kelompoks and individuals to implement replanting. The cooperative leader expected the last old palms to be poisoned by 2018 (interview, 12-03-2018). Although the cooperative still exists, it currently incurs considerable losses (KPS Maju, 2017) but might prosper again once production resumes. The management of Cooperative 4 organized corn cultivation packages for kelompoks during replanting.

5.4.3.2 Collective action and replanting at kelompok level and by individuals

With actual monitoring in the field a key responsibility at the kelompok level and all farmers having a direct vote in kelompok decision making, kelompoks were fundamental in the smallholder production system. Rules and regulations had been developed at the kelompok level since the initiation of the project and hence varied per kelompok throughout the plantation's existence (Jelsma et al., 2017b). This diversity led some kelompoks to be better prepared for replanting than others. In Cooperative 1, kelompoks generally followed the plans proposed by the cooperative's management. However, for example Kelompok 13 decided to procure empty fruit bunches as fertilizers, collectively purchased these and distributed them among their members' plots. Discussions in Cooperative 1 mainly focussed on whether to maintain a shared group income or move towards individual incomes. In Cooperatives 2 and 5, some kelompoks performed some collective replanting activities, after which collective activities appear to have come to a complete halt. Former kelompok leaders there indicated that there were no more collective activities or administration, and hence collective activities had stopped (interviews with former kelompok leaders in Cooperatives 2 and 5, 2018).

In Cooperative 3, leaders from three kelompoks initiated a new cooperative in 2009. This cooperative initially collectively sold their produce via Cooperative 1, with which they split the price difference for direct sales to the mill compared to selling to regular middlemen. Although this cooperative initially assisted in obtaining quality planting materials and engaged in collective fertilizer purchases, many members left when the actual replanting was finished. Although the proper management of oil palms during the immature phase is crucial, farmers often neglect their plantations during this period as they do not provide income, stunting palm development. This cooperative did not engage in lending practices and demands for services were therefore limited after replanting (interview with Kooperasi Tani Mandiri, 04-03-2018). Whereas Kelompok 51 organized replanting and fertilizer purchases collectively and organized joint sales to the middlemen, the shared income system was abandoned and the head of the kelompok did not have any responsibility for safeguarding the implementation of standards in the plantations. In Kelompoks 46, 56, 61 and 67, there were no more collective activities.

The majority of the interviewed kelompoks in Cooperative 4 had collective replanting activities and were still involved in the marketing of produce from the last old palms and the first newly yielding oil palms, either to middlemen or the cooperative. Four of the five kelompoks investigated in Cooperative 4 engaged in corn growing programmes during replanting, some renting out the land collectively whilst others only providing corn growing packages. Kelompok leaders received a salary of 3-4 US$ farmer^{-1} month^{-1} for organizing labour activities, which in the majority of cases was no longer performed by farmers. A considerable share of plot owners no longer lived in the direct vicinity of the plantation (see Table 5.3) and received deductions for the hired labour organized by the kelompok leader. Whilst Kelompoks 77 and 82 had decided to partially mechanically fell old palms, nearly all individual farmers and kelompoks outside Cooperatives 1 and 2 had implemented the underplanting and intercropping strategy. This strategy provided a low but continuous income and with an estimated cost per two hectare of roughly 220 US$ for injections, 1,000 US$ for seedlings and 250 US$ for labour, is much cheaper than the more professional solution applied in Cooperative 1.

5.5 Discussion

Jelsma et al. (2017b) provided a detailed overview of the institutional setup of the smallholder plantation in Ophir and forcefully demonstrated that smallholders can manage oil palm intensively but that this does not happen by chance. Although they provide a clear overview of the Ophir smallholder business model and briefly acknowledge changes to the model in their conclusions, their theoretical approach and analysis resulted in a fairly static overview of a successful business model: if you do this then that is what you get. This chapter builds on their results, applies an ANT lens, provides three constellations of actants that impact the Ophir smallholder collective, provides additional data on key events such as replanting and the return of land certificates, and thereby highlight that actants are constantly reassessing and renegotiating their business model and thus highly dynamic. Whereas in his analysis of oil palm and agrarian change in Sumatra, McCarthy (2010, p. 837) noted *'Same scheme, divergent outcomes*' and highlighted the different impacts of the business model and subsequent agrarian change, this chapter shows it is also the business model itself that is renegotiated due to agrarian change.

Whereas policymakers often proclaim a final state of development, for example organizing farmers as achieved in the first constellation of Ophir, our analysis emphasizes that development does not end there. Whilst smallholder support from government and development agents was drastically reduced, Ophir farmers maintained their organizations and plantations well during the second constellation. However, although efforts to improve smallholders' production practices and sustainability have increased over the last 15 years (Johnston et al., 2018; RSPO, 2017a; Susanti, 2016b), coinciding with the second and third constellation in Ophir, and the organization of farmers is often presented as a tool to achieve this, in practice these initiatives did not lead to any significant support for Ophir smallholders. If the sustainability promoting actor-networks cannot support farmers who have already participated in organizing and maintaining proper records, agricultural practices and yields, this casts severe doubts on the strength of these actor networks to take on the vast, diverse and generally poorly performing independent smallholder oil palm sector (see e.g. Jelsma, 2019), and guide these into meaningful farmer groups.

McCarthy (2010) acknowledged the importance of 'things', as he emphasized that '… *oil palm is a rich farmer's crop that requires expensive inputs if it is to be farmed successfully*.' Although it is clear that oil palm requires considerable input, farmers organizations in Ophir allowed economically and socially vulnerable groups, for example elderly people and widows or families where labour was unavailable, to have access to these inputs, assistance in proper plantation maintenance and decent incomes (see Tables 5.1, 5.2 and 5.3). The oil palm's lifespan characteristics clearly impacted the farmers' organization, as yields, oil content and thus incomes dropped. We acknowledge, however, that during yield decreases and replanting it is the poor who are the most vulnerable, as they always are. A third object that shaped outcomes is the land certificate. Although effects on farmers' institutions did not become apparent immediately, the distribution of land certificates to individuals in Cooperatives 2, 3, 4 and 5 had severe impacts on the ability of the cooperatives and kelompoks to recover loans or finance collective replanting once yields, oil content and thus prices, were dropping. Whereas land certificates were intended to strengthen the position of farmers, the outflow of these from farmers organizations eventually severely impacted the trust of farmers in the organizations that supported them in intensively managing their plantations.

Blaming the collapse of collective action on a single event appears a gross simplification of events. This chapter has shown a wide range of variables and differences within and surrounding the Ophir farmer organizations (see Figures 5.1 and 5.2: Tables 5.1, 5.2 and 5.3) and demonstrated that conditions are always unique. In these complex systems it is clearly constellations of actants, not just single actants, that lead to certain outcomes. A regression analysis on the importance of a limited number of variables on farmer characteristics therefore appeared inappropriate for this research. ANT proved a valuable method for tracing actants and their associations and for exploring their outcomes to gain insights into smallholder business model dynamics. It is acknowledged, however, that the tracing of associations is never finished and is always limited by time and resources, as it was in this study.

The tracing of associations can only be done retrospectively and how actants will behave in the future remains uncertain. Having professionally replanted and maintained organizational structures that support good agricultural practices, logistics and marketing, Cooperative 1 appears best positioned to produce intensively in the next cycle of oil palms and provide farmers with proper incomes. This assumption, however, is by no means certain. A replanting strategy implemented by the vast majority of farmers in Ophir is underplanting, in which old oil palms decay in the field and field sanitizing measures were absent. During 2018 field visits, farmers mentioned the frequent occurrence of *Ganoderma*, a pest that especially appears in second- or third-cycle oil palms, kills the palms and thus threatens yields. With the disintegration of most cooperatives, the technical units to counter pests and diseases were disbanded. The occurrence of this new actant is likely to increase, impact productivity and may well become an undesirable but undeniable part of the new collective. These pests also jeopardize the smallholder plantations in Cooperative 1, making their considerable investments a relatively risky endeavour compared to the cheap and less intensive planting techniques implemented by the majority of Ophir farmers.

Although the future remains uncertain, it will be interesting to observe associations again in a fourth constellation, once palms have matured, production is up again and undoubtedly internal as well as external conditions changed again. As many former Ophir collective farmers appear to use good quality planting materials, have gained considerable experience in the first cycle of oil palms and fertilizers shops are present, it remains uncertain what yields will be produced in a few years, to what extend exclusion of farmers based on sustainability criteria will materialize, and to what extent formerly organized farmers may reassemble into organizations once production recommences and there is a perceived need for collective action, e.g. to collectively counter the aforementioned Ganoderma threat.

5.6 Conclusion

This chapter analysed nearly 40 years of collective smallholder oil palm management in Ophir, West Sumatra. It demonstrates that whereas the debate on inclusive business models tends to present projects as static entities, in fact business models are continuously re-assessed and re-assembled. Through three constellations of the Ophir plantation and their surroundings, this chapter traces the internal and external dynamics which led a single business model to very different outcomes. Whereas Cooperative 1 has successfully managed to replant collectively, and their initial business model largely remains in place, collective action in the other cooperatives often came to a grinding halt. Well-conceived business model are fundamental to desirable outcomes, but these 'theoretical business models' are only one input into complex negotiations among a wide range of actants.

The dynamics surrounding smallholder plantations are uncertain and clearly smallholders are moving targets. However, this uncertainty does not mean that nothing can be done. On the contrary, it requires continuous labour to assemble collectives that push for improving smallholder production systems. Threats to collective action need to be identified, proper science needs to provide relevant facts, and making these findings part of collectives which actually support desired change. The position of land certificates and the age of oil palms are two important 'things' that undermined collective action in Ophir and deserve attention in future projects. The first constellation of actants involved in setting up the Ophir smallholder plantation provides a clear example of a successful and large actor network and the importance of government and development organizations therein. The third constellation on the contrary highlighted the absence of substantial smallholder support. Whereas leading sustainability initiatives promote farmer organisation as a tool for improving smallholder sector sustainability and prepare farmers for increased demands for transparency in global value chains, in practice even well established and experienced smallholder organization partially disintegrated and hardly received assistance. This a clear message to sustainability initiatives that their obligations for smallholders to partake in farmer organisations needs to be accompanied with considerable investments in professional support for farmer organisations. This impartial support should not only present during establishment but also accessible when crisis appear.

6 Conclusions; Towards inclusive and sustainable palm oil

Ophir organized smallholders attending a workshop on replanting at Cooperative 1 training centre (photo taken by the author in April 2009).

6.1 Introduction

Interest in the role of smallholder farmers in agriculture and in rural and sustainable development has undergone a resurgence in recent years. This dissertation contributes to the broader debate on the future of smallholder farms and the quest to implement more sustainable practices and inclusive business models. The Indonesian smallholder oil palm sector provides an interesting case, as it has experienced the massive engagement of smallholder farmers, involves different models in which smallholders engage with industry, suffers considerable performance issues, and both state and non-state sustainability initiatives have attempted and are still attempting to shape smallholder practices. The four empirical chapters in this dissertation provided a wide range of insights into past and contemporary smallholder inclusion in the oil palm value chain. They demonstrate that oil palm smallholders are moving targets, highly heterogeneous and operate in considerably different landscapes, and all these factors need to be acknowledged in smallholder support. This concluding chapter synthesizes the findings in four arguments and links these with the broader debate on the currently dominant oil palm smallholder sustainability narrative and smallholder development more broadly.

6.2 Synthesis of findings

6.2.1 Smallholder heterogeneity needs to be acknowledged for relevant policy development

This dissertation shows that 'The Indonesian oil palm smallholder' does not exist and argues that the heterogeneity among oil palm smallholders needs to be acknowledged in order to develop better targeted policy measures. This argument is most explicitly developed in Chapter 2, on the independent smallholders in Rokan Hulu, Riau province. The five variables used to develop the smallholder typology in Chapter 2 were informed by findings on socioeconomic differentiation amongst smallholders, as presented in recent literature (e.g. Gatto et al., 2015; McCarthy and Zen, 2016). The variables are: 1) contrasting migrants vs local populations; 2) land holding size, as a proxy for wealth; 3) residence, as a proxy for absenteeism; but also including landscape characteristics, namely 4) mineral vs peat soils and 5) farming within or outside the forestry domain. The typology identifies seven distinct farmers types and quantifies these on the area as well as the number of farmers present in the Rokan Hulu smallholder oil palm landscape. This typology ranges from small local farmers to large peat investors. The small local farmers originate from the area and reside close to their plantations on the mineral soils of Central Rokan Hulu, on average own less than two hectares and predominantly operate outside the state forestry domain. These farmers own 7% of the land but constitute 20% of the farmers. On the other end of the smallholder spectrum are the large peat investors in the peatlands of Bonai Darussalam, who own considerable land holdings close to small companies and usually operate in the forestry domain. Whereas large peat investors represent only 2% of farmers their plantations cover 31% of the research area, indicating that the land grab debate should focus not only on companies but also on the role of smallholders in this.

Chapters 2 and 3 provide evidence that although different types of independent smallholders face many similar challenges, they also face considerably different challenges that hamper performance and certification. The lack of formal land registration documentation has been identified as a challenge for the certification of especially indigenous smallholders (Brandi et al., 2015; Gatto et al., 2015). The present research, however, refined smallholder characteristics and combined findings with land classification data in order to make a more detailed assessment for certification and sustainability issues among differentiated smallholder groups. The results show that small local farmers benefit most from the formalization of land documentation campaigns. This appears relatively easy compared to legality issues surrounding large peat investors, who often operate within the forestry domain. Reducing their legal compliance issues requires land classification maps to be redrawn and the involvement of the Ministry of Forestry. Land reclassification is currently part of the agrarian reform agenda, which aims to improve land security for small farmers. Findings in Rokan Hulu highlight, however, that if not implemented with care, it may well be the urban elites who benefit most from such processes instead of 'real' small farmers – the intended beneficiaries of the agrarian reform.

Oil palm smallholder differentiation is relevant not only for informing land classification or land entitlement debates. Access to proper planting materials appears relevant for all smallholder types and it is clear that investments in the distribution of high-quality planting material and illegalizing illicit seed distributors will increase yield potential and oil content for all farmer types, and this could eventually lead to higher prices for smallholders. Chapters 2 and 3 emphasize that it is especially the small and medium-sized farmers on mineral soils who suffer most from poor planting materials and sub-optimal planting patterns. If peat subsidence becomes a priority, the largest gains can probably be achieved by approaching a few large peat investors and developing strategies with them, rather than by organizing broad discussions involving all smallholders on peat. In the marketing of produce, larger farmers have shorter links with mills compared to small farmers, who sell via multiple middlemen. These extra links not only complicate traceability and reduce smallholders' profits, but usually also increase the time that fruits are in transport, leading to reduced produce quality and partially explaining the lower prices for smallholders. The involvement of labour varies significantly per farmer type and training to improve practices in the plantations is therefore likely to require different approaches. These are only a few examples and they are based on the Rokan Hulu context, but they show that smallholder differentiation can contribute to better informed and targeted policy measures and technical support.

Whereas the importance of differentiation between smallholder types is a central tenet in the chapters on independent smallholders in Rokan Hulu, it is clear that smallholder diversity is also relevant in the chapters on organized smallholders in Ophir. The Ophir chapters demonstrated that although ethnic and religious affiliations are often important in Indonesia (Aspinall and Sukmajati, 2016), they do not necessarily lead to conflict. Not only did Ophir demonstrate that ethnic and religious harmony are possible, but the institutional setup also allowed for more vulnerable groups (such as the elderly) to participate. The diversity in backgrounds also made a considerable contribution to the skills and capacity required to manage farmers' organizations. Regarding the demise of collective action in Ophir, however, diversity eventually challenged the production systems, as prosperous farmers had more options than poorer farmers. It is clear that diversity is present, demands to be acknowledged in order to receive and provide suitable support, and although it possibly provides benefits, it may also lead to considerable tension. This call to acknowledge diversity and the need for diversified approaches reemphasizes that improving smallholder practices is not merely a technical endeavour, as it is often presented in sustainability initiatives, but also involves many political choices (Ferguson, 1994), as measures may not affect all farmer groups equally.

6.2.2 Local conditions and positionality are crucial for developing relevant policy

The chapters on Rokan Hulu highlighted the differences in smallholder characteristics and practices in the peatlands compared to those on mineral soils. Although the research areas covered in this research are limited, the cases show that conditions – such as the quality of infrastructure, flooding risks, differences in fertilizer requirements, the presence of fertilizer shops and labour, the capacity of and monitoring by government agencies, farm sizes and alternative livelihood options – all impact farmers' choices, the likelihood and implementation of better agricultural practices, and the measures that policymakers should implement to increase the implementation of better agricultural practices.

The Ophir case also emphasized the importance of acknowledging the environment in which farmers operate. Whereas in the first constellation of the smallholder plantation (Chapter 5) there were hardly any alternative marketing channels and only limited alternative livelihood opportunities for farmers, the situation was very different in the description of the third constellation. In the third constellation of the smallholder plantation, the area developed into a separate district, there were plenty of marketing opportunities for smallholders, fertilizer shops were widely available, the independent smallholder sector had boomed, population densities had increased and banks had entered the area, indicating an increase in economic activities and alternative livelihood opportunities. It is clear that under the influence of so many new actants, collectives change and the potential for sustainable and inclusive business models differs per environment. Besides the surroundings, it is clearly also the actual oil palms that influence the kind of measures that are most relevant. In the third constellation, the oil palms were old and this provided a whole set of different dynamics that was different from the set present during the first two constellations. These findings highlight the significance of whether one works in frontier or established agricultural areas.

6.2.3 Poor practices are common but smallholders can intensively manage oil palm

This argument relates to the emphasis on the implementation of good agricultural practices (GAP) and yield improvements among sustainability initiatives. Although it is still debated in academia (Byerlee et al., 2014; Villoria et al., 2013), the implementation of GAP should lead to agricultural intensification and thereby contribute to land sparing. Increased productivity can also increase smallholders' incomes and the implementation of GAP could even lead to cost reductions for those farmers who currently employ costly but inefficient practices (Soliman et al., 2016; Woittiez et al., 2018).

That the implementation of GAP is limited among oil palm smallholders was established by previous research (Molenaar et al., 2013; Woittiez et al., 2017). Discussions on smallholder performance, however, often only differentiate between independent and organized smallholder farmers, and note that the organized smallholders linked to companies perform better (see e.g. Euler et al., 2016b; McCarthy, 2010; Molenaar et al., 2013). Chapter 2 showed, however, that independent farmers are highly diverse and that independent smallholder disaggregation proves useful for improving smallholder sector governance. As sustainability initiatives such as ISPO and RSPO regard the implementation of GAP a fundamental tool for improving sustainability, Chapter 3 applied the typology developed in Chapter 2 to assess the differences in practices among seven types of independent smallholders. The underlying hypothesis was inspired by McCarthy's (2010, p. 845) statement that '*oil palm is a rich farmer's crop*', and tested whether larger farmers, who are assumed to be richer, implemented better agricultural practices than smaller farmers, who are often assumed to be poor and too preoccupied to implement GAP.

This hypothesis did not hold. The results indicated limited differences in yields and implementation of a wide variety of GAP between smallholder groups, except for considerably lower yields on peat. In line with the literature on smallholder oil palm farmers, a considerable yield gap was identified with all smallholder types and there appears considerable room for the implementation of better agricultural practices (Molenaar et al., 2013; Soliman et al., 2016; Woittiez et al., 2018). Fertilizer applications rates were generally too low to sustain a 20 Mt ha^{-1} $year^{-1}$ yield – a yield that is not excessively high but is well above the common plateau yields achieved by independent smallholders. Especially K fertilizers, which are expensive and thus risky investments, were applied insufficiently, a result in line with findings in Jambi and West Kalimantan (Woittiez et al., 2018). Although all smallholder types performed fairly poorly, some notable differences between farmer groups were observed; for example, smaller farmers have exceptionally high dura infestations and poor planting patterns (see Chapter 3 for more details). In the end, all smallholder types generally take a default position of implementing a low-input, low-output production system. However, conditions and abilities among the types of farmers are different and indicate the need for a differentiated approach to solve performance issues.

The chapters on Rokan Hulu confirmed the image of smallholder oil palm farmers as underachievers and inefficient producers. However, Chapter 4 – on collective action among smallholder oil palm farmers in Ophir – showed that smallholders are not per definition condemned to low-input, low-output production systems. The smallholders in Ophir were organized and their institutional setup consisted of one supra-cooperative, five cooperatives, 102 kelompoks and 2,400 farmers, all shouldering their responsibilities in maintaining a 4,800 ha intensive smallholder production system. Their business model coordinated fertilizer procurement and distribution, road maintenance, harvesting, sales and credit provision, and provided farmers with monthly overviews of their earnings and costs. The system allowed smallholders to maintain yields well above those of their partner company during the whole first lifecycle of oil palms and provided them with good incomes from their two-hectare plots. It is thus an example of collective action overcoming the multitude of barriers associated with smallholder agriculture, such as limited knowledge of markets and technologies, traceability issues, input purchases and lack of access to capital (Poulton et al., 2010). Through their farmer organizations, the Ophir oil palm smallholders capitalized on the advantages of the scale and structure of corporate plantations, but they also benefitted from the advantages associated with smallholder agriculture, which mostly pertain to a direct interest in production and a better ability to monitor activities in the field (Poulton et al., 2010). The case proves that smallholders can be highly efficient producers and that the organization of farmers can play an important role in this.

6.2.4 Establishing meaningful farmer organizations requires considerable support and continued maintenance

Sustainability initiatives such as the RSPO and ISPO regard farmer organization as an essential tool to improve smallholder performance, increase traceability, and link oil palm smallholders with sustainable and increasingly complex global value chains. The overview of the institutions that facilitated collective action in Ophir provided a clear example of how smallholders can indeed collectively and intensively manage an oil palm plantation over a long period of time. It showed that farmer organization can indeed be a useful tool in improving the poor performance of smallholders. However, both chapters on Ophir showed that achieving this level of collective action required considerable capacity building and maintenance. Chapter 4 provided an insightful overview of the institutional setup of the project, but paid limited attention to the continuously changing conditions in and around the plantation that impacted its functioning. Therefore, Chapter 5 shifted from a fairly static institutional overview on 'the Ophir business model' to a perspective that accentuated the dynamics and diversity within the Ophir smallholder plantation over a nearly 40-year period.

Chapter 5 showed that initial smallholder populations of cooperatives and kelompoks in Ophir differed slightly in age, wealth and background. The sizes of the farmer organizations differed, as did the amount of training received by farmers and the physical conditions throughout the Ophir plantation, and these and many other factors have an impact on smallholders' evaluations of the functioning and desirability of their institutions (see section 5.4.1). Once these plantations and institutions were properly established, evaluations continued under the influence of continuous dynamics within as well as beyond the smallholder plantation and the institutional setup was deemed preferable (see section 5.4.2). Replanting, however, is a critical event that many oil palm smallholders are ill prepared for (Hutabarat et al., 2018). After about 20 years, income from oil palms drops as yield and oil content decrease. The replacement of oil palms requires considerable investments and farmers have to wait three years before their oil palms yield again. Whereas Chapter 5 provided more details on how and why, it is sufficient here to state that replanting proved a catalyst for the partial disintegration of smallholder collective action in Ophir (see section 5.4.4). Cooperative 1 managed to replant collectively and maintain its institutional setup similar to the initial setup of the plantation, and several other cooperatives and kelompoks managed to partially replant collectively and maintain some collective activities, whilst others completely disintegrated. Although it appears that farmers in Cooperative 1 are best positioned to produce intensively with their second cycle of oil palms, it will be interesting to see in a few years' time how the other farmers perform, what kinds of collective action evolve, the extent to which smallholders implement GAP, and who will be the important actants impacting a fourth constellation of the Ophir plantation.

Developing and maintaining properly functioning smallholder organizations is clearly no easy feat. Although committed and extensive capacity building appears a prerequisite for the successful collective action and functioning of farmer organizations, it is no guarantee of success. Internal and external dynamics continuously impact farmer organizations, cannot always be predicted and may well move beyond the influence of group management. Although overt dependency on external assistance needs to be avoided, support to smallholder organization should be available when crises emerge and worthwhile institutions appear to fail. That even relatively well-functioning organizations suffered considerable disintegration shows that support for farmer organization is currently weak, conditions for massively establishing farmer organizations that truly support their farmers are minimal, and that in order to develop and maintain functional farmer organizations, considerable investments in capacity building and maintenance need to be made.

6.2.5 Unequal but inclusive – and possibly too inclusive for the current sustainability narrative

That smallholder oil palm development can lead to increasing inequality was established by previous studies (see McCarthy, 2010; Euler, 2017), and Chapter 2 confirmed that a limited number of elites have managed to capture a large part of the smallholder oil palm area. The presence of Sakai – an indigenous tribe of forest dwellers in Riau – living in very poor conditions next to the road from Bonai to Duri evidences that the overexploited forestry sector and the subsequent land grab by oil palm companies and smallholders did not benefit everybody; these people deserve attention and support. Results from Rokan Hulu highlight, however, that oil palm plays a major role in the income portfolio of groups of smallholders (see Table 2.4). In Ophir, large numbers of farmers from modest backgrounds have also earned good incomes from their two-hectare farms for many years now (see Table 5.1 and Table 5.2). Furthermore, non-farm owning populations also appear to have benefitted from expanding oil palm activities (Bou Dib et al., 2018; Euler et al., 2017). That elites benefitted most and that inequality is likely to have increased does not negate the fact that large numbers of the poor local populations and immigrants have also benefitted considerably from the opportunities provided by oil palm.

Susanti (2016) described in detail how the crisis in the forestry sector led to policies that allowed for the rapid but uncontrolled expansion of the company as well as smallholder oil palm sector in Riau. Infrastructural development for timber and mineral oil extraction and company plantations allowed for the commodification of land that was previously poorly accessible and of limited value (Bissonnette and De Koninck, 2017; Susanti, 2016). This increased availability of cheap land, low rubber prices, relatively good prices for palm oil and a relatively low demand for labour allowed oil palm farmers to cultivate more land and engage in other livelihood activities (Kubitza et al., 2018; McCarthy, 2010; Rist et al., 2010). Whereas Lee et al. (2014) claim the environmental impacts of large-scale oil palm companies exceed those of oil palm smallholdings in Indonesia (and their research highlights Rokan Hulu specifically), and indeed the actual deforestation itself may have been caused by especially logging companies, the methods applied in this dissertation provide much more detail on the extend of smallholder and company plantations in the research area. It shows that roughly 50% of the oil palm area in the frontier is covered by smallholders, either living in urban or rural areas, and that smallholders are fundamental actors in the Rokan Hulu land grab. This finding highlights that smallholders need to be acknowledged as part of the broader land grab debate (see e.g. Zoomers and Kaag, 2014). However, it appears there was an implicit understanding among policymakers that the smallholder oil palm sector did not really need any support or restrictions and that scarce resources were better spent on issues deemed more pressing. The sector was expanding rapidly by itself, the industry had a cheap source of supply and good export earnings were made without much effort.

Whereas Ophir farmers and scheme farmers received considerable support and training, many independent smallholders developed plantations with minimal knowledge of oil palm or access to proper inputs. Their primary source of knowledge appears to be the farmers' peers (Woittiez, 2019; Chapter 2), and whereas this can be an important source for the diffusion of knowledge, it can also lead to the 'deaf leading the blind' – and this certainly seems to be the case with smallholder oil palm farmers. Triggered by cheap land, many parts of society leaped aboard the oil palm-land conversion train, hoping for the same results as the supported smallholders (McCarthy, 2010). Mertz (2013) refers to smallholder oil palm plantations as 'productive fallows': with minimal input you can get a reasonable return, have a nice investment and clearly mark the land as occupied. Although especially in the Rokan Hulu peatlands land ownership documents appear to be legally dubious, in practice this is not a problem and many make considerable profits from converting the peatlands into oil palm plantations (Purnomo et al., 2017). A vast share of farmers also have other sources of income and although they may receive a fair share of their income from oil palm (see Table 2.4) they may still primarily identify with their other livelihood sources. It appears that for many of these semi-farmers neither the comparative advantages associated with smallholder agriculture nor those associated with large-scale agriculture are relevant. More importantly, however, it remains unclear to what extent these investors remain interested when production requirements are upgraded and investments need to be made. Whereas measures that allow farmers to participate in the oil palm sector on better terms deserve priority, it seems only fair that those who engage in undesirable practices or are unwilling to improve practices are excluded.

6.3 Reflections on improving the performance of Indonesian oil palm smallholders and on inclusive businesses models and the future of farmers

6.3.1 Fairly straightforward measures to improve the performance of the smallholder oil palm sector

A wide range of actions can be undertaken to increase the performance of the smallholder sector. Chapter 3 and Woittiez (2019) provide a considerable list of practices in smallholder plantations that could lead to improved performance. These include improving weeding practices, fertilizer regimes and application practices, implementing better water table management, improving harvesting practices, selective thinning, implementing proper planting patterns and the use of high-quality planting materials. Access to proper knowledge of these practices often proves an issue and deserves attention. Fairly straightforward measures that can improve access to knowledge are strengthening extension services, developing farmer training centres in collaboration with companies that allow farmers access to proper knowledge on GAP, improving their incomes from oil palm, and also sharing and discussing useful own experimentation. Furthermore, billboard or other public awareness campaigns that demonstrate the value of high-quality planting materials and proper planting patterns and other basic requirements regarding, for example, fertilizer use may well improve smallholder knowledge and reduce unnecessary spending. Finally, it is clear that in peatlands there is a requirement for proper water table management, and both government and smallholders have to play a role in this.

Making high-quality planting materials widely available is an important first step towards upgrading smallholder production systems, and seedling companies must be encouraged to improve their links with smallholders. Subsidizing high-quality planting materials, reducing red tape for purchasing high-quality planting materials and increasing the number of seedling distribution centres may stimulate this. In combination with illegalizing illicit nurseries and new plantings with poor planting materials, these measures can lead to reductions in dura infestation, improve yield potential, lower crushing costs for mills and may eventually even lead to higher prices for smallholders as oil extraction rates go up. Although agronomic principles are similar, developing science specifically relevant to smallholder conditions also appears important. For example, optimal replanting strategies may well be different for smallholders compared to companies (Woittiez, 2019) and intercropping could be a worthwhile strategy for certain smallholders (Khasanah, 2019).

Difficulties accessing fertilizers, other agro-inputs and finance are also common barriers to the implementation of better agricultural practices (Brandi et al., 2015; McCarthy, 2010; Woittiez, 2019). Fertilizers are essential for intensive oil palm cultivation and need to applied in large and balanced quantities. It requires considerable investments to purchase them and proper infrastructure to deliver them to farmers. Developing and maintaining proper infrastructure by local governments in areas where oil palm is desired and limiting infrastructure development in areas where it is undesired may well stimulate the implementation of GAP and reduce the attractiveness of investments in areas deemed undesirable for oil palm cultivation.

The need for improved finance requires careful deliberations and finely developed schemes. This research quantified the amount of land owned by seven types of smallholders and showed that much of the oil palm area is owned by farmers with sizeable land holdings and that many farmers could also have purchased less land and invested more in their practices. Furthermore, Chapter 2 (Table 2.6) highlighted that in Rokan Hulu, banks or other formal credit suppliers were hardly involved in financing the independent plantation establishment, and similar findings were made in Kalimantan (Schoneveld et al., 2019). These findings show that considerable amounts of capital are already present and that increasing further access to finance under current conditions may well lead to further investments in low-input, low-output production systems instead of intensifying them. However, combined with other measures, improving access to finance may well result in the implementation of better agricultural practices.

Farmer organizations are often presented as a fairly straightforward tool to improve smallholder performance and inclusion in modern value chains. However, this is obviously much more complicated than placing billboards or illegalizing illicit seedling producers. Considerable capacity-building and professional assistance is required to support farmers, not only during establishment but most likely also when crises arise after establishment (see Chapters 4 and 5), and it remains unclear who will have to pay for this.

6.3.2 Complex structural issues limiting the uptake of more sustainable practices by smallholders

6.3.2.1 Bifurcation of the oil palm sector and competitor crops

Although sustainability initiatives are gaining ground in Indonesia, especially in some leading plantation companies, it is becoming clear that the push for sustainability leads to a bifurcation into green and brown value chains (Pacheco et al., 2018). It is clear that the push for sustainability is primarily driven by Northern countries, be it directly – as exemplified by the RSPO – or indirectly by the reaction of Southern countries with, for example, the establishment of the ISPO (Hidayat et al., 2018; Schouten and Bitzer, 2015). These Northern markets may be more lucrative and are indispensable in maintaining a reasonable palm oil price. However, Figure 1.1 shows that the main destinations for palm oil are not Northern markets and that the biggest growth in demand for palm oil can be expected in upcoming markets such as China, India, Pakistan and Africa. Environmental and social sustainability concerns in producer countries generally have a position in the hierarchization of palm oil concerns different from that in Northern markets; price is more important. The position of Indonesia as both a producing country and a major consumer of palm is twofold. Social sustainability in Indonesia clearly puts more emphasis on job creation and sector growth than is the case in Northern perspectives. It is also clear that whereas there is a push for sustainability and producers feel the pressure, since 2013 the uptake of palm oil that is sold under RSPO has hovered at around 50% (RSPO, 2017b), indicating that markets, including Northern markets, are unwilling to actually pay for sustainable palm oil and improved practices in producer countries.

That the European Union identified oil palm as not sustainable enough for their biofuel directive is likely to reduce Northern demand for palm oil. Whereas at first sight this appears a justified stance against unsustainable vegetable oil production, it also appears short-sighted. The decision is likely to lead to increased imports of soy oil – a competitor vegetable oil that not only requires considerably more land and stimulates land conversion in Latin American, but also hardly contributes to opportunities for smallholders and rural populations. Furthermore, with a retreat from the sector there is clearly also less leverage in discussions on how to improve practices in the oil palm sector.

6.3.2.2 Huge expansion of the sector, decentralization and coordination issues.

In the 1970s and 1980s, the concerted push for the NES/PIR programme by the state and international donors, supported by oil revenues and development organizations, kick-started the smallholder oil palm sector (Badrun, 2011; Pramudya et al., 2017). Governance issues became much more complex as decentralization processes in Indonesia complicated coordination, the sustainability debate emerged, funds for state support programmes for agriculture largely dried up, and the sector expanded massively and is highly diverse in landscapes as well participating actors (Badrun, 2011; Pramudya, 2017; this dissertation).

This increased complexity is very challenging and it is becoming clear that generic approaches – as exemplified by the programmes of RSPO, ISPO and the Oil Palm Plantation Fund (BPDP) – face difficulties with implementation. As highlighted in the introduction, the RSPO has not been able to certify a sizeable share of smallholders, and certification is not obligatory anyway (RSPO, 2018). Although ISPO certification is a legal obligation for companies, incompliance is rife and ISPO is weak in authority and limited in capacity (Hidayat et al., 2018). Therefore, the planned obligatory certification of all independent smallholders by 2022 (InPOP, 2015) is very likely to be a paper tiger. The BPDP further demonstrates the difficulties the state is encountering in providing direct support to the smallholder sector and is far from achieving its replanting targets (BPDPKS, 2018). These actors are crucial in shaping broader frameworks and arranging funds, but they currently appear unable to induce considerable transitions on the ground. They may have a bird's-eye view, but they are unable to account for the local particularities that determine eventual outcomes (Scott, 1999).

This dissertation has continuously emphasized the importance of local conditions in shaping associations that may prove essential in triggering more sustainable practices by smallholders. An interesting approach that is better adapted to local conditions and diversity compared to the 'bird's eye view' approaches mentioned above is the jurisdictional or landscape approach. Such an approach centres on a certain landscape or jurisdiction, involves local government and other relevant stakeholders, aligns activities, includes accountability and develops the shared goal agreements of involved parties (Proforest, 2016). There are examples of promising jurisdictional approaches, for example the Musi Banyuasin Jurisdictional Certification plan, which aims to certify Lalan sub-district in South Sumatra (Luttrell et al., 2018) and thereby mitigate the complications associated with having to trace and certify all individual smallholders. The first constellation of the Ophir smallholder project (Chapters 4 and 5) also exhibits interesting characteristics of a landscape approach, as it provides a good example of successful coordination between a large number of actants in a certain location. It also shows that the role of national government or broad sustainability initiatives is by no means disregarded; they are still crucial in providing insight into what is required locally. Ophir taught us that it is not merely a matter of establishing a certain situation to achieve desirable outcomes: desirable outcomes require continuous work.

It is acknowledged, however, that a landscape approach will not change the whole smallholder sector overnight. Some areas may be unable to develop the actor networks required to upgrade sector performance and will remain brown, possibly even by choice. Clearly, there are no silver bullets. The enforcement of strict sustainability criteria is unlikely to be politically or technically achievable at short notice and, as Varkey (2018) predicts, most likely the sector's production will grow through both intensification and area expansion. Successful examples can, however, inspire actors elsewhere and thereby spread practices that increase the sustainability of the smallholder sector.

Besides the landscape or jurisdictional approaches there are many other interesting avenues to explore and cases can always inspire a broad range of actors. In Ukui, Riau, independent smallholders have received and maintained ISPO as well as RSPO certification, and more importantly, have improved practices in their plantations. This was achieved through interesting collaborations with the private sector and third parties (Hidayat et al., 2015; Hutabarat et al., 2018). Farmers' leaders in Ukui are participating in knowledge transfer to other projects (see www.fortasbi.org), demonstrating that good examples can trigger change elsewhere.

6.3.3 Linking with the broader debate on inclusive business models

The case studies in this research – namely independent smallholders in Rokan Hulu and organized smallholders in Ophir – both fall under a broad definition of inclusive business (IB), which Chamberlain (2018) regards as economic growth opportunities for low-income communities induced by the commercial sector. Industry rightfully claims that oil palm provides millions of jobs in rural areas and is a key driver of economic development in many of those areas (see e.g. GAPKI, 2019). Smallholder oil palm value chains have undoubtedly allowed for agrarian change throughout Sumatra (McCarthy, 2010) and many have benefitted. However, when narrowing the definition and looking for a 'partnership' component (Chamberlain, 2018; Vermeulen and Cotula, 2010a), it soon becomes clear that especially the independent oil palm smallholders hardly ever directly engage in partnerships with companies and sales usually pass through intermediaries. Mills hardly engage in knowledge transfer, credit supply, fertilizers disbursement or any other input supplies, and generally have very limited knowledge of where their produce is from. For their part, farmers hardly ever participate in any upstream activities and have a poor understanding of the value chain beyond delivering fresh fruit bunches to middlemen. In fully developed oil palm landscapes such as Riau, both middlemen and mills are plentiful and although general sales patterns are established, sales relations are very flexible. It can therefore be concluded that whereas the oil palm sector is very inclusive of smallholders, the majority of oil palm smallholders developed endogenously, operate without partnerships with companies, and therefore do not fall under a narrow definition of IB.

Large numbers of smallholders lack partnerships and the associated benefits – such as the transfer of knowledge, the provision of financing, assistance in marketing and obtaining better prices, certification and other benefits – and efforts by industry to engage with independent oil palm smallholders have generally been limited. However, IB partnerships are often unequal and skewed towards the interests of companies, and they often lead to corporate control over farmers' resources and to agreements that low-income communities can barely understand, influence or benefit from (Chamberlain, 2018; Vermeulen and Cotula, 2010b). These processes have been observed in IB models in the oil palm sector as well, and although scheme smallholders are produce higher yields, it is not always clear whether they earn more (Cramb, 2013; Gillespie 2011). Although the union of smallholder oil palm farmers (SPKS) states that proper support for smallholder farmers is needed, they also warn of the 'plasmafication' of smallholder plantations with assistance programmes, referring to a process whereby farmers lose their autonomy (SPKS, 2018).

It is clear that there are inherent tensions between farmers' and companies' risks and interests. This tension was often experienced in the Ophir project, where third parties such as GTZ and PCC had an important role in defending farmers' interests. In their second constellation, the partnership became a more equal one when the smallholder organizations were firmly established and alternative markets emerged. In their third constellation, Ophir smallholders even abandoned all previous partners when state-owned company replanting recommendations were ignored, Cooperative 1 started to collectively sell to other mills, and kelompoks and individual members started to side sell and engage in practices that resemble the independent smallholder model, which allows for much autonomy for farmers but provides little structure for implementing GAP.

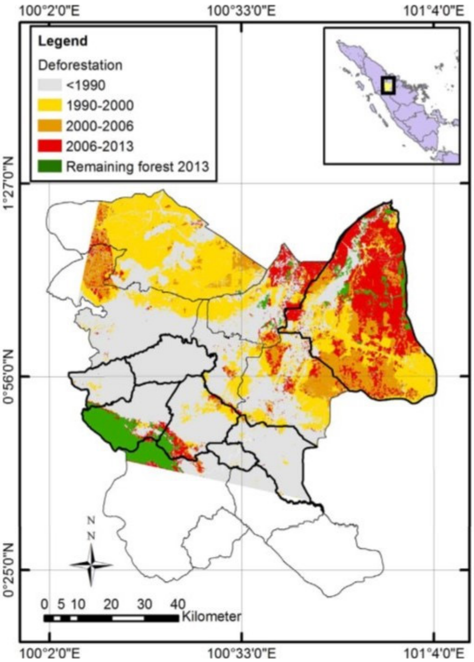
The tension between farmer autonomy vs. forced guidance by companies or government is clearly a topic at the heart of discussions in IB models, and developing models that propose an acceptable balance remains a worthwhile research field. However, the alternative to IB models – namely increasing the availability of proper support for smallholders via public services – is also worthwhile, possibly in collaboration with the private sector via financial, technical and/ or managerial support, in combination with the implementing and monitoring of a regulatory framework that strongly stimulates the implementation of proper agricultural practices. Developing proper plans for this and determining costs will also require additional research.

6.3.4 The future of smallholders and of smallholder oil palm farmers more specifically

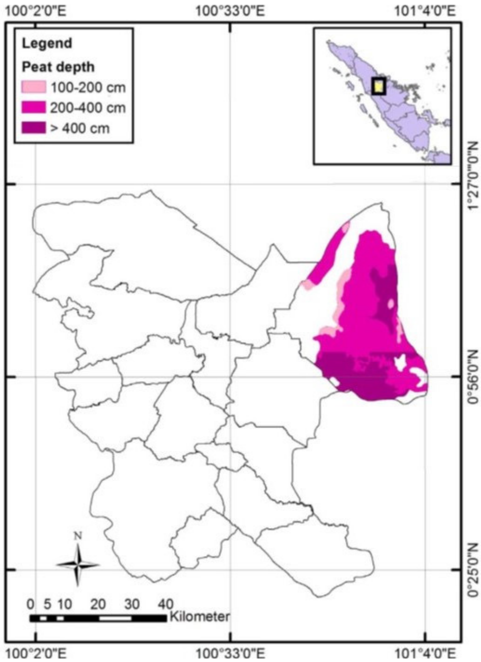
Rural development cannot be seen in isolation from urban development (Rigg et al., 2016; Zoomers et al., 2017). Mobility has increased massively in East and Southeast Asia, and although rural wages have been increasing since the beginning of the new millennium, they still are low compared to wages in urban areas (Wiggins and Keats, 2015). Like elsewhere in East and Southeast Asia, employment opportunities in urban areas have led to the massive migration of especially young people to urban areas. This has led to labour shortages in rural areas, to the planting of crops that require less labour and to the de-intensification of agriculture (Rigg et al., 2016). These general trends are clearly relevant to the smallholder oil palm sector. Although Budidarsono et al. (2013) show that oil palm induced an opposite trend of attracting considerable migration to rural areas, the main reason for this was the availability of cheap land. This condition is not present in large parts of East and Southeast Asia, nor is it one that stimulates intensification. These trends show that the initial advantages of smallholder agriculture over plantation agriculture may well be diminishing. In light of these broader trends, it is clear that the current sustainability narrative, with its emphasis on increasing smallholder productivity, may well be swimming against the current and requires considerable steering by government, civil society and the private sector if change is truly desired.

The future of smallholder farmers has proven difficult to predict and it is clear that there are many other actor networks competing for the vast resources (human and financial capital) required to upgrade the smallholder sector generally, and the smallholder oil palm sector specifically. These include but are not limited to fuel subsidies, rice production, poverty alleviation in urban areas or environmental protection by other means. However, this dissertation has provided insights into the smallholder oil palm sector, and however limited they may be, they can help the sustainable oil palm actor network to devise strategies to achieve more sustainable smallholder oil palm production systems. Oil palm smallholders' heterogeneity needs to be acknowledged for better targeted sector governance and farmer organization may well lead to highly sustainable production systems, but such organization requires considerable investments to establish and maintain. The sector is inclusive and has grown organically and voraciously over the past two decades, but it is in dire need of some long overdue maintenance to eliminate undesirable practices and allow for sustainable growth. Measures have been proposed in this dissertation and hopefully the findings presented here can strengthen the alliances that favour smallholder oil palm farming specifically and smallholder agriculture more broadly.

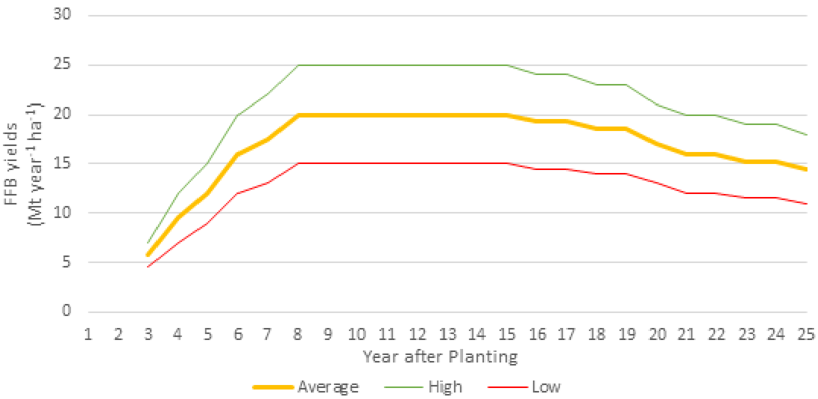
Appendices



Appendix A: Deforestation in study area. Sources: Author's representation based on CIFOR (2014) and BAPPEDA Rokan Hulu (undated), for white area data was not available.



Appendix B: Peatland presence and depth in study area. Sources: Author's representation based on BAPPEDA Rokan Hulu (undated) and MoA (2011).



Appendix C: Production curve of independent smallholders.

Adapted from Cramb (2016; p. 32). Original does not contain the average yields.

Appendix D: 20 palms field audit

Cell No.:				Plantation No.:			Date:	
				Name owner:				
Oil palm conditions check								
					Nutrients			
No. palm	Abnormal or missing	Dura	Tenera	Black Bunch Count	P deficiency	K deficiency	Mg deficiency	B deficiency
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Comments:

Scoring system (although data confirms frequent K deficiencies, deficiency data is not further used in dissertation):

- P deficiency: If trunk strongly resembles bottle shape (2), if observed but limited (1), none (0)
- K deficiency: strong indications (2), present but not strong (1), if (almost) absent (0)
- Mg deficiency: strong indications meaning more than on two leaves (2), present but not strong meaning only one leaf (1), if not observed (0)
- B deficiency: Strong indications on more than two leaves (2), present but only observed on one leaf (1), not observed (0)

Appendix E: Field audit form

Digital form using Samsung Tablets and ESRI software (see Chapter 2), with which photos could be added to the survey.

Field check			
	Cell No.:	Plantation No.:	Date:
		Name owner:	
No.	Subject		Answer
			(0 for no, 1 for yes unless indicated otherwise)
1	Soil composition	Clay; much (m) some(s) none(n).....	
		Sand; much (m) some(s) none(n)..	
		Peat; much (m) some(s) none(n)..	
2	Topography	Flat	
		Slightly hilly	
		Steep	
3	Water works	Clean canals	
		Dams present	
		Dams regularly present	
		Water table level good (30-70 cm below ground)	
		Water table level to high (less than 30 cm below ground	
		Water table level to low (more than 70 cm below ground)	
4	Feeder road quality	Quality good (not many holes and easily accessible, bridges well passable)	
5	Main road quality	Quality good (not many holes and easily accessible, bridges good enough)	
6	Distance feeder to main road	Less than 10 minutes by motorbike	
7	Harvesting path:	Present every two rows	
		Harvesting path 50 cm wide at least	
		Harvesting path easy access	
8	Clear signs of weeding		
9	Circle weeding good		
10	Loose fruits present in circles		
11	Woody shrubs present		
12	Other crops present in plantation		
13	Bare soils common in plantation		
14	Cover crops present		
	Front stack size	Size small	
		Size medium	
15		Size large	
	Front stack in U shape or neat rows	Row	

16		Shape U	
17	Pruning correct number of leaves	if you see frequent overpruning or underpruning in plantation (more than 30%) mark as not correctly pruned	
18	Front butts correctly pruned	if you see frequent overpruning of front butts or under pruning in plantation (more than 30%) mark as not correctly pruned	
19	Canopy cover	Cover closed	
		Canopy cover reasonably open	
		Canopy cover open	
20	Oil palms have similar age		
21	Estimate of palm age (years)		
22	Estimate of bunch weight (kg)		

Appendix F: Farmer survey Rokan Hulu

Date:

Survei tanah dan Rumah tangga – Proyek LIFFE Options

Name interviewee	
Name respondent + no. tel.	
Name location sub-district in which plot is located	
Address plot owners (village)	
Cell no.	
Plantation no.	

1 Area and productivity

a. How many hectares of productive oil palms do you have at this location? ……………Ha

b. What is the productivity of your oil palms at this location?

	Volume (kg/harvest)	Frequency of harvesting
Low season		
High season		

c. How many hectares of oil palm do you own in total?……………................................... Ha (Include from other places as well)

2 Establishing the plantation

Did you plant or buy the plantation? (circle your answer) Buy Plant

a. What year did you buy/plant your plot; what was the price ha^{-1}?

Year	
Price ha^{-1}	IDR……………………………………

b. From where did you obtain planting material?
   i. Local agent without certificate
   ii. Local agent with certificate
   iii. Bought straight from an official oil palm seed company
   iv. Don't know
   v. 'Brondol' (took fruits from other oil palms and planted this)

c. If you did not buy Marihat or from another official producer, what is the reason for that?
   i. No access to an official producer
   ii. No money to buy from an official producer
   iii. Other
   iv. Not relevant

d. Are you involved in "land sharing" in your plot? Yes No
   (circle the correct answer)

e. Are you involved in "harvest sharing"? Yes No
   (circle the correct answer)

f. Please indicate who performed the following activities (but a V to indicate yes)

	Open land for starting the plantation	Develop infrastructure	Maintain infrastructure	Develop drainage system	Planting	Organise labour in the plantation	Selling of FFB
Individually							
Collectively with family and/or friends							
Collectively with previously unknown people							
Government							
Contractor [x]							
Don't know							

[x] If by contractor indicate who paid the contractor

3 Fertilizer application

a. Fertilizers application

Indicate which fertilizers you have used in the past three years, when you used them, how much you applied and what your source is. Work from top to bottom and left to right

Nama pupuk	Last application (month and year)	How frequent per year	How much		Source of Fertilzier: (See Code A)
			Per oil palm	Per ha	
Urea					
SP36					
ZA					
Dolomite					
KCl					
NPK Phonska					
NPK Mutiara					
Pupuk NPK other:					
Triple Super Phosphate (TSP)					
Kieserite					
Borax/Boron					
Copper sulphate					
Zinc sulphate					
Empty Fruit Bunches					
Animal dung					
Other					

Code A

1. Individually at the marker/shop
2. Oil palm company/mill
3. Cooperative or group which is officially recognized and provides subsidized fertilizers
4. Informal farmer groups, friends, shared purchase with other farmers
5. Government
6. Others (indicate)…………………….
7. Not relevant

b. Access to fertilizers:

1. In your opinion do you provide enough fertilizers? Yes No
2. In your opinion do you provide fertilizers timely? Yes No
3. In your opinion is the quality of fertilizers good (not false)? Yes No

4. From who do you receive information concerning fertilizer management (quality & quantity)?............................ (choose from Code A)

4 Work in the plantation and sales of FFB

a. Types of activities performed by whom?

Activity	Direct house hold	Other family or friends	Outside labourers
Provide fertilizers			
Harvesting			
Pruning			
Weeding			
Organise daily activities (For large farmers only)			

b. To whom do you sell your FFB? (encircle correct one)

Small middlemen (sells to large middlemen)	Large middlemen (Sells straight to mill)	Straight to mill with Delivery Order	Other.................

c. What is the current price per KG of FFB you received? IDR. ....

5 Social economic position

a. What are your other sources of income besides oil palm.

Civil servant	
Employee	
Labourer	
Other non-farming activities (e.g. shop keeper)	
Other farming	

b. Can you indicate how important oil palm is for your total income? (Check if yes)

0%	25%	50%	75%	100%

c. Did you migrate to this area? Yes No

d. If yes, did you migrate for oil palm? (Check if yes)

No	
Yes, to become an oil palm employee/labourer	

Yes, to become an oil palm farmer	

e. Before you started this plantation did you have experience in oil palm already? (Check for yes)

No	
Yes as a labourer in a company	
Yes as a non-labourer in a company	
Yes as a farmer	

f. What did you do before you were an oil palm farmer ? (Check for yes)

Cultivate another crop	
Government employee	
Private sector employee	
Worker in farm	
Business owner/entrepreneur	
Other…………………	

g. From where did you get the capital to start your plantation? (Check for yes)

Private capital	
Bank	
Social funds/assistance	
Other………………………	

h. What land ownership documents do you possess? (Check for yes)

Village level letter	
Sub-district level letter	
Certificate/ National level letter (BPN)	
Land lease from government (HGU, Hak Guna Usaha)	
No official land documentation	

Appendix G: Two examples of photos from plantations, expert assessments, survey data and calculations of input to BBC yield assessments.

Photo examples from cell 64933: Large Peat Investor (LPI), waterlogged plantation. The plantation pictures indicates generally poor management (e.g. poor (circle) weeding and access within plantation, waterlogging). The picture left under shows hooked leaves, which is an indicator of Boron deficiency.

		Age estimate	Yield estimate		Plantation condition	Bunch Size	
	Units	Years	Category	Category translated to $kg\,ha^{-1}$ $year^{-1}$		Category	Category translated to kg^{-1} bunch estimate
Expert assessment	Academic	3.0	0	0	1	0	0
	Farmer	5.0	1	5000	1	1	3.0
	CIRAD expert	4.0	1	5000	1	1	3.0
	Compound expert estimate	4.0	.67	3333	1	.67	2.0
Survey estimate		4.0		1415			3
Values used for BBC yield benchmark against production curve ((survey + average expert estimates)/2)		4.0	Not relevant	Not relevant	Not relevant	Not relevant	2.5

Photo examples from cell 37836, a Small Migrant Farmer's plantation in Central Rokan Hulu, with generally proper management but high share of dura fruit producing palms.

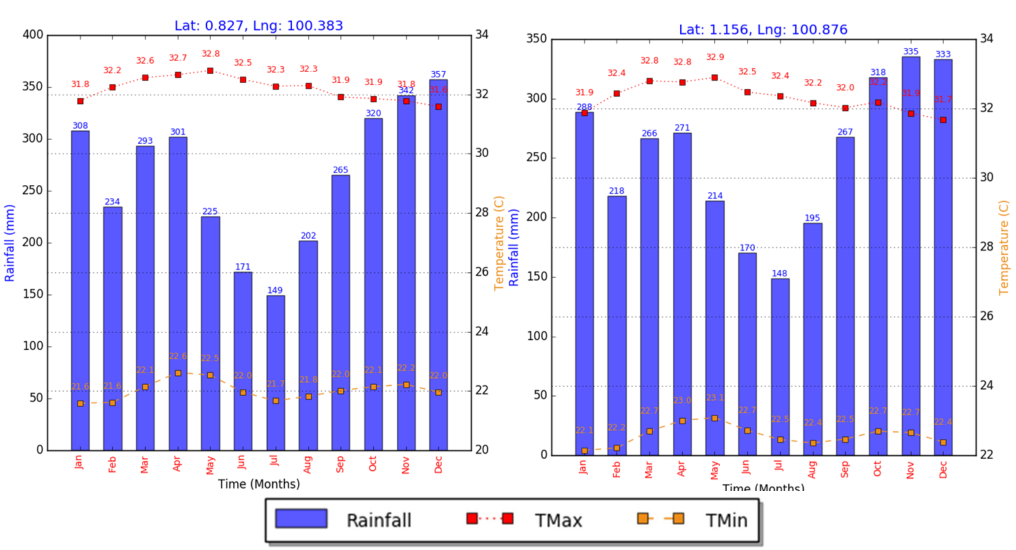
		Age estimate	Yield estimate		Plantation condition	Bunch Size	
	Units	Years	Category	Category translated to kg ha^{-1} $year^{-1}$		Category	Category translated to kg^{-1} bunch estimate
Expert assessment	Academic	15	5	25000	3	4	17.5
	Farmer	10	4	20000	3	3	12.5
	CIRAD expert	10	4	20000	3	4	17.5
	Compound expert estimate	11.7	4.3	21667	1	3.7	15.8
Survey estimate		4.0		17033			12
Values used for BBC yield benchmark against production curve ((survey + average expert estimates)/2)		4.0	Not relevant	Not relevant	Not relevant	Not relevant	13.9

Appendix H: Correction factors applied based on yields from nearby corporate plantations

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
PT. 2, 2013	Share month^{-1}	7.5%	6.7%	6.4%	7.4%	6.6%	6.8%	9.6%	9.9%	10.0%	9.6%	9.6%	9.9%
PT. 1, 2014	Share month^{-1}	8.4%	5.3%	6.4%	7.1%	7.0%	6.5%	8.9%	10.7%	10.1%	12.0%	10.0%	7.8%
PT. 3, 2014	Share month^{-1}	5.9%	6.2%	6.6%	6.9%	6.3%	7.2%	9.8%	10.0%	10.2%	10.0%	10.3%	10.5%
PT. 2, 2015	Share month^{-1}	8.0%	6.4%	8.5%	7.4%	7.5%	7.8%	9.4%	12.7%	10.5%	8.6%	6.9%	6.3%
PT. 1, 2015	Share month^{-1}	7.6%	5.4%	6.3%	6.4%	6.7%	6.6%	7.9%	14.3%	11.4%	10.4%	8.6%	8.3%
Average PT. Share month^{-1}		7.5%	6.0%	6.8%	7.1%	6.8%	7.0%	9.1%	11.5%	10.4%	10.1%	9.1%	8.6%
Theoretical average		8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%
Moving means for four month yields		27%	27%	28%	30%	34%	38%	41%	41%	38%	35%	31%	29%
Correction factor		1.22	1.25	1.20	1.11	0.97	0.88	0.81	0.81	0.87	0.94	1.07	1.15

Appendix I: Calculated weather conditions in research area for 2015 (source: http://gismap.ciat.cgiar.org/MarksimGCM/#, all models included, 99 replications, visited 22-10-2018)

Central Rokan Hulu	Bonai Darussalam



Appendix J: Overview of nutrient values used to calculate nutrient requirements ha^{-1} year^{-1}

Source; Ng (1999) in Corley & Tinker (2016; p. 365). Note: cover crops were not included as no values were available and only one farmer had cover crops.

			Static variables (Kg^{-1} ha^{-1} year^{-1})				Yield dependent variables (Kg^{-1} ha^{-1} year^{-1})			
			N	P	K	Mg	N	P	K	Mg
Nutrient Supply	Input through Fertilizer application (Fe)		x	x	x	x				
	Input through Rainfall (De)		17	2.4	31.6	4.8				
Nutrient Demand	Trunk growth (Tr)		42	4.1	122	10.2				
	FFB requirement (c)	Shell		0.1			Ye*0.15		Ye*0.07	Ye*0.01
		Fibre					Ye*0.26	Ye*0.063	Ye*1.075	Ye*0.095
		FFB (without shell or fibre)					Ye*2.89	Ye*0.45	Ye*3.175	Ye+.1
	Loss through Run-off (Ru)		15	1	21.6	2.1				
	Loss through leaching (Le)		3.4	0.9	6.3	3.4				
	Loss through erosion (Er)		2.4	0	0	0.2				
Balance	Supply-Demand		0	0	0	0				

Yield estimate (Ye) in Mt ha^{-1} year^{-1}

Appendix K: Overview of most common types of fertilizers and quantities applied by farmers in the past 12 months

Fertiliser application in kg ha^{-1} year^{-1}. For micronutrients as Boron and Copper only whether they were applied is included). Fertilizers are ranked according to share of total farmers who apply the relevant fertilizer. Fertilizer application outliers with values >3.0 IQR in both combined sample and farmer groups were removed from further analysis although farmers still are included in calculations on % of farmers applying fertilizers.

Fertilizer (N-P_2O_5-K_2O-MgO)		Small Local Farmers	Medium sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium sized Migrant Farmers	Small & Medium sized Peat Farmers	Large Peat Investors	Total sample
% farmers applying fertilizers		83.3%	87.5%	97.1%	93.9%	97.5%	90.0%	96.9%	92.6%
Urea (46-0-0-0)	% applying	40.0%	46.9%	61.8%	57.6%	60.0%	26.7%	43.8%	48.9%
	Kg^{-1} ha^{-1} year^{-1} Users	208.9	254.7	292.3	348.8	362.2	426.8	268.3	309.4
	Std. dev. Users	104.6	112.4	186.7	225.6	161.8	235.1	194.1	184
	Kg^{-1} ha^{-1} year^{-1} Total	83.6	119.4	180.5	200.8	217.3	113.8	117.4	151.3
	Std. dev. Total	122.3	149.6	180.5	243.4	218.5	223	184.6	201.3
Dolomite (0-0-0-15)	% applying	36.7%	43.8%	23.5%	23.3%	37.5%	66.7%	81.3%	43.7%
	Kg^{-1} ha^{-1} year^{-1} Users	236.7	365.5	692.3	500.1	396.7	573.1	530	476
	Std. dev. Users	136.8	164.2	607.6	221.8	284.9	287.1	244.7	476
	Kg^{-1} ha^{-1} year^{-1} Total	130.9	159.9	262.9	151.5	148.8	417.8	430.6	224.5
	Std. dev. Total	302.2	212.7	408.9	394.8	258.8	423.1	304.1	352.9
KCl (0-0-60-0)	% applying	10.0%	25.0%	55.9%	39.4%	47.5%	43.3%	59.4%	40.7%
	Kg^{-1} ha^{-1} year^{-1} Users	215.4	242.7	371.1	333.0	361.3	502.2	313.7	354.5
	Std. dev. Users	123.3	133.8	315.4	281.6	177	293	178.6	244.3
	Kg^{-1} ha^{-1} year^{-1} Total	21.5	60.7	207,4	121.2	171.6	217.6	186.3	144.3
	Std. dev. Total	73.3	124.3	298.7	238.8	218.7	315.6	207.4	233.7
NPK Ponska (15-15-15-0)	% applying	36.7%	50.0%	26.5%	51.5%	35.0%	23.3%	21.9%	35.1%
	Kg^{-1} ha^{-1} year^{-1} Users	311.3	317.4	452.4	345.1	295.7	320.8	660.1	363.5
	Std. dev. Users	142	81.7	249.4	282.4	107.6	246.1	371	230.5
	Kg^{-1} ha^{-1} year^{-1} Total	114.2	158.7	119.8	177.8	103.5	74.9	144.4	127.5
	Std. dev. Total	142	81.7	249.4	282.4	107.6	246.1	371	230.5

Fertilizer ($N-P_2O_5-K_2O-MgO$)		Small Local Farmers	Medium sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium sized Migrant Farmers	Small & Medium sized Peat Farmers	Large Peat Investors	Total sample
TSP (0-46-0-0)	% applying	13.3%	40.6%	29.4%	30.3%	32.5%	30.0%	18.8%	28.1%
	Kg^{-1} ha^{-1} year^{-1} Users	191.5	237.3	236	346.3	293.3	501.7	202.6	295.7
	Std. dev. Users	132.1	131	151.6	249.6	169.6	277.2	125.4	203.4
	Kg^{-1} ha^{-1} year^{-1} Total	25.5	96.4	69.4	104.9	95.3	150.5	38	83.2
	Std. dev. Total	78.7	143.8	134.8	208.9	168	275.5	94.8	171.1
ZA (21-0-0-0)	% applying	0.0%	0.0%	11.8%	18.2%	22.5%	10.0%	12.5%	11.3%
	Kg^{-1} ha^{-1} year^{-1} Users	0	0	442.3	380.8	352.5	368.5	240	357.4
	Std. dev. Users	-	-	218.3	222	147.1	213.2	137.3	178.6
	Kg^{-1} ha^{-1} year^{-1} Total	0	0	52	69.2	79.3	36.9	30	40.2
	Std. dev. Total	-	-	158.9	173.1	163.3	125.6	91.25	127.6
SP36 (0-36-0-0)	% applying	6.7%	9.4%	17.6%	15.2%	22.5%	0.0%	3.1%	11.3%
	Kg^{-1} ha^{-1} year^{-1} Users	271.3	370.7	279.1	325.4	308.3	-	387	312.2
	Std. dev. Users	269.8	35.6	173.9	158.1	96.5	-	-	130.8
	Kg^{-1} ha^{-1} year^{-1} Total	18.1	34.8	49.3	49.3	69.4	-	12.1	35.1
	Std. dev. Total	85.1	110.1	127.5	131	137.5	-	68.4	35.1
Kieserite (0-0-0-26)	% applying	0.0%	0.0%	14.7%	3.0%	5.0%	10.0%	15.6%	6.9%
	Kg^{-1} ha^{-1} year^{-1} Users	-	-	362.4	284	218	350	227.6	299.5
	Std. dev. Users	-	-	243.9	-	77.8	127.4	105.2	162.9
	Kg^{-1} ha^{-1} year^{-1} Total	-	-	53.3	8.6	10.9	35	56.6	23.3
	Std. dev. Total	-	-	155.5	49.4	49.7	111.9	174.9	102.2
NPK other (15-15-15)	% applying	3.3%	3.1%	14.7%	0.0%	12.5%	3.3%	6.3%	6.5%
	Kg^{-1} ha^{-1} year^{-1} Users	177	308	649.4	-	203.6	163.2	276	364.3
	Std. dev. Users	-	-	425.5		79		14	313.9
	Kg^{-1} ha^{-1} year^{-1} Total	5.9	9.6	95.5	0	25.5	5.4	17.3	23.66
	Std. dev. Total	-	-	276.5	0	72.7	29.8	67.9	118.7

Fertilizer (N-P_2O_5-K_2O-MgO)		Small Local Farmers	Medium Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium Migrant Farmers	Small & Medium Peat Farmers	Large Peat Investors	Total sample
Boron	% applying	0.0%	0.0%	11.8%	0.0%	5.0%	6.7%	12.5%	5.2%
Manure (2-1-1-0)	% applying	6.7%	3.1%	2.9%	6.1%	7.5%	3.3%	0.0%	4.3%
	Mt^{-1} ha^{-1} $year^{-1}$ Users	6.8	12.5	2.3	17.1	12.1	15.6	-	11.4
	Std. dev.	.5	-	-	7.7	4.7	-	-	5.9
	Mt^{-1} ha^{-1} $year^{-1}$ Total	0.45	0.39	0.67	1.03	.91	.52	-	.50
	Std. dev. Total	1.7	2.2	.4	-	0.3	2.8	-	2.6
EFB (10-1-2.4-.2)	% applying	0.0%	0.0%	8.8%	0.0%	2.5%	3.3%	6.3%	3.0%
	Mt^{-1} ha^{-1} $year^{-1}$ Users	-	-	9.0	-	10.9	19.2	4.5	9.4
	Std. dev.	-	-	2.9	-	-	-	2.7	5.4
	Mt^{-1} ha^{-1} $year^{-1}$ Total	-	-	.8	-	0.3	.6	.3	0.3
	Std. dev. Total	-	-	2.7	-	1.7	3.5	1.2	1.8
Copper	% applying	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	9.4%	1.7%
Ash (1-2-33-4)	% applying	0.0%	0.0%	2.9%	0.0%	0.0%	10.0%	0.0%	1.7%
	Kg^{-1} ha^{-1} $year^{-1}$ Users	-	-	137	-	-	1691.3	-	1302.8
Solid/Palm oil mill effluent (0-.1-1.1-.2)	% applying	3.3%	0.0%	5.9%	0.0%	0.0%	0.0%	0.0%	1.3%
	Kg^{-1} ha^{-1} $year^{-1}$ Users	6450	-	6200	-	-	-	-	6283.3
	Kg^{-1} ha^{-1} $year^{-1}$ Total	215.0		182.4					27.2
Rock Phosphate (0-15-0-0)	% applying	0.0%	0.0%	0.0%	0.0%	2.5%	3.3%	3.1%	1.3%
	Kg^{-1} ha^{-1} $year^{-1}$ Users	-	-	-	-	147	277	256	226.7
	Kg^{-1} ha^{-1} $year^{-1}$ Total					3.7	9.2	8.0	1.0
n		30	32	34	33	40	30	32	231

Appendix L: Expert assessment of plantation condition

All experts were asked to assess all available photos of plantations and provide their opinion on the level of implementation of Good Agricultural Practices in their plantation. *To little* indicates a clearly neglected plantation with the plantation subsequently being in poor condition, *reasonable* implies a plantation which clearly is managed but practices appear not yet optimal, whilst *good* implies the plantation appears well managed and Good Agricultural Practices appear standard. Results were as follows.

		Small Local Farmers	Medium sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium sized Migrant Farmers	Small & Medium sized Peat Farmers	Large Peat Investors
Academic	to little	5	7	8	2	7	7	2
	reasonable	19	18	17	23	29	18	20
	good	5	7	8	6	3	4	6
Farmer	to little	4	2	8	3	7	7	15
	reasonable	18	21	16	19	23	17	9
	good	7	9	9	9	9	5	4
CIRAD Expert	to little	2	3	5	3	3	5	7
	reasonable	22	26	23	23	32	22	19
	good	5	3	5	5	4	2	2

		Small Local Farmers	Medium sized Local Farmers	Large Resident Farmers	Small Migrant Farmers	Medium sized Migrant Farmers	Small & Medium sized Peat Farmers	Large Peat Investors
Academic	to little	17.2%	21.9%	24.2%	6.5%	17.9%	24.1%	7.1%
	reasonable	65.5%	56.3%	51.5%	74.2%	74.4%	62.1%	71.4%
	good	17.2%	21.9%	24.2%	19.4%	7.7%	13.8%	21.4%
Farmer	to little	13.8%	6.3%	24.2%	9.7%	17.9%	24.1%	53.6%
	reasonable	62.1%	65.6%	48.5%	61.3%	59.0%	58.6%	32.1%
	good	24.1%	28.1%	27.3%	29.0%	23.1%	17.2%	14.3%
CIRAD Expert	to little	6.9%	9.4%	15.2%	9.7%	7.7%	17.2%	25.0%
	reasonable	75.9%	81.3%	69.7%	74.2%	82.1%	75.9%	67.9%
	good	17.2%	9.4%	15.2%	16.1%	10.3%	6.9%	7.1%

Wilcoxon Signed Ranks Tests indicate no significant differences among expert assessments

Test Statistics

	Academic vs. CIRAD
Z	-.346[a]
Asymp. Sig. (2-tailed)	.729

a. Based on negative ranks

Test Statistics

	Farmer vs. CIRAD
Z	-.956[a]
Asymp. Sig. (2-tailed)	.339

a. Based on negative ranks

Test Statistics

	Farmer vs. Academic
Z	-.480[a]
Asymp. Sig. (2-tailed)	.631

a. Based on negative ranks

Appendix M: Regression analysis on bunch number, age and share tenera fruits on plantations

Model Summary

Peat	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
No	1	.384[a]	.147	.136	1.15528
Yes	1	.329[a]	.108	.075	1.44356

a. Predictors: (Constant), Share_Tenera, Age

ANOVA[b]

Peat	Model		Sum of Squares	df	Mean Square	F	Sig.
No	1	Regression	35.683	2	17.842	13.368	.000[a]
		Residual	206.872	155	1.335		
		Total	242.556	157			
Yes	1	Regression	13.432	2	6.716	3.223	.048[a]
		Residual	110.445	53	2.084		
		Total	123.877	55			

a. Predictors: (Constant), Share_Tenera, Age
b. Dependent Variable: Bunch Numbers (corrected)

Coefficients[a]

Peat	Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			B	Std. Error	Beta		
No	1	(Constant)	3.586	.248		14.446	.000
		Age	-.092	.022	-.308	-4.141	.000
		Share_Tenera	1.042	.361	.214	2.884	.004
Yes	1	(Constant)	3.879	.490		7.915	.000
		Age	-.097	.045	-.282	-2.165	.035
		Share_Tenera	.696	.612	.148	1.137	.261

a. Dependent Variable: Bunch Numbers (corrected)

Appendix N 2009 Ophir survey

1. Background of the research

The surveyor will explain:
- Objectives of the research
- How and why the respondent is chosen
- How the information will be used
- That the information will be analyzed without the name of the respondent and will not be used outside the survey
- The survey will take approximately one hour

2. Background of the Farmer

2.1 KPS of which you are a member (please choose one)

Sejahtera **Perintis** **Indah** **Maju** **Makmur**

2.2 Kelompok (Group) Number

2.3 Number of house

2.4 Sex Male Female

2.5 Year of birth year

3. History of the Farmer

3.1 What is your ethnicity? (Please choose one)

Husband	**Minang**	**Batak/Mandailing**	**Jawa**	**Other**
Wife	**Minang**	**Batak/Mandailing**	**Jawa**	**Other**

3.2 Are you first, second or third generation Ophir kapling holder?

First **Second** **Third**

3.3 When did you arrive in Ophir? year

3.4 What was your employment before you join in Ophir project? *(please choose one of the institutions below and mention your position)*

Institution	**Position**
ABRI	
PTPN 6 Employee	
Civil servant	
Farmer	
Trader	
Other_________________________	

3.5 Do you receive a pension from former employment? Yes No

3.6 If farmer, what kind of farmer were you before join in Ophir? *(choose one)*

Farmer without land ownership **Farmer with land ownership**

3.7 If farmer, what kind of plantation was it? (You can choose more than one)

Shifting land **Rice field farming** **Dry land farming** **Plantation farming**

3.8 Where are you originally from? (please choose one)

West Pasaman **West Sumatera** **Sumatera** **Other island**

3.9 from other island, what island? Name of island

3.10 If from West Pasaman, which Nagari? (please mention)

Kinali **Kapar** **other**

3.11 Did you grow up in the country side area or in the city? (choose one)

Country side **City**

4. The current condition of the farmer family

4.1 Do you permanently reside in the Ophir estate?

Yes No, if no, answer questions 4.2 and 4.3

4.2 How many months you live in Ophir?

.... months

4.3 How many times you visit Ophir in one year? times

4.4 Do you have another land beside kebun and home plot in Ophir?

Yes, please continue with question 3.5 **No, please continue with question 3.6**

4.5 Please mention the location, size of the plot and the crop

Province	Nagari (if SumBar)	size (ha)	crop	since

4.6 Information about the farmer's children

No.	Year of birth	sex (m/f)	Latest education (SD, SLTP, SLTA, PT)	Employment (if available)	The employment you expect towards the children	Are they still dependent to family? (Yes/No)
1						
2						
3						
4						

4.7 When did you repay the credit for your kapling?

Year……………………… Don't rememeber

4.8 Where is the land certificate held at this moment?

In the landowners house At the bank At the KUD Other ……….

5. Current labor management

5.1 How many days are required for the following activities and who is responsible for those activities?

activity	Units	Total	husband	wife	children	laborer	If you hire labour, since when?
Harvesting	days/…….						
Inter Row Weeding	days/……..						
Weeding							
Fertilizer application							
Pest and desease control							
Pruning							
Other							

5.2 What is your reason to hire labour? *(please choose one)*

Too old Have another activity Far from kebun Other…………….

5.3 Is the productivity of a kebun managed by labour less efficient than a kebun is managed by its owner?

Yes No

5.4 If yes, do you know why? (you can choose more than one from the following options)

The laborer is not disciplined Work is not done in line with the standard guideline Doesn't follow the rules/ regulations Other………………

5.5 From whom do the labourers acquire their training?

By KUD By ketua kelompok By landowner Already trained somewhere else No training needed for activities

5.6 Does increased hired labor reduce solidarity amongst landowners?

Ya Tidak

5.7 Do you consider the homeplot to be important?

Yes, from my commercial farming I earn about (indicate ……………………IDR/ …… Yes, I grow a considerable amount of food for home consumption. No, I don't use the homeplot No, only small scale hobby farming

6. The services provided by institutions

6.1 What are the roles and responsibilities of actors concerning the following activities: Please indicate if you think these are done in a good manner (+), or whether it needs improvement (-).

	farmer	Kelompok	KUD	KJUB	PTPN 6	Other………
Replanting						
Fertilizer application						
Kebun maintenance						
Harvesting standard						
Financial issues						
Road maintenance						
Pest and desease control						
Training						

K = policy, B = supervision, M = control/monitoring, +/-

6.2 Does KUD (KPS) provide a regular training? Should be; Did you receive any trainings concerning plantation activities (including administration etc.) in the last year?

Yes **No (continue with question 6.4)**

6.3 If yes, could you mention what training you received in the last one year?

Subject Training	Duration training (hours or days)	Who provided the training

6.4 What position have you ever held in kelompok or KJUB/KUD?

Position	Year	Institution

6.5 Are there regular meetings amongst the members of kelompok?

Yes, (indicate timeframe) 1/ ……………… **Yes, irregular** **No**

If yes, how many times in percentage do you attend the meeting?

0 **25%** **50%** **75%** **100%**

6.7 If no, give your reason *(choose one)*

Live far from kebun **Have no time** **Not important** **There are no important decisions taken in the meeting**

6.8 In your opinion, what services should KUD provide in the future?

6.9 In your opinion, which KUD provides the best service in Ophir?

Perintis **Sejahtera** **Indah** **Maju** **Makmur**

6.10 Could you explain briefly the reason why this KUD is the best one? If too little space, write on back of paper.

6.11 In your opinion, does the system in Kelompok and KUD give a chance for you in term of Ophir project development?

no **Little** **Not so often** **much**

6.12 Do you use herbicide for weeding?

Yes **No**

6.13 If yes, what kind of herbicide do you use? (mention)

1 **2** **3** **4**

6.14 Do you use pesticide for pest and disease control?

Yes **No**

6.15 If yes, what kind of pesticide do you use? (mention)

1 **2** **3** **4**

6.16 Do you use any fertilizer?

Yes **No**

6.17 If yes, what kind of fertilizer and how much is the concentrate?

	Urea	RP	SP36	Kcl	Kieserite	Dolomite	Borate
Quantity (sacks/ year)							

6.21 Do you get any training about how to apply herbicide, pesticide and fertilizer?

Yes **No**

6.22 Do you know the current price of Fresh Fruit Bunches?

Yes, IDR_______/kg **No**

6.20 Do you still remember how many kilos of Fresh Fruit Bunches can you get from the last month harvesting in Ophir?

Yes, IDR_______/kg **No**

6.21 If no, do you know where to get the information about it?

……………………………………………………………………………………………………

6.22 Do you get any technical guideline about kebun maintenance?

Yes **No**

6.23 If yes, which institution provides the information? *(you can choose more than one)*

Kelompok **KUD** **KJUB** **Disbun** **PTPN VI** **Other sources____________**

7. Inheritance (AND REPLANTING)

7.1 When you decide to hand over your kebun in Ophir, who will become the next holder of the land-certificate?

wife **children** **relatives** **other**

7.2 Can you explain to me the regulations concerning sale of plot? (let farmer speak and check in the end if mentioned.) DO NOT PROPOSE THESE IDEAS!!!! (ADAPT AND INCLUDE MORE REGULATIONS).

Regulations	Y	N
One farmer can have one kapling only		
The first priority of kapling selling is given to the members of kelompok.		
If there is any outsider who wants to buy the land, thus he/she must get approval from majority of kelompok member.		
Kebun and home plot can be sold at the same time or separately		

7.3 If the member of kelompok lives outside Ophir, who will be responsible to manage the plantation? (let farmer speak and check in the end if mentioned.) DO NOT PROPOSE THESE IDEAS!!!!

Regulations	y	n
Kelompok leader manages harvesting and kebun maintenance		
The cost of the above activities is the responsibility of the farmer		
The operational cost is taken from the farmer's profit		

7.4 Do you think it is time to replant your kapling? (indicate why)

Yes, as ……………………………………………..	No, as ……………………………………………

7.5 If so have you been given any clear idea of options to carry out replanting?

Yes, by (list answers by farmers) ………………………………………………………………..	No

8. Income

8.1 How many members of your kelompok reside outside Ophir and their lands are managed by the leader of kelompok? …………………………………………members

8.2 What are your families four major sources of income?

Sources	Ophir's oil plantation	Ophir's home plot	Other farm	Non-farm
percentage				
IDR/ month				

8.3 What are your families main sources of non-farm income? Include remittances from family members)

8.4 Do you have multiple plots of oil palm plantation within Ophir or at another location?

No	Yes, multiple plots in Ophir	Yes, plots outside Ophir

9 . Strengths, Weakness, Opportunity, Threats

In your opinion, what are the strengths of the Ophir plantation?

In your opinion, what are the weaknesses of the Ophir plantation?

In your opinion, what are the opportunities for the Ophir plantation?

In your opinion, what are the threats to the Ophir plantation?

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Summary

Since the last global agro-commodity price hike, in 2007/8, interest in smallholder farming and partnerships between companies and smallholders has undergone a resurgence. Literature highlights the potential advantages of smallholder agriculture over company plantations and the former's importance for rural development, but also questions the extent to which the advantages associated with smallholder agriculture are still relevant. Processes of globalization have generated new opportunities for smallholders to participate in profitable global agro-commodity markets. This participation, however, is increasingly being influenced by differentiated capabilities to comply with emerging public and private production and quality standards. The question how smallholders can participate in, benefit from and contribute to sustainable production systems and modern value chains is the primary topic of this dissertation, and the Indonesian smallholder oil palm sector serves as the case to investigate this.

The dynamics within Indonesia's oil palm sector exemplify the types of challenges smallholders face in their integration into global agro-commodity chains and the challenges associated with sustainability concerns. Although the smallholder oil palm sector in Indonesia commenced only in the late 1970s, it now accounts for roughly half of the 12 million hectares of oil palm in Indonesia. Whereas the first oil palm smallholders were tied to plantations and participated in clearly delineated partnerships with companies, smallholder expansion primarily took place through endogenous smallholders, who are often referred to as independent smallholders. The smallholder sector, especially the independent smallholder sub-sector, is often associated with poor performance and faces the most difficulties in addressing the compliance barriers associated with modern value chains. As many governments, companies and consumers are attempting to clean up the value chain through self-regulatory commitments, certification and public regulation, it is clear that smallholders are in a vulnerable position and require considerable assistance in improving their practices.

However, failure to properly account for the heterogeneity of the smallholder oil palm sector is undermining the effectiveness and scalability of smallholder support. The first empirical chapter of this dissertation develops a typology of seven types of independent smallholder oil palm farmers encountered in Rokan Hulu regency, Riau province, ranging from small local farmers to large farmers who mostly live in urban areas far from their plantations and regard oil palm cultivation as an investment opportunity. The research area consisted of a relatively established agricultural area on mineral soils and a relatively new frontier area, mostly on peat. The chapter reveals the wide diversity of actors that compose the black box of 'independent oil palm smallholders', the types of compliance barriers they face and the challenges these smallholders pose to those trying to improve sector performance. The chapter primarily focusses on socioeconomic, marketing and legal issues. It illustrates how global agro-commodity chains can drive agrarian differentiation and offers new insights into the complex dynamics of agricultural frontier expansion.

Due to the weight given to the implementation of good agricultural practices (GAP) in leading national and international sustainability initiatives, the second empirical chapter delves into the implementation of GAP by the seven farmer types. The underlying hypothesis is that larger farmers have more capital and therefore implement better agricultural practices than small farmers, who are usually more cash constrained. A wide range of methods were applied, including farmer and farm surveys, remote sensing, tissue analysis and photo interpretation by experts. These methods provided data on fertilizer use, nutrient conditions in oil palms, planting materials, planting patterns and other management practices implemented in the plantations. The results show that

yields are poor and the implementation of GAP is limited among all farmer types. Although poor planting materials, square planting patterns and limited nutrient applications were particularly prevalent among small smallholders, among the other smallholder types there is also considerable room for improvement. This implies that farmers across different typologies opt for a low-input, low-output system for a myriad of reasons and that under current conditions, initiatives such as improving access to finance or good planting material alone are unlikely to significantly improve the productivity and sustainability of the smallholder oil palm sector.

The chapters on independent smallholders confirm the image of Indonesian oil palm smallholders as poorly implementing good agricultural practices, and present a wide range of measures that could lead to improving their production systems. In Chapter 4 the focus shifts to the organized smallholders and provides an example that demonstrates that smallholders do not per definition maintain low-input, low-output systems. The Ophir smallholder oil palm production system in West Pasaman, West Sumatra province, outperformed its nucleus estate plantation consistently and produced yields far above the national smallholder or company average for over 25 years. Its institutional setup allowed farmers to combine the advantages of smallholder and plantation agriculture by capitalizing on collective action. Collective action design principles (Ostrom, 1990; Cox, 2010) are used to analyse the institutional setup of a smallholder production system. This case study demonstrates that with a strong institutional setup, smallholder oil palm farmers can participate in supply chains on advantageous conditions and maintain intensive production for a prolonged period, and thereby contribute to both rural development and land sparing. Leading private and public sustainability initiatives oblige farmers to organize in collectives as a precondition for certification and assistance, and indeed the Ophir case appears to confirm the benefits of smallholder organization. It is clear, however, that this does not happen by chance and that considerable investments are needed to achieve properly functioning farmer groups.

The last empirical chapter stays with the smallholder oil palm plantation in Ophir but it includes the replanting event at the end of the first cycle of oil palm cultivation and takes a different perspective. Although it does not in any way negate the achievements of the Ophir smallholders, a more dynamic approach is taken to analyse why and how at the end of the first cycle, collective action appears to have come to a grinding halt in parts of the collective plantation. The chapter borrows from actor-network theory and provides three constellations of actants to describe nearly 40 years of collective action and the internal and external dynamics impacting the smallholder collective. These constellations highlight a shift from tied smallholders to a partnership, and eventually independence from their nucleus estate. However, it also illustrates the shift from an organized smallholder model towards partially independent oil palm cultivation, a trend that runs counter to the objectives of leading sustainable governance initiatives, which oblige farmers to participate in farmer organizations. The chapter highlights that smallholders are moving targets, that smallholder governance needs to acknowledge local dynamics and that if smallholder organization is a desired tool for sector upgrading, not only do considerable investments need to be made to establish worthwhile farmers organizations, but also the maintenance of such organizations must be supported.

The concluding chapter synthesizes the main findings from the empirical chapters. By this stage of the dissertation it is clear that the independent smallholder oil palm sector is characterized by the lack of partnerships between companies, smallholders or the governments at different levels. This absence of inclusive business (IB) models in a more narrow definition, and the absence of private or public sector support, has not inhibited a voracious growth of the smallholder sector.

Although this growth has been inclusive of many parts of society, it has been neither equal nor environmentally sustainable. The reasons for the popularity of oil palm among smallholders include the availability of cheap land, limited labour requirements and a reasonable price compared to other crops. Although conditions differ per location, general conditions appear only limitedly conducive to the current intensification narrative and will remain so, unless sector governance is able to align considerable resources (both financial and managerial) to push this narrative.

IBs are often biased towards company control over farmers' assets, whilst many farmers value their autonomy. Nevertheless, successful IBs do exist and they should not per definition be deemed unsuitable. Further research on how independent farmers can link up with companies therefore remains highly relevant. However, other strategies through which smallholders can be supported are proposed in this dissertation. It remains to be seen what the future will bring for smallholders and how networks competing for resources will align. Urban developments clearly compete with farming and rural developments, and it is only fair to make well-informed trade-offs. This dissertation shows that smallholder diversity needs to be acknowledged for proper smallholder governance, that the different environments and conditions need to be acknowledged, and that although smallholder organizations may play an important role in sector governance, their development and maintenance require considerable investments. However minimal – and acknowledging the uncertainty about how actants will align in the future – the findings presented in this dissertation make several contributions to the debate on the future of smallholder farmers and the sustainability of their production.

Samenvatting

Sinds de laatste wereldwijde prijsstijging van landbouwproducten, in 2007/8, is de belangstelling voor kleinschalige boeren en partnerschappen tussen bedrijven en kleine boeren weer toegenomen. In de literatuur wordt vaak gewezen op de potentiële voordelen van kleinschalige landbouw ten opzichte van grootschalige plantages en de belangrijke rol die kleine boeren hebben in de ontwikkeling van rurale gebieden. Centraal in het huidige debat staat echter ook de vraag in hoeverre de voordelen van kleinschalige boeren nog relevant zijn. Globalisering heeft voor vele kleine boeren nieuwe kansen gecreëerd om deel te nemen aan lucratieve waardeketens. Deze deelname wordt echter in toenemende mate beïnvloed door gedifferentieerde mogelijkheden om te voldoen aan steeds belangrijker wordende productie- en kwaliteitseisen. De vraag hoe kleine boeren kunnen deelnemen in, profiteren van en kunnen bijdragen aan duurzame en moderne waardeketens is het onderwerp van dit proefschrift. De Indonesische palmoliesector dient als casus om deze processen verder te onderzoeken.

De Indonesische oliepalmsector is een voorbeeld van het soort uitdagingen en de dynamiek waarmee kleine boeren worden geconfronteerd bij hun integratie in de wereldwijde landbouwwaardeketens en de toenemende duurzaamheidseisen. Hoewel kleinschalige oliepalmboeren pas eind jaren zeventig hun intrede deden in de Indonesische oliepalmsector, beslaat deze groep nu ongeveer de helft van de 12 miljoen hectare oliepalm in Indonesië. De eerste kleinschalige boeren waren verbonden aan grootschalige plantages en namen deel aan duidelijk afgebakende samenwerkingsverbanden met deze, in eerste instantie, staatsbedrijven. De voornaamste expansie van kleinschalige oliepalmboeren vond echter plaats via endogene plantage ontwikkeling. Deze boeren kregen geen directe steun van bedrijven of overheid en worden daarom vaak aangeduid als onafhankelijke kleine boeren. Deze kleinschalige oliepalmboeren, met name de onafhankelijke, worden vaak geassocieerd met beperkte prestaties en kunnen moeilijk voldoen aan de eisen die moderne waardeketens stellen. Omdat overheden, bedrijven en consumenten proberen de waardeketen te verbeteren door middel van zelfregulering door bedrijven, overheidsregulering en certificering, is het duidelijk dat kleine producenten in een kwetsbare positie verkeren, risico lopen van aantrekkelijke markten afgesloten te worden en ondersteund dienen te worden bij het verduurzamen van hun praktijken.

Het feit dat er onvoldoende rekening wordt gehouden met de heterogeniteit van kleine boeren ondermijnt echter de doeltreffendheid en schaalbaarheid van de steun voor deze actoren. Daarom wordt in het eerste empirische hoofdstuk van dit proefschrift een typologie ontwikkelt om de heterogeniteit onder kleine producenten weer te geven. De typologie identificeert en kwantificeert zeven typen onafhankelijke kleinschalige oliepalmboeren in het regentschap Rokan Hulu, provincie Riau. Deze typen variëren van kleine lokale boeren tot grote boeren die meestal in stedelijke gebieden ver van hun plantages wonen en de oliepalmteelt als een investeringsmogelijkheid beschouwen. Het onderzoeksgebied in Rokan Hulu bestaat uit twee verschillende landschappen, een relatief gevestigd landbouwgebied op minerale bodems en een relatief recent ontgonnen gebied, voornamelijk op veenbodems. Het hoofdstuk richt zich voornamelijk op sociaaleconomische, marketing- en juridische kwesties. Door de diversiteit onder kleinschalige boeren expliciet te maken kan gerichtere ondersteuning geboden worden voor het verduurzamen van kleinschalige oliepalmproductiesystemen. De typologie geeft verder aan hoe wereldwijde landbouwwaardeketens agrarische differentiatie beïnvloeden en biedt nieuwe inzichten aangaande de complexe dynamiek met betrekking tot oliepalm expansie in ecologisch kwetsbare gebieden.

Aangezien nationale en internationale duurzaamheidsinitiatieven veel waarde hechten aan de implementatie van goede landbouwpraktijken, wordt in het tweede empirische hoofdstuk ingegaan op de implementatie van deze praktijken door de zeven typen boeren. De onderliggende hypothese is dat relatief grotere boeren meer kapitaal hebben en daardoor betere landbouwpraktijken kunnen toepassen dan kleinere boeren. Voor dit hoofdstuk werd een breed scala aan onderzoeksmethoden toegepast, waaronder enquêtes, blad en rachis analyse, remote sensing en foto-interpretatie door deskundigen. Deze methoden leverden gegevens op over het gebruik van meststoffen, de nutriëntenstatus van de palmen, het gebruikte plantmateriaal, de plantpatronen en andere landbouwpraktijken die in de plantages toegepast worden. De resultaten geven aan dat de implementatie van goede landbouwpraktijken onder kleine producenten laag is, de opbrengsten beperkt zijn en dat dit voor alle typen boeren geldt. Slecht plantmateriaal, vierkante en dus suboptimale plantpatronen en beperkte bemesting komen veel voor onder alle typen kleinschalige boeren producenten. Dit suggereert dat gebrek aan kapitaal slechts één van de redenen is voor de wijdverbreide implementatie van low-input low-output productiesystemen. Het lijkt er dan ook op dat onder de huidige omstandigheden initiatieven die het verbeteren van alleen de toegang tot financiering of goed plantmateriaal centraal stellen niet genoeg zullen zijn om productiviteit en duurzaamheid van de kleinschalige oliepalmboeren substantieel te verbeteren.

De hoofdstukken over onafhankelijke kleine oliepalmboeren bevestigen het imago van oliepalmboeren als inefficiënte producenten, maar bevatten een breed scala aan maatregelen die bij kunnen dragen aan verbetering van hun productiesystemen. In hoofdstuk vier verschuift de aandacht van de onafhankelijke boeren naar de georganiseerde boeren. Dit hoofdstuk laat zien dat kleinschalige boeren niet per definitie een low-input low-output system implementeren. De georganiseerde boeren in Ophir, regentschap West Pasaman in de provincie West-Sumatra, hebben meer dan 25 jaar hogere oogsten behaald dan de naastgelegen grootschalige plantage waarmee ze een samenwerkingsverband hadden. Opbrengsten lagen ver boven het nationale gemiddelde voor boeren of grootschalige plantages. De institutionele set-up van de boerenorganisatie stelde hen in staat om, door middel van collectieve actie, zowel van de voordelen van kleinschalige als grootschalige landbouw te profiteren. De principes voor collectieve actie zoals beschreven door Ostrom (1990) worden gebruikt om de institutionele opzet van de Ophir boerenplantage te analyseren. Deze casus toont aan dat met een sterke institutionele setup kleinschalige boeren onder gunstige omstandigheden en over langere periodes deel kunnen nemen aan de intensive productieketens en daarmee bij kunnen dragen aan zowel plattelandsontwikkeling als andbesparing. Toonaangevende duurzaamheidsinitiatieven verplichten boeren om zich te organiseren als voorwaarde voor certificering en steun. De Ophir casus lijkt de voordelen van organisatie van boeren te bevestigen. De casus geeft echter ook duidelijk aan dat er aanzienlijke investeringen nodig zijn om goed functionerende boerengroepen te realiseren.

In het laatste empirische hoofdstuk wordt nogmaals op de Ophir casus ingegaan. De casus omvat nu echter ook de cruciale fase omtrent herbeplanting en wordt bovendien vanuit een ander perspectief geanalyseerd. De sterke prestaties van de Ophir boeren worden zeker niet gebagatelliseerd. Echter, in dit hoofdstuk wordt een Actor-Network Theory benadering gebruikt om de interne en externe dynamiek rond de Ophir plantage te traceren en daarmee te verklaren waarom en hoe aan het einde van de eerste levenscyclus van oliepalmen collectieve actie in delen van de plantage tot stilstand komt. Om bijna 40 jaar boerenorganisatie weer te geven worden drie constellaties van de actanten relevant voor de Ophir plantage gepresenteerd. Deze constellaties laten de verschuiving zien van grote afhankelijkheid van het bedrijf waarmee een samenwerkingsverband was aangegaan tijdens het opzetten van de plantage, naar een gelijkwaardiger partnerschap en uiteindelijke complete zelfstandigheid. Deze transitie illustreert echter ook de verschuiving van een strak georganiseerd model naar het uiteenvallen van boeren organisaties en daarmee een verschuiving richting het onafhankelijke productie model. Deze trend gaat lijnrecht in tegen de doelstellingen van toonaangevende duurzaamheidsinitiatieven en geeft de complexiteit omtrent het opzetten en behouden van functionerende boerenorganisaties weer. Dit hoofdstuk laat zien dat zowel kleine boeren, als hun organisaties en de omgeving waarin zij opereren constant in beweging zijn en hun samenwerkingsverbanden evalueren. Deze dynamiek moet worden erkend wanneer boerenorganisatie een gewenst instrument is voor participatie in duurzame waardeketens. Er zijn dus niet alleen aanzienlijke investeringen nodig om functionerende boerenorganisaties op te richten, maar ook om condities te creeeren waarin deze organisaties op langere termijn kunnen worden ondersteund.

De conclusie synthetiseert de belangrijkste bevindingen uit de empirische hoofdstukken. Het is inmiddels duidelijk dat de onafhankelijke kleinschalige palmoliesector gekenmerkt wordt door een gebrek aan actieve samenwerking tussen bedrijven, kleine boeren en overheden. Het ontbreken van bedrijfsmodellen gericht op inclusiviteit en ondersteuning van kleinschalige producenten en het ontbreken van steun van de publieke sector heeft de sterke expansie van oliepalmboeren echter niet belemmerd. Hoewel deze groei veel lagen van de samenleving omvatte en voordelen voor velen bracht, waren deze noch gelijk, noch vanuit milieuoogpunt duurzaam. De redenen voor de populariteit van oliepalm bij de kleine boeren zijn onder meer de beschikbaarheid van goedkoop land, de beperkte arbeidsbehoefte en een redelijke prijs in vergelijking met andere gewassen. Hoewel condities per locatie verschillen, lijken de algemene huidige condities slechts in beperkte mate bevorderlijk voor verduurzaming van productie systemen zoals uitgedragen door zowel private als publieke duurzaamheidsinitiatieven. Tenzij zowel publiek als private partijen in staat zijn om aanzienlijke (financiële en bestuurlijke) middelen vrij te maken om hun duurzaamheidsbetoog te stimuleren en functionerende allianties te vormen, lijkt de intensivering en verduurzaming van de kleinschalige oliepalm sector een moeilijke opgave.

Inclusieve bedrijfsvoeringsmodellen leiden vaak tot intensivering van bedrijfscontrole over de bezittingen van boeren en beperking van hun autonomie. Toch bestaan er succesvolle inclusieve bedrijfsvoeringsmodellen, ook in de Indonesische oliepalmsector en moet inclusieve bedrijfsvoeringmodellen niet per definitie als onwenselijk beschouwd worden. Verder onderzoek naar samenwerkingsverbanden tussen boeren en bedrijven blijft dan ook zeer relevant. In dit proefschrift worden echter ook andere strategieën voorgesteld om kleine boeren te ondersteunen. Het valt echter te bezien wat de toekomst voor de kleine boeren zal brengen, hoe sterk en streng de allianties omtrent duurzaamheid zijn en hoe concurrerende actor-netwerken, als stedelijke ontwikkelingen maar ook markten die minder duurzaam zijn, zich doen gelden.

Dit proefschrift toont echter aan dat voor beleidsbepaling, diversiteit onder kleine boeren erkend dient te worden, net als het belang van specifieke omgeving en condities. Hoewel boerenorganisaties een belangrijke rol kunnen spelen in het verduurzamen van productie, vereist de ontwikkeling en onderhoud hiervan aanzienlijke investeringen. Het blijft onduidelijk wie deze investeringen wil of kan maken. Hoe beperkt de bevindingen ook zijn - en hoezeer de onzekerheid over de wijze waarop de actanten zich in de toekomst gaan gedragen erkend wordt - met deze bevindingen heeft dit proefschrift een bijdrage geleverd aan het debat over de toekomst van de kleine boeren en het verduurzamen van hun productie.

Curriculum Vitae

Idsert Jelsma (ijelsma@gmail.com) was born in The Hague, The Netherlands, on 23 November 1979. After growing up mainly in Drenthe and a few years in Saudi Arabia, Idsert completed a Bachelor of Education at the Hogeschool van Arnhem en Nijmegen and briefly worked as a geography teacher at a high school. Enjoying the geography more than teaching high school students, he continued his studies at Wageningen University and followed a masters programme International Development Studies, with a specialisation in Environmental Policy. For his MSc. thesis and internship Idsert went to Laos and studied Jatropha Curcas developments, a bio-fuel crop which never really took off. After completing his MSc. in 2008 he continued following a course at the Plant Production Systems group at the WUR to improve his understanding on the production of bio-fuel crops. After this course he was involved in several projects at Wageningen University & Research. These projects were on smallholder oil palm developments in Indonesia, soybean developments in Latin America and smallholder involvement in sugarcane outgrower schemes in Mozambique.

In 2011 Idsert moved to the private sector and left for Ethiopia, where he was involved in setting up a smallholder bamboo supply chain at African Bamboo. After a year he went to South Africa for a few months and learned to paraglide. When returning to The Netherlands in 2013 he applied for a sandwich PhD. position at Utrecht University and the Centre for International Forestry Research (CIFOR), got the position and commenced activities soon afterwards. In August 2013 Idsert left for Indonesia and was hosted at the wonderful CIFOR campus in Bogor for 4.5 years. Initially working under the Large-Scale Investments in Food, Fibre and Energy (LIFFE) project and later the Oil Palm Adaptive Landscapes (OPAL) project, he worked on his dissertation which focussed on the massive involvement of smallholders in the oil palm value chain. Idsert has extensively visited oil palm landscapes in Sumatra and Kalimantan and whereas fluent in Dutch and English, he also considerably improved his Bahasa Indonesia skills during fieldwork.

In search of sustainable and inclusive palm oil production:

The role of smallholders in Indonesia

This dissertation builds on the old debate regarding the role of smallholder farmers in society and links it to the integration of smallholders into modern global value chains. Since the peak in global agro-commodity prices in 2007/08, interest in agriculture has increased again among policymakers and in the private sector. Modern global value chains provide opportunities for smallholder farmers but also increasingly dictate conditions in terms of production practices, and thereby determine conditions for inclusion.

The Indonesian oil palm sector provides an interesting case regarding smallholder inclusion in modern global value chains and the role they play in sustainable agro-commodity production. Palm oil production in Indonesia has thrived due to insertion in global value chains, experienced massive smallholder engagement, faces considerable sustainability challenges and illustrates the impacts sustainability initiatives can have on smallholders. It thus provides a promising case to further explore the nexus of sustainable and inclusive development, smallholder agriculture and policy.

The primary aim of this dissertation is to advance the understanding of how the oil palm sector can be made more sustainable and inclusive. It does so by exploring independent and organized oil palm smallholders in Sumatra, explaining their emergence and performance, and discussing strategies to improve their performance. Whereas the smallholder oil palm sector clearly has its unique characteristics, this dissertation unpicks some stereotypical views on smallholders and highlights the dynamics impacting farmers' organizations over time, and thereby contributes to debates on the future of farming.

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