



Costs and benefits of RSPO certification for independent smallholders

A science-for-policy paper for the RSPO

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Key messages

1. **Upfront costs of certification** of three groups of independent smallholders in Indonesia and Malaysia were **87, 114 and 215 EUR ha⁻¹**. For independent smallholders in Indonesia, these costs were estimated to be **equivalent to 5% and 14% of mean annual revenue from oil palm**.
2. **Recurrent costs at cooperative level were** estimated to range from **21 to 65 EUR farmer⁻¹** for groups of 200-400 farmers, and were dependent on group size. These costs include an annual RSPO fee and surveillance audit, but exclude costs for group management.
3. **Operational costs at smallholder level** (agricultural inputs, labour and fees) increased by **329 EUR ha⁻¹ year⁻¹** for one group of independent smallholders in Indonesia, equivalent to **20% of mean annual revenue** and 27% of net income from oil palm. In two other cases recurrent costs were estimated to increase much less (+86 EUR ha⁻¹ year⁻¹) or decrease (-34 EUR ha⁻¹ year⁻¹).
4. The **evidence** on **increased profitability** in the first year after certification is **inconclusive**.
5. **GreenPalm premiums** are very **small**: only **1-4%** of CPO prices. This would sometimes but not always be sufficient to cover recurrent costs.
6. There is **limited evidence** that certification of independent smallholders **increases yield**. This may be due to a lag time in realising benefits from improved agricultural practices and limited data availability.
7. Certification of independent smallholders **changes market relations**, and seems to increase access to training and technical support and access to agricultural inputs and finance. However, **the effects** of these changes **are not yet quantified**.
8. **Good agricultural management practices** are shown to **increase yields by 12-30%**, and are predicted to increase income. Improving the uptake of good agricultural practices seems to be **the most promising area** for **increasing the impact** of RSPO certification on **smallholders' livelihoods**.
9. This is a **preliminary study** as **little systematic investigations** of benefits of RSPO certification for smallholders have been conducted. There is a need for **sound baseline data** and **comparison with reference groups** for diverse groups of farmers in various contexts.

Scope of the report

The aim of this paper is to provide an assessment of the monetary costs and benefits of smallholder RSPO certification, based on available data sources. In particular, we are interested to understand the upfront costs needed to prepare smallholders for certification, and the recurring costs and benefits of certification. Explicit attention is paid to possibilities of yield improvement and good agricultural management for independent smallholders, and the costs and benefits of those.

In this paper, the RSPO-definitions of smallholders, scheme smallholders and independent smallholders are used (Box 1). Independent smallholders are not bound to a particular mill and free to choose how to manage their land. Scheme smallholders, in contrast, are bound to a particular mill by contract, credit agreement or planning. Scheme smallholders' crop management is often supervised by the mill. This paper focuses on the costs and benefits of independent smallholders in particular.

Analysis of costs and benefits primarily focuses on costs and benefits for smallholders: at the group level and at the individual level. Also, attention is given to the financiers of smallholder certification programs: who bears the costs? Analysis of costs and benefits further along the supply chain is beyond the scope of this paper.

We distinguish between costs at farm level (implementation of practices)

BOX 1. RSPO DEFINITIONS OF SMALLHOLDERS, SCHEME SMALLHOLDERS AND INDEPENDENT SMALLHOLDERS [2, 3]

Smallholders: “Farmers growing oil palm, sometimes along with subsistence production of other crops, where the family provides the majority of labour and the farm provides the principle source of income, and where the planted area of oil palm is usually below 50 hectares in size.”

Scheme smallholders: “...while also very diverse, are characterized as smallholders who are structurally bound by contract, by a credit agreement or by planning to a particular mill. Scheme smallholders are often not free to choose which crop they develop, are supervised in their planting and crop management techniques, and are often organized, supervised or directly managed by the managers of the mill, estate or scheme to which they are structurally linked.”

Independent smallholders: “... while very varied in their situations are characterized by their: freedom to choose how to use their lands, which crops to plant and how to manage them; being self-organized, self-managed and self-financed; and by not being contractually bound to any particular mill or any particular association. They may, however, receive support or extension services from government agencies”

and costs at group level, and between upfront investments and recurrent costs (as did [10]). Where possible, effects of certification on yield, price, and income are quantified. Changes in market relations, access to trainings and inputs are described in a qualitative way. This study focuses primarily on monetary costs and benefits of certification. Other possible benefits, such as reduced deforestation, soil, water and biodiversity conservation and improved health are not included in this study.

This research focuses primarily on Malaysia and Indonesia, as they account for 80% of global oil palm production. However, reference to cases from Ghana, Ecuador and Thailand is made to highlight the importance of contextual factors and give an indication about the validity of the results in other countries.

Understanding the barriers to smallholder certification is crucial for increasing the number of smallholders that are RSPO certified. This question will be addressed in a separate science for policy paper.

Methods

This is a preliminary study, based on secondary data and literature review. Information is provided about certification of smallholders in eight locations (Appendix I). These cases are numbered and referred to by number throughout the report. “Case” or “case study” refers to the (mean) results for a group of farmers, not to individual farmers.

Data on case #1 was collected in the framework of a PhD-thesis. This data consisted of 20 interviews to collect information about upfront costs of certification; of 102 independent smallholder surveys to collect information about agricultural management practices and associated costs prior to and after certification; and of sales and price data provided by the cooperative. For four other certification projects (case #2, #3, #7 and #8) an NGO provided information about monetary costs and benefits of certification, separated into upfront and recurrent costs and costs at farm and at group level. This information was provided by the NGO and by partner organisations implementing certification projects. Another NGO provided information about two Malaysian cases (case #4 and #5). This included information about smallholders’ sales prior to and after certification based on mills’ data and farmers’ records of fertilizer and pesticide use. Information about case #6 was obtained from [12, 13].

Monetary benefits for smallholders from GreenPalm premiums were estimated, using data about GreenPalm premiums for scheme smallholders from the GreenPalm website and estimations of GreenPalm premiums by experts. In the literature review,

four relevant studies [12, 14-16] about the monetary costs and/or benefits of RSPO certification on smallholders were found. To obtain insight in current agricultural practices of smallholders and the agronomic and monetary potential of adoption of best management practices, eight relevant empirical studies [1, 6-9, 11, 18, 19] and two-ex ante analyses based on model calculations [8, 20] were included. A detailed overview of data collection and a description of case study data can be found in Appendix 2.

All Tables, except Table 1, 2 and 3 are shown in Appendix 3. To enhance comparison between cases, all monetary costs and benefits were calculated to euro using the following exchange rates: 14,778 IDR, 4.5 MYR, 39.0 baht and 1.1 USD are all equivalent to 1 EUR (exchange rates for March 2016).



People weighing bunches and recording yield in the field.

Rationale

Globally, there are 3 million oil palm smallholders who contribute 40% of global oil palm production [6, 21]. Access to RSPO certification for those smallholders is important for two main reasons: first, it may enhance the sustainability of their production system, and second, it may be a prerequisite for market access if RSPO certified oil palm will become the norm.

A WWF publication [14] describes the costs and benefits of RSPO certification, based on interviews with eight oil palm producing companies from Indonesia and Malaysia. They conclude that “business benefits gained from adopting the RSPO Principles and Criteria typically outweigh the costs of implementation (...) often through unexpected and indirect channels”. However, this study primarily investigated costs and benefits for plantations, including the costs and benefits (for plantations) of certification of scheme smallholders. Furthermore, the study did not pay much attention to certification of independent smallholders.

Only 14% of all RSPO certified production area is managed by smallholders, and they account for 11% of total RSPO certified palm oil production [22]. Certification of independent smallholders is lagging behind certification of scheme smallholders: in September 2015, 127 202 scheme smallholders were certified, and only 1 951 independent smallholders [22]. Certification of scheme smallholders is less challenging: scheme smallholders mostly are already organized e.g. in farmers' cooperatives, and more often already receive some sort of support (in terms of input provision and training on best management practices), and the mill they are connected to can provide guidance in terms of management. Moreover, RSPO members are obliged to work towards certification of their supply base, including scheme smallholders.

Initial costs of certification are perceived as a bottleneck to smallholder certification, and it is generally acknowledged that smallholders need support in order to become certified, both in terms of capacity building and finance [1, 11, 23]. RSPO recognises the need for financial support, and developed to the RSPO smallholder support fund. This fund, with a budget of EUR 2 045 455 for 2015/2016, aims to support smallholders in the process of certification. An accurate estimation of the costs of preparing smallholders for certification is needed to better estimate costs of certifying larger numbers of smallholders, and can feed in to discussions about where the costs and benefits of RSPO certification accrue.

Based on the findings of four studies from three countries [12, 14-16], smallholders are motivated to join RSPO certification for economic reasons, rather than improving

sustainability per se. These reasons include the prospects of better market relations, a premium price, yield improvement, and access to agricultural knowledge.

In all cases, certification projects were initiated by development organizations or companies, and not by the smallholders themselves. In the absence of apparent direct benefits, convincing farmers to participate in certification proved challenging [12]. RSPO certification of smallholders aims to “support smallholders to improve their livelihoods” [24] of which household expenses and income from oil palm form an integral part. Thus, an accurate analysis of costs and benefits of smallholder RSPO certification is imperative.

At smallholder level, adoption of appropriate best management practices is one of the key criteria of RSPO certification, and a criterion that directly affects farm operational management, and, potentially, yield and farmers’ income. Therefore, we are interested in understanding the costs and benefits of appropriate best management practices and pay explicit attention to it.

Market access, access to technical assistance, finance and agricultural inputs (notably fertilizer) are among the key constraints for enhancing smallholder productivity [8]. Certification could potentially help fill this gap. We describe what is known about effects of certification of independent smallholders on those factors in a qualitative way.

To date little material about the costs and benefits of smallholders’ RSPO certification, including the uptake of best management practices, is available. Therefore, this paper aims to answer the following questions:

1. What are the upfront costs of certification for independent smallholders?
2. What are the recurrent annual costs of certification at smallholder group level and at individual smallholder level?
3. What are the (monetary) benefits of RSPO certification for smallholders?
4. How do uptake of good agricultural practices and yield affect smallholders’ net income?

Costs of certification

Upfront costs

Key message: Upfront costs of certification of three groups of independent smallholders in Indonesia and Malaysia were 87, 114 and 215 EUR ha⁻¹. For independent smallholders in Indonesia, these costs were estimated to be equivalent to 5% and 14% of mean annual revenue from oil palm.

Upfront costs of certification were categorized into documentation & materials; training & organization; land assessment and management; and the certification process (Table 1).

TABLE 1. OVERVIEW OF MOST IMPORTANT UPFRONT COST ITEMS FOR INDEPENDENT SMALLHOLDER CERTIFICATION PER CATEGORY. ICS=INTERNAL CONTROL SYSTEM, HCV=HIGH CONSERVATION VALUE AREA, EIA=ENVIRONMENTAL IMPACT ASSESSMENT, CAR=CORRECTIVE ACTION REQUEST. BASED ON [10, 14, 25]

CATEGORY	ITEM
Documentation & materials	Farmers' documents
	Group certification documents
	Materials & facilities
Training & organization	ICS Establishment
	ICS training
	Group member training
Land assessment and management	HCV identification, and management
	EIA
	SIA
Certification process	Internal assessment I
	Internal assessment II
	RSPO registration fee
	Pre-audit
	Remedial CARs
	Main audit (third party)

For independent smallholders in Malaysia and Indonesia, upfront certification costs were 191, 402 and 751 EUR smallholder⁻¹ and 87, 263 and 114 EUR ha⁻¹ (case #1, #2, #3; Table 2, 6). These costs were estimated to be equivalent to 5% and 14% of mean annual revenue from oil palm for independent smallholders in Indonesia (case #1, #2),

and 7% of mean annual income (case #1). For case #3 and #8, comparison with annual income from oil palm was hampered by lack of reliable data on yield, price or income from oil palm.

For scheme smallholders in Ecuador (case #7) and Ghana (case #8), estimated costs of certification were 38 and 43 EUR ha⁻¹ (Table 2). These upfront costs were equivalent to 2.5% of mean annual income from oil palm for scheme smallholders in Ecuador (case #7).

This is somewhat higher than what was found in a previous study: costs for certification of scheme smallholders were estimated to range between 1.1 and 31.2 EUR ha⁻¹ for plantations [14], which could be related to the geographic scope: [14] mainly focused on Indonesia and Malaysia and did not include operations in Latin America. Except for case #8, upfront costs of certification were higher than what was found for other perennials. Based on a review of 141 peer reviewed articles, upfront investments for coffee and cocoa were found to be between 51 and 188 EUR farmer⁻¹ year⁻¹ [10].



Safe storage of spraying equipment is required for smallholder certification.

Costs for the various categories differed widely between cases (Table 2, Table 6) which is due to differences in project set up, context and different data collection methods across cases. For other schemes and commodities, key factors determining the costs of certification include the starting situation of the farmer prior to certification, the number of farmers already organised in producer groups and the organizational capacities of those groups [10]. These are likely to affect certification costs for oil palm smallholders too: given that a large part of the costs is made in organizing and training farmers, better organized farmer groups are likely to incur less costs.

Some important cost items explaining differences between cases will be highlighted. In case #1, costs for obtaining business, environmental and land permits took up a significant part of the costs. Smallholders did not have these permits

prior to certification and local government agencies were poorly equipped to provide them. No data on these costs for case #2 were available. In case #3, costs for social impact assessment were very high as they included a satisfaction survey, baseline survey, social training and social impact study conducted by a consultant. The higher costs for Ecuador (case #7) are related to the lack of certification bodies and auditing capacity in Latin-America: In Ecuador, auditing costs took up 38% of total certification costs. Trainers and facilitators were based approximately 7 hours from the project site, causing high transportation and accommodation costs (included in training costs) in Ghana (case #8). Upfront costs of certification per farmer decreased linearly with the number of farmers for three cases (#1, #2, #3) of independent smallholders in Indonesia and Malaysia. The sizes of the certified groups were 54, 227 and 348 farmers, and the mean costs were 751, 402 and 191 EUR farmer⁻¹. A similar pattern was found for certification of scheme smallholders [14] and in other certification schemes [10].

To our knowledge, smallholders did not have to provide cash to cover upfront certification costs in these cases (#1, #2, #3, #7, #8) or in the cases for which no detailed information about upfront costs was available (#4, #5, #6). Funding was provided by other actors, including a retail group (case #1), an NGO and/or a development organization (funded by European governments) (case #2, #3, #6, #7, #8), a food manufacturer (case #3), mills & palm oil processors (case #3, #5, #7, #8), consumer goods manufacturers (case #3, #4, #5), a government agency (case #4), and an association of oil palm growers (case #8).

TABLE 2. UPFRONT COSTS OF SMALLHOLDER CERTIFICATION IN EURO FOR FIVE CASES (SUMMARY, FULL TABLE IN APPENDIX 3). # SMALLHOLDERS REFERS TO THE NUMBER OF SMALLHOLDERS INVOLVED IN THE CERTIFICATION PROJECT. REVENUE REFERS TO MEAN REVENUE FROM OIL PALM. % INDICATES % OF TOTAL COSTS FOR THAT PARTICULAR CASE. IND.=INDEPENDENT, N.A. IS NOT APPLICABLE OR UNKNOWN. START PREP. FOR CERT.=STARTING DATE OF A PROJECT PREPARING SMALLHOLDERS FOR CERTIFICATION

Case #	1		2		3		7		8	
Country	Indonesia		Indonesia		Malaysia		Ecuador		Ghana	
Smallholder type	Ind.		Ind.		Ind./Scheme		Scheme		Scheme	
# smallholders	348		227		54		104		438	
Area (ha)	763		347		357		3316		1650	
Mean farm size (ha)	2.3		1.5		7		32		4	
Revenue (EUR ha ⁻¹ y ⁻¹)	3668		2489*		n.a.		44957			
Year of planting	1998-2000		n.a.		After 2003		n.a.		1995-1998	
Start prep. for cert.	March 2012		2009		2010		June 2013		Jan 2012	
Certification	July 2013		2014		Nov 2010		Sep 2013		Aug 2014	
Cost category	EUR	%	EUR	%	EUR	%	EUR	%	EUR	%
Documents, materials	26 802	40	947	1	1 111	3	14 545	12	8 850	13
Training, organization	28 519	43	66 382	73	1 667	4	33 091	28	30 399	43
Impact assessment	**		2598	3	31111*	77	18 182	8	15 000	21
Certification process	11 216	17	21 231	23	6 667	16	61 818	52	31 400	23
TOTAL	66 537	100	91 159	100	40 556	100	127636	100	70 649	100
TOTAL (EUR farmer⁻¹)	191		402		751		1 227		161	
TOTAL (EUR ha⁻¹)	87		263		114		38		43	
Cost as % of revenue	5		14		n.a.		2.5		n.a.	

*Assuming the same revenue from oil palm ha⁻¹ as in case #1, which was similar to what was found by [11] **Included in Documentation & materials ***Including a satisfaction survey, baseline survey, social training and social impact study conducted by a consultant.

Recurrent costs

Key message: Recurrent costs at cooperative level were estimated to range from 21 to 65 EUR farmer⁻¹ year⁻¹ for groups of 200-400 farmers. These costs include an annual RSPO fee and surveillance audit, but exclude costs for group management.

Operational costs at smallholder level (agricultural inputs, labour and fees) increased by 329 EUR ha⁻¹ year⁻¹ for one group of independent smallholders in Indonesia, equivalent to 80% of operational costs, to 20% of gross revenues and to 27% of net annual income of oil palm. However, in two other cases recurrent costs were estimated to increase much less (+86 EUR ha⁻¹ year⁻¹) or decrease (-34 EUR ha⁻¹ year⁻¹).

Recurrent costs at group level Recurrent costs of certification at group level consist of an RSPO fee, an annual surveillance audit and, once in five years, costs of a certification audit. These costs were estimated between 21 and 65 EUR farmer⁻¹ year⁻¹, excluding costs of the certification audit. Recurrent costs at group level, expressed per farmer, decreased near linearly with the number of farmers being member of a group.

Annual membership fee is 250 EUR for smallholder groups smaller than 1000 ha, 1000 EUR for smallholder groups between 1000 and 1999 ha and 2000 EUR for smallholder groups larger than 1999 ha. Annual surveillance audit costs are estimated between 8000 and 11000 EUR group⁻¹ (based on [12], case #1, #2) for groups between 200 and 400 farmers (idem). These costs are within the range of costs reported for other perennials: for coffee and cocoa, recurrent costs for certificate holders ranged between 6 and 165 EUR farmer⁻¹ year⁻¹ [10]. Recurrent costs at group level were higher for scheme smallholders in Ecuador (case #7): annual surveillance audit costs were reported to be 22 727 EUR (218 EUR farmer⁻¹) and born by the mill.

Labour costs of farmer group management and functioning of the ICS were not known or foreseen for the majority of cases. When group management and membership of the ICS are not to be seen as unpaid positions, such costs should be taken into account.

Recurrent costs at farm level Whether certification leads to increased or decreased recurrent operational costs at farm level depends on the agricultural practices applied prior to certification, and on the emphasis that is put on improving agricultural practices in the certification process.



An Indonesian woman applies fertilizer to a palm tree. Costs of fertilizer application increased by around 100 EUR ha⁻¹ in case #1 and case #3 after certification.

Costs for agricultural inputs and labour increased by 127 EUR ha⁻¹ year⁻¹ in case #1, and were estimated by experts to increase by 86 EUR ha⁻¹ year⁻¹ in case #3, to decrease by 34 EUR ha⁻¹ year⁻¹ in case #2, and to remain unchanged in case #7 (Table 4). For independent smallholders in Indonesia and Malaysia (case #1 and #3), costs for fertilizers increased by around 100 EUR ha⁻¹. For independent smallholders in Thailand (case # 6), fertilizer costs increased from 316 to 355 EUR ha⁻¹ on average. Fertilizer application rates increased by 26%, but costs increased less, as mills offered fertilizers at 85-90% of market prices after certification [13]. For three groups of independent smallholders (case #1, #2, #3), costs for herbicides and pesticides were reduced by 18, 34 and 15 EUR ha⁻¹. In case #1, these costs were replaced by labour costs as applying herbicides and pesticides was done by a spraying team after certification. This, and slightly increased costs for pruning, harvest and fertilization, but reduced costs for block weeding, increased labour costs with 34 EUR ha⁻¹ (case #1). In the other cases (#2, #3, #7), no important changes in labour costs were observed.

Independent smallholders in Indonesia (case #1) had to pay fees to the cooperative after certification, which summed up to 10.3 EUR kg FFB⁻¹ and 202 EUR ha⁻¹ at mean yield (Table 5). These fees were paid for transport and weighing of FFB, for road maintenance, for group membership, and for the development of plans for farm management. Total recurrent costs at smallholder level in case #1 increased on

average by 329 EUR ha⁻¹ year⁻¹, which is, on average, equivalent to 80% of operational costs, 20% of gross revenues and 27% of net annual income from oil palm.

In other locations, such fees did not have to be paid or were much smaller. In case #3, transportation costs increased with 30 EUR ha⁻¹. In case #2, smallholders had to pay a membership fee to the cooperative of 4 EUR smallholder⁻¹ year⁻¹, irrespective of whether they were RSPO-certified.

Reviews of other voluntary standards and certification systems show that compliance with standards and certification increases (recurrent) costs at farm level [10, 26]. For coffee and cocoa, the increase in recurrent costs for smallholders was slightly lower than what we found, and ranged between 18 and 55 EUR farmer⁻¹ year⁻¹. Differences can be due to differences between geographies, certification systems and commodities as well as lack of (complete and comparable) data [10, 26]



A truck for transportation of fresh fruit bunches. Transportation costs increased after certification in case #1 and case #3.

BOX 2. SMALLHOLDER OIL PALM YIELDS AND POTENTIAL FOR IMPROVING YIELDS

Oil palm has a production cycle of approximately 25 years, as schematically shown in Figure 1. No fresh fruit bunches are produced until the palms are three years old (yield building phase). Oil palm yield increases naturally when the palms are between 3 and 7 years old (increasing yield). Yield remains stable thereafter (plateau phase), if no major changes in management or weather occur. Yield starts to decline when the palms are around 20 years old (decline phase).

Smallholder yields are on average considerably lower (11-40%) than plantation yields in Indonesia (Figures presented by [4-6] cited in [1, 8], Figure 1). Cases in which smallholder yields are higher than those of plantations are also known: for example, in the NESP Ophir-project in Indonesia, smallholder yields were 30% higher than those of plantations (24.4 t ha⁻¹ versus 18.7 t ha⁻¹) over a 24 year period[9]. Smallholder yields show a large variation [1, 8]. Scheme smallholders are found to achieve higher yields than independent smallholders. One study reports differences of 10-15% higher yields [1] whereas another found 25% higher yields in young plantations (5-8 years) and 38% lower yields in mature plantations (9-19 years) [11]. Both average smallholder and plantation yields are lower than what could be achieved under optimal conditions and management (Figure 1).

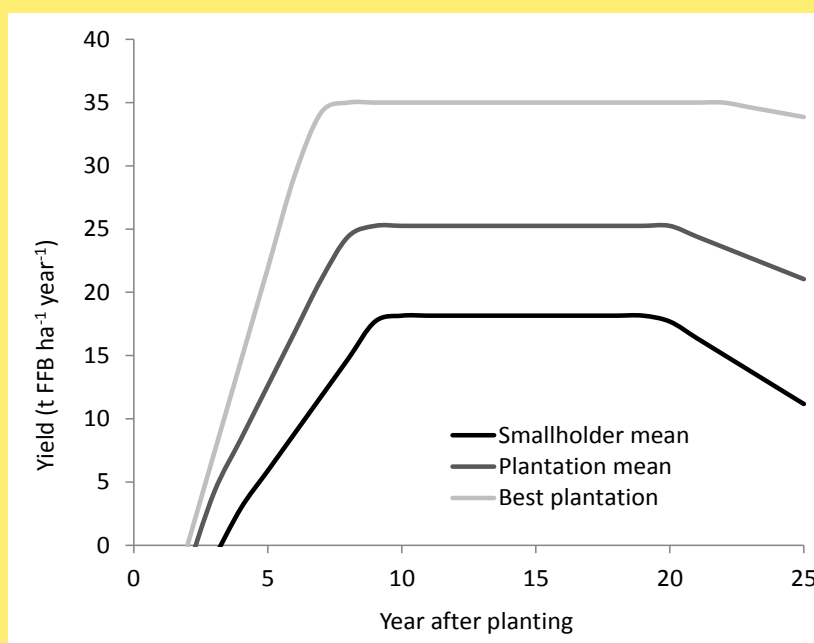


FIGURE 1: DEVELOPMENT OF OIL PALM YIELD OVER TIME FOR THREE LEVELS OF PRODUCTION. NUMBERS REFLECT MEAN AND BEST YIELDS IN INDONESIA, HEIGHT OF THESE LINES MAY BE DIFFERENT FOR OTHER COUNTRIES. FOR ALL THREE PLANTATIONS, THE YIELD BUILDING (NO YIELD), YOUNG MATURE (INCREASING YIELD), MATURE (PLATEAU) AND YIELD DECLINE PHASE CAN BE DISCERNED. BASED ON [1, 11, 17].

The possibility to increase yields by adopting good agricultural practices is shown for degraded sites in Indonesia [1, 19], for Indonesian plantations [18], and for Ghanaian plantations and smallholders [7]. On Indonesian plantations, yields in best management practices blocks were 12% higher than in reference blocks at optimal sites and 18% higher in best management practices blocks than in reference blocks at suboptimal sites, on average over a 5-year period [7, 8, 18]. In Ghana, smallholder yields were 30% higher in best management practices blocks than in reference blocks one year after implementation [7].

Benefits of certification for smallholders

Potential benefits

Previous studies have identified increased income and premium prices as potential monetary benefits of certification for smallholders. Potential benefits with an indirect effect on income included better market access, increased production and enhanced quality (a higher oil extraction rate) [10, 14]. Based on the literature and findings from the case studies, we identified several pathways by which RSPO group certification can lead to enhanced revenues for independent smallholders (FIGURE 2). Broadly, these can be divided into pathways leading to a higher price (upper part of FIGURE 2) and pathways leading to increased production and sales (lower part of FIGURE 2). Partly, these are a direct consequence of compliance with the RSPO Principles & Criteria and of being RSPO certified, such as income from sales of GreenPalm certificates. Partly, however, benefits come from changes in yield, price and sales that are associated with, but not necessarily part of, RSPO certification.

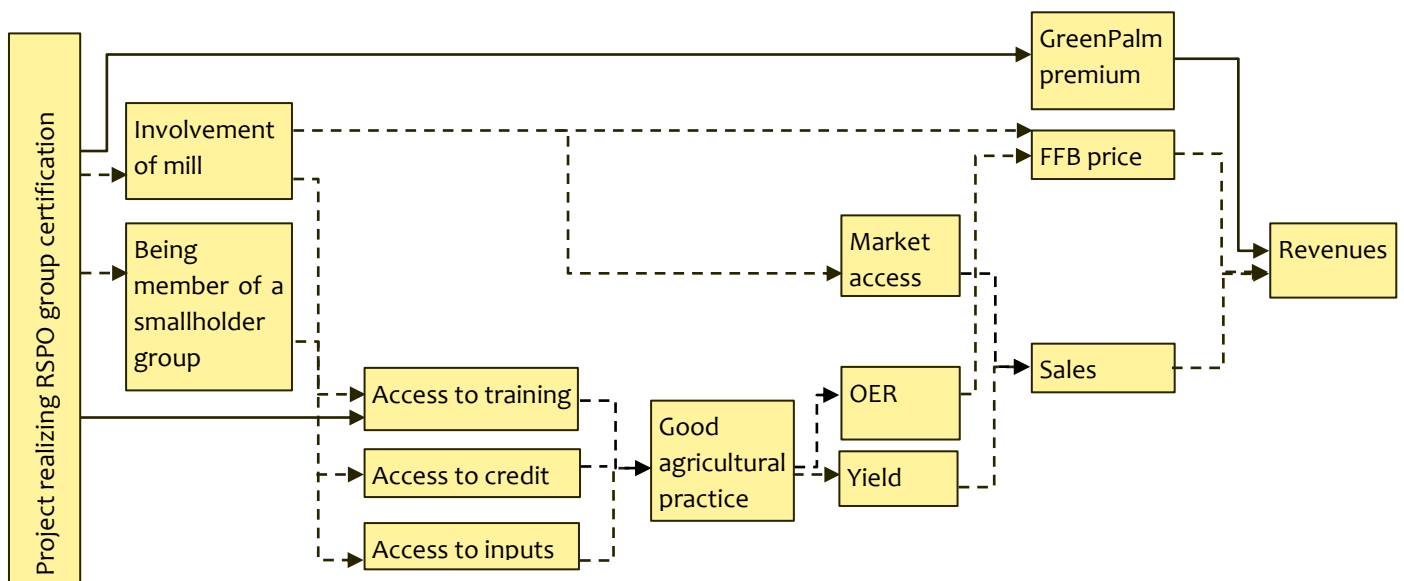


FIGURE 2. PATHWAYS BY WHICH RSPO GROUP CERTIFICATION CAN LEAD TO ENHANCED SMALLHOLDERS' REVENUES. SOLID LINES INDICATE A DIRECT RELATION WITH COMPLIANCE WITH RSPO PRINCIPLES AND CRITERIA AND BEING RSPO CERTIFIED. DASHES LINES INDICATE PATHWAYS THAT CAN BE ASSOCIATED WITH RSPO CERTIFICATION. FFB=FRESH FRUIT BUNCHES, OER=OIL EXTRACTION RATE. CHANGES IN COSTS ARE NOT INCLUDED IN THIS FIGURE. BASED ON BENEFITS DESCRIBED BY [10, 14] AND OBSERVATIONS FROM THE CASE STUDIES.

In this section, the evidence base for these benefits will be discussed. The discussion is limited to benefits that have a link with income. Firstly, effects of RSPO certification on smallholders' (net) income are described. Net income is calculated as the difference between gross revenue and costs, and thus also influenced by changes in costs discussed in the previous section. Then, the effects on (premium) prices are described. After that, changes in sales as affected by changes in yield and market access will be discussed. Finally, attention will be paid to changes in access to credit, agricultural inputs (fertilizer and pesticides) and training as a consequence of certification projects.

Net income

Key message: The evidence on increased profitability in the first year after certification is inconclusive.

Mean net income of independent smallholders in Indonesia (case #1) decreased in the first year after certification, by €75 ha⁻¹ or 6% [25]. For 80% of those smallholders, net income decreased, up to -296 EUR ha⁻¹. Nevertheless, for almost 20% of the smallholders, net income increased, up to +532 EUR ha⁻¹. Mean gross revenue indeed increased by 16%, from 1646 EUR ha⁻¹ year⁻¹ to 1912 EUR ha⁻¹ year⁻¹, but this was not sufficient to cover cost increases. These numbers do not include GreenPalm premiums, as individual smallholders were not aware of those (case #1) [25].

These findings are in contrast with the perception of smallholders of the effects of RSPO certification on their income. These were investigated in another study, for two groups of smallholders, including the independent smallholders of case #1. 74% of the 66 respondents stated RSPO certification enhanced income, and 77% said certification reduced costs [16].

A similar disagreement between measured income and smallholder perception was observed for certified smallholders in Malaysia. In two locations in Malaysia (case #3 and #4), the vast majority of certified smallholders (81% and 76%) reported an increase in annual household income after joining RSPO. Nevertheless, in both locations, no significant difference in annual household income between certified and non-certified smallholders could be observed [15].

These differences can be due to sample selection ([25] and [16] interviewed different smallholders), a too positive vision of the smallholders on their income (in [15, 16]); a too negative estimation of income change (in [25]); or a too small effect and/or sample size for the difference to be significant. Finally, in case #3 and #4, the certified farmers could have been poorer than the uncertified ones prior to certification, and certification could have helped closing the gap (although this is unlikely for at least one location given that certified farms were larger than uncertified farms).

Higher income, premium prices for better quality FFB and reduced production costs after RSPO certification were also reported for independent smallholders in Thailand, although this was not tested quantitatively [12].

These findings are in line with what was found for other certification schemes. An extensive review study showed that the evidence of increased profitability is inconclusive [26].

Price & premiums

Key message: Estimated GreenPalm premiums are very small: 1-4% of CPO prices. These would sometimes but not always be enough to cover recurrent costs.

GreenPalm premiums GreenPalm premiums for crude palm oil (CPO) under "on-market deals" (Box 3) are notably low: between 2013 and 2015 the premium was 1.7 EUR ton⁻¹ and average monthly premiums varied between 0.1 and 4.37 EUR ton⁻¹ [based on 27]. GreenPalm premiums for palm kernel oil (PKO) are higher: between 2013 and 2015 the premium was 44 EUR ton⁻¹ and average monthly prices varied between 6 and 78 EUR ton⁻¹.

The amounts of GreenPalm premiums for independent smallholders are not publicly available. Those premiums are at least as high as premiums for "on-market deals", and probably higher. The benefits that independent smallholders could obtain from GreenPalm certificates were estimated assuming premium prices of 9 and 23 EUR ton⁻¹ CPO, and 91 and 109 EUR ton⁻¹ PKO.

BOX 3. OBTAINING PREMIUMS THROUGH THE SALES OF GREENPALM CERTIFICATES

GreenPalm is the name of a book-and-claim system, in which certificates representing an amount of RSPO certified product are traded. Oil palm growers can obtain certificates representing an amount of RSPO certified crude palm oil (CPO), palm kernel oil (PKO) and palm kernel expeller (PKE). GreenPalm facilitates the trade of these certificates between producers and parties aiming to make sustainability claims. The certificates and the physical CPO, PKO and PKE thus can be sold through different channels.

For scheme smallholders, GreenPalm certificates for palm oil will be sold through the mill under so-called "on-market deals". The prices of these certificates are publicly available and notably low compared to CPO and PKO prices.

Independent smallholders can sell certificates through GreenPalm under a so-called "off market deal". Under such a deal, a smallholders' cooperative and a buyer negotiate a price without interference of a third party. The price of these certificates is not publicly available.

GreenPalm premiums for CPO are low compared to CPO prices: between 0 and 1% for scheme smallholders and (estimated) between 1 and 4% of CPO prices for independent smallholders (CPO prices were 605 EUR t⁻¹ CPO in Indonesia and 812 EUR t⁻¹ CPO in Malaysia in 2012 [28]).

Based on these prices and on assumptions for yield, GreenPalm premiums (Box 3) for scheme smallholders were estimated between 11 and 36 EUR ha⁻¹ on average, depending on yield (Table 7). GreenPalm premiums for independent smallholders were estimated between 45 and 182 EUR ha⁻¹, depending on yield and amount of premium (Table 8, Box 3).

In almost all cases, sales of PKO certificates contributed to over half of the income from GreenPalm certificates. The palm kernel oil extraction rate is approximately 2.5% (based on [29]), and independent smallholders currently sell approximately 10 times more CPO certificates than PKO certificates (based on [30]). Even though amounts of PKO certificates traded are small, premiums for PKO are important.

For independent smallholders, GreenPalm premiums would sometimes be enough to cover upfront costs of certification (87, 114 and 263 EUR ha⁻¹), the annual RSPO fee and surveillance costs (between 21 and 65 EUR farmer⁻¹) or the increased operational costs (+86 and +329 EUR ha⁻¹ year⁻¹). However, to cover both upfront and recurrent costs in all cases, GreenPalm premiums for independent smallholders should be considerably higher than those for scheme smallholders.

Furthermore, to cover increased smallholder operational costs, GreenPalm premiums should be distributed to individual smallholders. For independent smallholders, the benefits of the sales of GreenPalm certificates accrue at group level. It depends on the group management and functioning how these funds are spent, who is benefitting from these premiums and who decides on that.

The contribution of GreenPalm premiums to smallholders' income is relatively small compared to the income from sales of FFB. At current premium levels, more is to gain from improving yields than from receiving additional income through GreenPalm premiums, especially for smallholders with low yields.

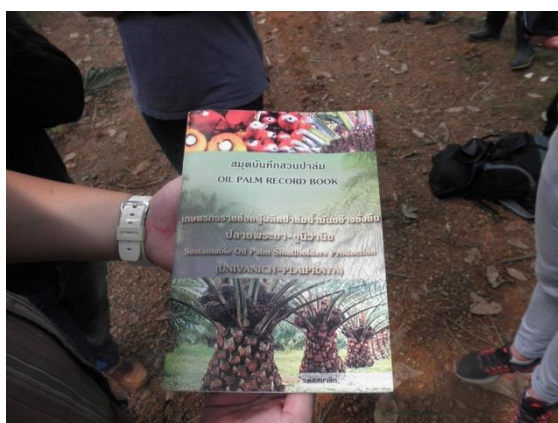
Direct price changes In Indonesia and Thailand, mills paid a fee to groups of independent smallholders (case #1, #6) to ensure their delivery to that mill and to motivate smallholders to join the certification program. This fee was 5% of FFB price in Indonesia (case #1) and between 1 and 5% of FFB price in Thailand (case #6, calculation based on [12, 13]). In Malaysia (case #3), prices were 5% higher after certification than before certification, but this could also be related to regular price fluctuations. So far, there is no evidence that certification leads to large increases in price. This is in contrast to the findings for other certification schemes which show that certification generally increases farm gate prices [26].

Yield

Key message: There is limited evidence that certification of independent smallholders increases yield. This may be due to a lag time in realising benefits from improved agricultural practices and limited data availability.

Yields are shown to increase within 6 to 12 months after implementation of good agricultural practices (Box 2), and the full effects of good agricultural practices on yield can take up to four years. Given that certification of independent smallholders started only recently, the full effects of improved agricultural management cannot be seen yet.

Recording changes in yield of independent smallholders proved challenging, since most smallholders did not record yields prior to certification (case #1, #2, #4, #5, #6). Rather than actual production data, researchers and NGOs obtained sales data from cooperatives or buyers. This can lead to an under- or overestimation of yield, especially when side-selling occurs (see Appendix 1). Considering these limitations, the following impacts of certification on yield were found.



Most smallholders are not used to keeping records prior to RSPO certification.

For independent smallholders in Indonesia mean FFB yield increased from 17.9 t ha⁻¹ to 19.7 t ha⁻¹ for mature palms (Figure 3). According to another study at the same location, the majority of smallholders (80% of 32) said production increased upon certification, but the authors did not report measured values [16].

Studies of yield for independent smallholders in Malaysia showed mixed results. Yield of mature palms seemed to increase after certification

in case #4, although the number of observations was too small for the result to be significant (Figure 3). In a study on smallholders in a different village in the same project, no differences in yield between certified and non-certified smallholders were found for young, mature or old palms (8, 30 and 21 smallholders, respectively) [15]. No yield increase after certification was observed in case #5 (Figure 3).

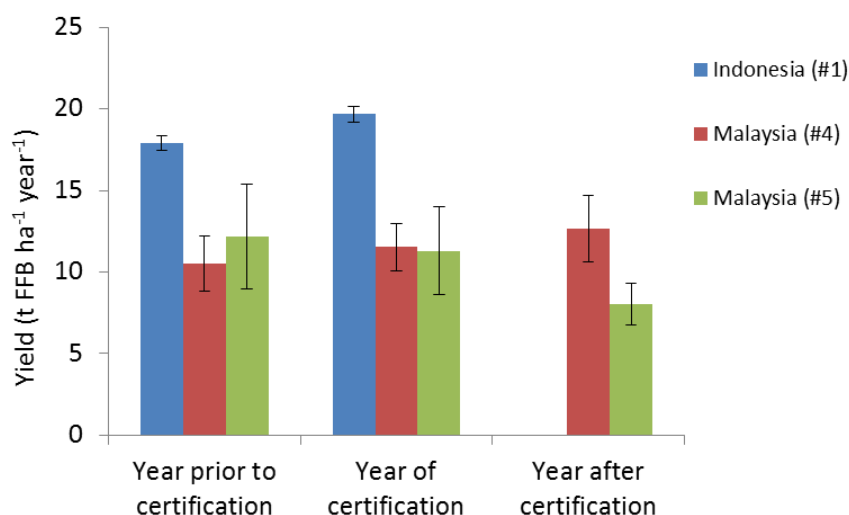


FIGURE 3. YIELD OF MATURE PALMS PRIOR TO AND AFTER CERTIFICATION FOR INDEPENDENT SMALLHOLDERS IN INDONESIA (102 SMALLHOLDERS) AND IN TWO LOCATIONS IN MALAYSIA (19 AND 11 SMALLHOLDERS). ERROR BARS REPRESENT 2*STANDARD ERROR OF MEAN. (AFTER [25], AND INFORMATION FROM CASE #4 AND #5).

In Malaysia (case #3) yields were higher for certified smallholders than for non-certified smallholders (11.6 and 8.4 t ha⁻¹ for certified and non-certified smallholders, respectively) [15]. Certified farms were also larger than non-certified farms (mean total land size 6.6 vs. 3.5 ha), so that structural differences between certified and non-certified smallholders could have confounded these results. (For example, certified farmers may have had more cash to invest in their palms already prior to certification). In case #3, yield data prior to and after certification of the (certified) smallholder group could not be used to draw conclusions on the effect of certification on yield, because the palms were under seven years of age at the onset of the certification process, and yield increased naturally as the palms matured [15] (box 2).

In Thailand, FFB yields of mature trees increased from 18.4 to 20.3 t ha⁻¹ (for trees aged 9-14 years; 37 plots) and from 21.3 to 23.8 t ha⁻¹ (for trees aged 15-20 years; 45 plots) during the project leading to certification [13]. In accordance with these observations, 87 of 100 interviewed smallholders reported increased oil palm yield and quality [13].

Changing market relations

Key message: certification of independent smallholders changes market relations, but the consequences are not well investigated yet.

Certification affected sales channels in four cases of independent certified smallholders in Indonesia, Malaysia, and Thailand (case #1, #2, #3, #6). In all cases, smallholders had closer links to a mill after certification. Independent smallholders in Indonesia (case #1) experienced better market access after certification, as mills had a preference for certified FFB [16]. The cooperative made an agreement with an RSPO certified mill to sell FFB to this mill, in exchange for the mills' involvement in the certification process [25]. In Malaysia (case #3), a group of smallholders who were independent at the onset of the certification process, became scheme smallholders after certification. The mill played an important role in providing training and support in the certification process (case #3). Independent smallholders in Thailand (case #6) reported a closer relationship with the mill after the certification project [12, 13].

These changes in the relationship between smallholders and mills can have consequences for other actors in the supply chain. Independent smallholders in Indonesia (case #1 and #2), no longer sold FFB to middlemen and local traders, but only through the cooperative to the mill [25] (case #1, #2).

Preferred buyer relations are likely to be most beneficial for smallholders when smallholders compete with each other for access to mills. This is the case in large parts of Indonesia and Malaysia, where mills are saturated and can reject FFB that does not meet quality standards. In contrast, in Thailand, mills have overcapacity. As a consequence, mills compete with each other for FFB's of smallholders and accept low quality FFB [12]. Further research should focus on investigating the positive and negative consequences of changes in sales channels for smallholders and other actors involved.

Increased access to training, inputs and credit

Key message: certification of independent smallholders enhances access to training and technical support, and seems to enhance access to agricultural inputs and finance, yet these effects and their consequences are not systematically investigated.

Certification of independent smallholders seems to enhance access to agricultural inputs and finance. These benefits are associated with membership of a cooperative and with the aforementioned involvement of mills. Membership of an association or cooperative was found to enhance access to credit either directly through government support (case #2) or because farmers can get loans from the cooperative

[16]. Involvement of the mill in the certification process enhanced access to credit for smallholders in Malaysia (case #3) and Thailand (case #6, [12]). In the same two cases, the mills provided access to fertilizer, including, in the Thai case, discount on fertilizer, access to high quality fertilizer and free empty fruit bunches [12, 13]. For independent smallholders in Indonesia (case #1), certification enhanced access to fertilizer, but only to a fixed amount of land included in the agreement between the cooperative and the mill. In another case in Indonesia, obtaining fertilizer remained challenging for independent smallholders (case #2).

Certification enhances access to training, as training is an integrated part of the process of preparation for certification and part of the RSPO Principles and Criteria [2]. Topics include RSPO principles and criteria, good agricultural practices, the



Training is an integrated part of RSPO certification.

functioning of ICS, and may include financial literacy, entrepreneurial skills, soil and water conservation, and health and safety. Where mills are involved in the certification process, access to technical support and extension services also seemed to improve once the farmers were certified (case #1, #3, #4). Previous research in Indonesia showed that technical assistance positively affected the uptake of best management practices by smallholders, but access to such assistance was limited [1]. Certification thus could help fill this gap. Future research should address the ways in which this could best be achieved.

Box 4. KEY MANAGEMENT PRACTICES FOR IMPROVING YIELDS IN SMALLHOLDER OIL PALM SYSTEMS

For both scheme and independent smallholders, there is considerable room for improvement of oil palm plantation management [1]. The most important management practices are described here.

Improving harvesting practices was seen as an important and quick way to increase smallholder yields in Indonesia and Ghana [1, 7]. Harvesting practices consist of accessibility of palm trees, harvesting frequency and judgement of quality control. Full harvesting was severely restricted by poor plantation access in both Indonesian and Ghanaian smallholder plantations [1, 7]. Harvesting practice of Indonesian smallholders was correlated with yield [1]. In another study, a model was developed that quantified the effect of harvesting frequency on yield. Yield would increase from around 15 ton FFB ha⁻¹ up to 24 ton FFB ha⁻¹ when harvesting frequency would increase from once to thrice a month. However, this model explained very little of the data obtained through smallholder surveys, which suggest it has limited explanatory power [11]. Quality control encompasses judging whether oil palm fruits are ripe and bunches need to be harvest. This notably affects the oil extraction rate and the number of bunches accepted by mills (unripe or too ripe bunches may be rejected). Pruning practices could be improved in the majority of Indonesian smallholder plantations [1]. Suboptimal pruning decreases the capacity of palms to produce sugars that can be used for growth, and prevents a clear view on ripe bunches.

Improving fertilization practices is seen as a key area for enhancing smallholder yields [8]. This includes application of the right types and quantities of fertilizer and of empty fruit bunches at the right moment. Nutrient deficiencies were quantified in Indonesian smallholder oil palm plantations [6, 8], and imbalanced and insufficient nutrition limited smallholder oil palm yield. Fertilization practices showed a significant correlation with yield in a study including 1069 Indonesian smallholders [8, 16].

Water management is notably crucial for smallholders on peat. It consists of both drainage to prevent water logging and of making dams to prevent peat oxidation.

Finally, smallholder yields could be improved by using better planting materials [6]. Half of the Indonesian smallholders were found to have (mainly) *dura* or *pisifera* rather than *tenera* palms. *Tenera* palms have a higher oil extraction rate, and a higher yield (at least under optimal management) [1].



Improving fertilization (left) and using better planting materials (right) are two key management practices for improving yields in many smallholder oil palm systems.

Potential of good agricultural practices

Key message: Good agricultural management practices are shown to increase yields by 12-30% (in on-farm experiments), and are predicted to increase income (in a modelling study). Improving the uptake of good agricultural practices seems to be the most promising area for increasing the impact of RSPO certification on smallholders' livelihoods.

Net income & yield

For independent smallholders Indonesia (case #1), net income change in the first year after certification showed a strong positive correlation with the change in yield (Figure 4): smallholders who obtained large yield gains ($>2694 \text{ kg ha}^{-1}$) experienced net income gains, and the largest income losses were experienced by smallholders whose yield hardly increased. This suggests that more smallholders will experience income gains when yields increase further (for example, when the full effects of fertilizer application materialize). This is in line with a review study of other certification schemes, which concluded that costs of smallholder certification can only be overcome by increased production volumes [10].

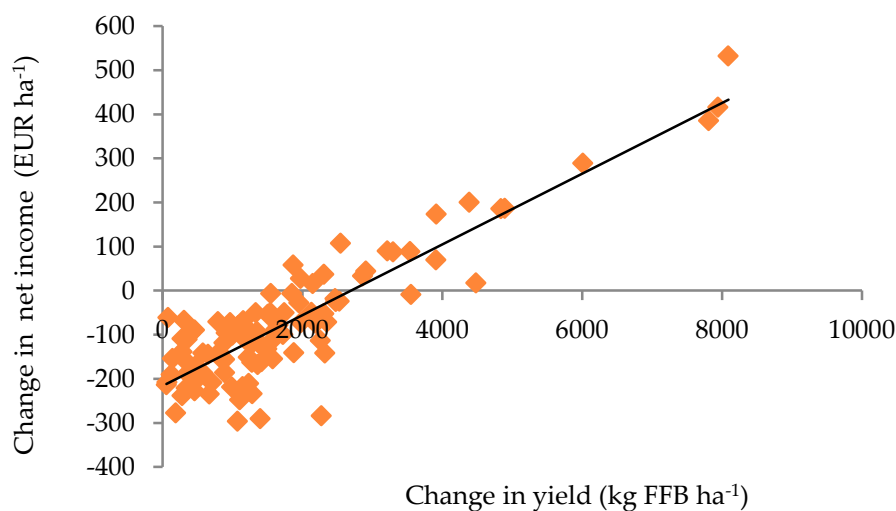


FIGURE 4. RELATION BETWEEN YIELD INCREASE AND CHANGE IN NET INCOME IN THE FIRST YEAR AFTER CERTIFICATION, COMPARED TO THE YEAR PREVIOUS TO CERTIFICATION, FOR INDIVIDUAL INDEPENDENT FARMERS IN INDONESIA (CASE #1). 102 SMALLHOLDERS, EACH SQUARE REPRESENTS A SMALLHOLDER. CHANGES ARE CALCULATED AS AFTER-BEFORE (BASED ON [25]).

Simulated monetary benefits of good agricultural practices

There is large potential for increasing production volumes in smallholder oil palm, considering current yield levels and results of on-farm experiments (Box 2). Good agricultural management practices (Box 4) are shown to increase yields in plantations and smallholder plots by 12-30 % [7, 18] (Box 2). However, remarkably little empirical data on the costs and benefits of uptake of best management practices in smallholder oil palm plantations in Indonesia and Malaysia are available.

To gain insight in costs and benefits of adoption of good agricultural management practices for smallholders, [8] conducted a modelling study. Oil palm yield, management costs and income were simulated for three different management scenarios for scheme smallholders, based on assumptions by experts (TABLE 8). Annual income, calculated over a 26 year production cycle, was 1691 EUR ha⁻¹ for the good agricultural practice scenario, whereas it was only 73 EUR ha⁻¹ for the low input standard smallholders. Whereas costs for low input standard smallholders were simulated to be over three times less than for high input standard smallholders, net income was calculated to be 16 times lower, due to lower yields and more post-harvest losses.

“Upgrading” existing plantations or improving management practices 10 years after plantation establishment would result in an increase of 48% (EUR 459) of average annual income for a change from medium input standard to high input standard smallholders, and an increase of 637% (EUR 258) for a change from low to medium

input standard smallholder [8]. This study assumed large yield increases: from 7 t FFB ha⁻¹ year⁻¹ (for low input standard smallholders), to 15 t FFB ha⁻¹ year⁻¹ (for medium input standard smallholders), and to 28 t FFB ha⁻¹ year⁻¹ (for high input standard smallholders).

In the first year after implementation of good agricultural practices, however, increased costs would be larger than increased revenues, leading to a reduction in net income [20]. Benefits are expected to outweigh costs after two to three years [20, 31]. For smallholders, short-term benefits may be important incentives to invest in good agricultural practice. Further research should thus focus on the factors affecting farmers’ willingness to invest in oil palm management.



A man pruning a palm tree in Kalimantan.

Conclusion

Independent smallholders lack the capacity to meet requirements for RSPO certification independently. Therefore, the certification process involves support of third parties, which is costly. Upfront costs of certification of independent smallholders in Indonesia and Malaysia were 87, 114 and 215 EUR ha⁻¹ and 191, 402 and 751 EUR farmer⁻¹. Upfront costs were mostly born by external donors, NGOs and mills. Estimated recurrent costs at group level ranged between 21 and 65 EUR farmer⁻¹ year⁻¹, excluding costs for group management. Recurrent costs at farm level depended on the situation prior to certification and the emphasis put on adoption of good agricultural practices, and were found to increase up to 127 EUR ha⁻¹ (excluding fees of 202 EUR ha⁻¹ that needed to be paid to the cooperative in one case). Recurrent costs were mostly born by smallholders themselves.

RSPO certification potentially has economic benefits for independent smallholders. Those include: increased yield, improved market relations and access to inputs, training and finance and price premiums through the sales of GreenPalm certificates. Yet, there is little conclusive evidence for these benefits. This is partly due to lack of data. This study did not investigate impacts of smallholder RSPO certification on deforestation and other social and environmental impacts that could justify investments in smallholder certification.

Smallholders are likely to benefit most from certification projects if these projects focus on adoption of good agricultural practices and creating enabling conditions for increasing yield. There is large potential for improvement of smallholder yields and agricultural practices in Indonesia and Malaysia. A scenario study showed investing in good agricultural practices could pay off, although revenues do not outweigh costs in the initial years.

Key knowledge gaps

Key message: Little systematic investigations of benefits of RSPO certification for smallholders have been conducted; including effects on yield and income, changing market relations, group functioning and distribution of costs and benefits within the group. There is a need for sound baseline data and comparison with reference groups for diverse groups of farmers in various contexts.

Baseline studies should preferably be conducted well before certification projects start. Such baselines preferably include data about households and household economy, farm size, agricultural management, yield, access to inputs, finance and training, sales channels and market relations.

Certification of smallholders goes together with organising farmers in a group, which brings about socio-institutional change, especially when smallholders were not organised in a farmer group before certification. Studies that focus on the functioning of producer groups in the context of certification, on inclusion and exclusion of smallholders in such groups and on the distribution of costs and benefits within such groups are necessary.

There are several pitfalls in investigating impacts of certification. When comparisons are limited to before-after certification, there is a risk of finding effects that are unrelated to certification [32]. When comparisons are limited to certified with non-certified groups, there is a risk of selection bias (as in [15];[32]). Therefore, there is a need for rigorous assessment of the impact of certification, including counterfactual analysis. Preferably, studies include comparisons of before and after certification and of certified and non-certified groups, or make use of a matching method.

To further enhance the impact of RSPO certification and certification projects, research on the following three topics is desirable. Firstly, effects of training and different methods of training on oil palm farmers' knowledge and practices. Secondly, studies on smallholders' investment strategies in combination with long-term empirical studies of the economic costs and benefits of uptake of specific good agricultural management practices in smallholder systems. Thirdly, studies on the diversity of smallholder oil palm systems and the challenges and opportunities for different types of farmers.

As the first independent smallholder groups were certified in 2013, no investigations of effects of RSPO certification for a period of longer than two years have been done yet.

Most studies are conducted in Malaysia and Indonesia. Hence there is a need for a wider geographical scope, particularly because extrapolating costs as well as impacts to other contexts is difficult [33]. This holds specifically for certification, as reviews of other certification systems have shown that impacts and costs and benefits are highly context specific [10, 26].

References

1. Molenaar, J.W., et al., *Diagnostic study on Indonesian oil palm smallholders. Developing a better understanding of their performance and potential*. 2013, IFC: Jakarta. p. 96.
2. RSPO, *RSPO Principles and Criteria for Sustainable Palm Oil Production. Including Indicators and Guidance*. 2007. p. 53.
3. RSPO, *RSPO Principles and Criteria for Sustainable Palm Oil Production: Guidance for Independent Smallholders under Group Certification*. 2010. p. 59.
4. Suharto, R., *Sustainable production in Indonesia*. 2009, Presentation at the China International Oil and Oilseeds Summit 2009, 8-10 July 2009: Beijing.
5. RSPO, *RSPO Principles and Criteria for Sustainable Palm Oil: Guidance on Scheme Smallholders*. 2009. p. 27.
6. Woittiez, L.S., M. Slingerland, and K.E. Giller, *Yield gaps in Indonesian smallholder plantations: causes and solutions*, in *PIPOC*. 2015: Kuala Lumpur. p. 11.
7. Rhebergen, T., et al., *The effects of climate, soil and oil palm management practices on yield in Ghana*, in *International Oil Palm Conference (IOPC)*. 2014: Bali. p. 16.
8. Molenaar, J.W., et al., *Analysis of the agronomic and institutional constraints to smallholder yield improvement in Indonesia*. 2010, Aidenvironment & Global Sustainability Associates: Amsterdam. p. 74.
9. Jelsma, I., K. Giller, and T. Fairhurst, *Smallholder oil palm production systems in Indonesia: Lessons from the NESP Ophir project*. 2009, Wageningen University: Wageningen. p. 105.
10. Kuit, M. and Y. Waarts, *Small-scale farmers, certification schemes and private standards: Costs and benefits of certification and verification systems for small-scale producers in cocoa, coffee, cotton, fruit and vegetable sectors*, in *Value Chains and Trade*. 2014, Technical Centre for Agricultural and Rural Cooperation: Wageningen. p. 148.
11. Lee, J.S.H., et al., *Oil palm smallholder yields and incomes constrained by harvesting practices and type of smallholder management in Indonesia*. *Agronomy for sustainable development*, 2014. **34**(2): p. 501-513.
12. Beall, E., *Smallholders in Global Bioenergy Value Chains. Evidence from three case studies*, in *Environment and Natural Resource Management Working Paper*. 2012, FAO: Rome. p. 133.
13. Thongrak, S. and S. Kiatpathomchai, *Impact study of the project on sustainable palm oil production for bio-energy in Thailand*. 2012, Prince of Songkla University.
14. Levin, J., et al., *Profitability and sustainability of sustainable oil palm production. An analysis of incremental costs and benefits of RSPO certification*. 2012, WWF-US: Washington DC. p. 60.
15. Sidique, S., et al., *Impacts of RSPO certification on livelihood and sustainability: evidence from independent smallholders in East Malaysia*. 2015, Presentation given at RT13, 16-19 November 2015: Kuala Lumpur.
16. Hidayat, N.K., P. Glasbergen, and A. Offermans, *Sustainability Certification and Palm Oil Smallholders' Livelihood: A Comparison between Scheme Smallholders and Independent Smallholders in Indonesia*. *International Food and Agribusiness Management Review*, 2015. **18**(3): p. 25.
17. Woittiez, L.S., et al., *Yield gaps in oil palm: a quantitative review of contributing factors*. In review.
18. Donough, C., C. Witt, and T. Fairhurst, *Yield intensification in oil palm plantations through best management practice*. *Better Crops*, 2009. **93**(1): p. 12-14.

19. Griffiths, W. and T. Fairhurst, *Implementation of best management practices in an oil palm rehabilitation project*. Better Crops International, 2003. **17**(1): p. 16.
20. Aidenvironment, NewForesight, and iied, *Case study report: palm oil in Indonesia*. 2015.
21. RSPO. *RSPO Smallholders definition*. 2016 [cited 2016 March 5]; Available from: <http://www.rspo.org/smallholders/rspo-smallholders-definition>.
22. Verburg, J., *Smallholders: Certification Benefits and Commitment*. 2015, Presentation given at RT 13, 16-19 November 2015: Kuala Lumpur.
23. Lee, J.S.H., et al., *No farmer left behind in sustainable biofuel production*. Biological Conservation, 2011. **144**(10): p. 2512-2516.
24. RSPO. *RSPO Certification*. 2016 [cited 2016 March 5]; Available from: <http://www.rspo.org/smallholders/rspo-certification>.
25. Hutabarat, S., et al., *Costs and benefits of certification of independent smallholders*. Submitted.
26. Loconto, A. and C. Dankers, *Impact of international voluntary standards on smallholder market participation in developing countries - A review of the literature*. 2014, FAO: Rome. p. 104.
27. GreenPalm. *Market volume and price charts*. 2015 [cited 2016 February 2]; Available from: <http://greenpalm.org/the-market/market-overview/market-volume-and-price-charts>.
28. FAOSTAT. *Prices of oil palm*. 2016 [cited 2016 January 21st]; Available from: <http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor>.
29. Corley, R.H.V. and P.B. Tinker, *The Oil Palm*. Fourth edition ed. 2008, Hoboken, NJ: John Wiley & Sons.
30. GreenPalm. *Sales of CPO and PKO of independent smallholders*. 2016 [cited 2016 March 15]; Available from: <http://greenpalm.org/the-market/registered-certificate-owners>.
31. Woittiez, L.S., *Personal communication*, P.I. Rietberg, Editor. 2016.
32. Blackman, A. and J. Rivera, *Producer-level benefits of sustainability certification*. Conservation Biology, 2011. **25**(6): p. 1176-1185.
33. Evans, D.K. and A. Popova, *Cost-Effectiveness Analysis in Development: Accounting for Local Costs and Noisy Impacts*. World Development, 2016. **77**: p. 262-276.

Appendix 1: Case studies included

TABLE 3. OVERVIEW OF CASE STUDIES INCLUDED AND TYPE OF DATA FOR EACH CASE STUDY. Q=QUANTITATIVE DATA, D=QUALITATIVE INFORMATION, E=EXPERT ESTIMATION I=DATA BASED ON INDIVIDUAL FARMERS' RECORDS, G=AGGREGATE NUMBERS FOR A GROUP, EITHER RECORDS OR ESTIMATIONS. DATA REFERS TO SECONDARY DATA SOURCES, LITERATURE TO PAPERS OR REPORTS.

#	Country	Smallholder type	Data	Literature	COST			BENEFITS					
					Upfront	Recurrent	Yield	Price	GreenPalm premium	Market relations	Organization	Training	Income
1	Indonesia	Independent	PhD study	[16, 25]	Q, G	Q, I	Q, I	Q, I	n.a.	D	D	D	Q, D, I
2	Indonesia	Independent	NGO1		Q, G	Q, G	n.a.	n.a.	Q, E	D	D	D	n.a.
3	Malaysia	Ind./Scheme*	NGO1	[15]	Q, G	Q, G	Q, I ***	Q, G	Q, E	D	D	D	Q,D,I
4	Malaysia	Independent	NGO2	[15]	n.a.	n.a.	Q, I	n.a.	Q, E	n.a.	n.a.	D	Q,D,I
5	Malaysia	Independent	NGO2		n.a.	n.a.	Q, I	n.a.	n.a.	n.a.	n.a.	D	n.a.
6	Thailand	Independent	n.a.	[12, 13]	n.a.	Q, G**	Q, I	Q, G	n.a.	D	D	D	D
7	Ecuador	Scheme	NGO1		Q, G	Q, G	Q,G,	Q,G	Q	n.a.	n.a.	D	n.a.
8	Ghana	Scheme	NGO1		Q, G	n.a.	Q, G	n.a.	Q	n.a.	n.a.	D	n.a.

*Smallholders were independent prior to the certification project but audited and certified as scheme smallholders **Audit and fertilizer costs only

***These data were not used in the analysis, because they represent sales to one particular mill and show large fluctuations, and the age of the trees and the area of the plots are not known.

Appendix 2:

Methods for data collation and analysis

This study was conducted between December 2015 and April 2016 and consisted of a literature review and analysis of secondary data.

Literature review Literature on costs and benefits of RSPO certification of (independent) smallholders was searched with GoogleScholar by using a combination of the terms “oil palm” “palm oil” “smallholders” “RSPO” “certification” “yield” and “income”.

Studies were included when they presented original research, information on methods, and empirical data about monetary costs and/or benefits of smallholder RSPO certification. Two studies fulfilled these criteria ([15, 16]). [12, 13] were published prior to certification of the smallholder groups studied, but were included as they described the (impacts of) the project leading to certification, and were the only source of information about certification of independent smallholders in Thailand (case #6). [14] was included as it provided figures for costs and benefits of smallholders, based on expert interviews. In total, five studies describing RSPO certification of independent smallholders were considered.

To complement the findings of these studies, and to gain insight in the potential of best management practices for smallholders, studies on current management practices and the potential of good management practices were searched by using a combination of the terms “oil palm” “smallholders” “management” “yield” “best management practices” “costs” and “income”. Studies were included when they presented original research, information on methods and empirical data about smallholder agricultural practices and/or results of on-farm experiments indicating the potential of good management practices in oil palm. Eight studies were selected [1, 6-9, 11, 18, 19]. We do not claim to give an exhaustive overview of this topic. No empirical studies on the costs and benefits of best management practices were found. Therefore, two studies that provided an ex-ante analysis of this topic were included [8, 20]. [8] consisted of a modelling study in which three scenarios were developed: for low, medium and high input smallholders. Assumptions for these scenarios were based on expert judgement and previous studies.

Findings were contextualized by using studies of [10, 26]. [10] is a systematic literature review of producer level impacts of smallholder certification. 270 studies were analysed, covering eight certification schemes in coffee, cotton, cocoa, fruit and vegetables. [26] describes a systematic literature review on the impact of certification schemes on smallholder market access in developing countries, including 123 cases reported in 101 studies.

Secondary data The following parties were approached to explore options to contribute to this study: Wild Asia, LEAP, Solidaridad, ProForest, Aidenvironment, Wilmar, NBPOL, RSPO, GIZ, and FELDA. Wild Asia and Solidaridad, its regional office Solidaridad West Africa and its partner organisations, Natural Habitats Group, Setara Jambi and Keresia Plantations & Mill, kindly provided data. Data from Setara Jambi came from a project conducted in collaboration with Hivos Indonesia. Aidenvironment kindly provided insight in the assumptions underlying the modelling of costs and benefits of good agricultural practices [8].

Case study #1 was conducted by a PhD-student in the framework of the SUSPENSE programme. Methods for data collection and analysis are also elaborated in [25]. Data was collected from June until October 2013 by a PhD-student and 12 university students and during shorter field visits in 2013, 2014 and 2015. The project leading to certification started in March 2012, the smallholder group was certified in July 2013.

Data on upfront costs of certification were obtained through 20 interviews with cooperative leaders, ICS members, farmer group leaders and NGO-representatives. Data on recurrent costs of certification and management practices were obtained through surveys of 130 randomly selected smallholders included in the group certification. The survey included questions on agricultural management practices and associated costs of inputs (fertilizer, pesticides, herbicides) and labour. Land and building taxes were the same for all smallholders. Depreciation of tools was included by asking purchase price for each of eight tools and assuming a depreciation time of 3-5 year, depending on the tool. Land and building taxes and depreciation of tools were assumed to be unaffected by certification and data for the calculations were obtained only once. Net annual income was calculated by subtracting all costs from all revenues.

Harvesting prior to certification was done in informal farmer groups (*kelompok tani*) of 20-40 persons. Data on price of FFB prior to certification were obtained by interviewing the leaders of those groups. As they did not keep records, they made an estimation of the average price obtained.

Data on FFB price after certification were obtained through records from the farmers' cooperative. As individual farmers were not aware of GreenPalm premiums and no information about these could be obtained through the cooperative, GreenPalm premiums were not included in the calculation of annual income. (GreenPalm certificates could be sold from 2014 onwards, and no information about these was available during the research in 2013).

Annual sales data of FFB of individual farmers prior to and after certification were obtained through records from the farmers' cooperative, from October 2012 and July 2013. In April 2014 sales data were triangulated by verifying sales with informal farmers group leaders. Farmers with recorded sales of >23 ton ha⁻¹ were excluded from the analysis, as this was considered an unrealistically high yield, and these records might have been affected by side-selling. 28 farmers were excluded, leading to a sample of 102 farmers. A different sample from the farmer group of case #1 was studied and described by [16].

For case study #2, #3, #7 and #8, data on monetary costs and benefits of certification were obtained by an NGO. The NGO collected this data in October 2014. For case #2, #3 and #7, the NGO and partner organisations of this NGO involved in the implementation of the certification project, were requested to provide information of monetary costs and benefits of certification. To this end, a framework with cost and benefit items was developed, distinguishing upfront and recurrent costs of certification at smallholder group and individual level, as well as recurrent benefits at individual level. Partner organisations filled out this framework, and based themselves on mill data for case #3 and #7. For case #8, upfront costs were based on an approved final project budget made at the end of the project. Information about these cases was also obtained through project proposals and reports provided by the NGO.

An NGO provided data on fertilizer and pesticide use, farm size, tree age and FFB sales for 42 individual smallholders of case #4 and 27 smallholders of case #5. For case #4, data were collected for 2012, 2013 and 2014, and for case #5, data were collected for 2013, 2014 and 2015. A field team of this NGO retrieved the data on fertilizer and pesticide use from farmers' records. Sales data were provided to the field team by mills to which smallholders delivered.

Observations for which data were missing in one of the years were not considered (e.g. a sales record for 2012 only, without information for 2013 or 2014). Palms of each farmer were classified as "young" (year of planting after 2004) "mature" (year of planting between 1994 and 2004), or "old" (year of planting before 1994). Means and standard errors were calculated for each age group, per location and per year of observation. Eventually, young and old palms were not considered for analysis, as yield for these palms is affected strongly by age, complicating singling out effects of good agricultural practices, and the number of observations was very low. Case #3 and case #4 were also studied by [15].

In cases #1, #4 and #5, sales data were used as a proxy for yield. This will likely lead to an underestimation of yield as field losses and unsold bunches are not taken into account. Additionally, the possibility of side-selling decreases the validity of these numbers: the yield of particular plots or farmers may be higher than

sales data suggest when farmers sell part of their yield through other channels. On the contrary, the yield of specific plots or farmers may be lower than sales data indicate when part of the yield of other plots or other farmers is included in the record. Whether differences in sales prior to and after certification were significant was tested with a two-sided t-test for three locations (case #1, #4 and #5) separately. Sales data for case #3 were available but could not be used for analysis as neither the age of the palms nor the size of the farms were known.

Communication with the PhD-candidate and the NGO's took place when data were unclear or ambivalent.

GreenPalm premiums for scheme smallholders were calculated based on the average price per month from 2013-2015 ([27] and assumed yields (Table 7). GreenPalm premiums for independent smallholders were estimated based on expert judgement, and the actual ratio between sales of CPO and PKO for independent smallholders [30] and assumed yields (Table 7). In order to compare GreenPalm premiums with CPO prices, CPO prices in Malaysia and Indonesia were obtained from FAOSTAT [28].

A draft of this policy paper was sent out for non-anonymous peer-review and comments were used for revision of the paper.

Appendix 3: Tables

TABLE 4. CHANGE IN RECURRENT COSTS OF CERTIFICATION (EUR ha⁻¹ YEAR⁻¹) DUE TO ADAPTATION OF FARM MANAGEMENT PRACTICES AT FARM LEVEL. FOR CASE #1, COSTS ARE BASED ON RECORDS OF 102 INDEPENDENT SMALLHOLDERS. FOR CASE #6, COSTS ARE BASED ON RECORDS OF 100 SMALLHOLDERS REPORTED IN [13]. FOR THE OTHER CASES, COSTS ARE BASED ON JUDGEMENTS OF EXPERTS INVOLVED IN SMALLHOLDERS' CERTIFICATION. 0=NO CHANGE, N.A. IS UNKNOWN

Case #	1	2	3	6	7
Country	Indonesia	Indonesia	Malaysia	Thailand	Ecuador
Smallholder type	Independent	Independent	Ind./Scheme	Independent	Scheme
Herbicides & pesticides	-18	-34	-15	n.a.	0
Fertilizers	109	0	101	39	0
Labour	36	0	0	n.a.	0
TOTAL	127*	-34**	86***	n.a.	0

*Excluding the fees described in Table 5 **Excluding cooperative membership fee of 3.6 EUR farmer⁻¹ year⁻¹ ***Excluding increased transportation costs of 30 EUR ha⁻¹ year⁻¹

TABLE 5. FEES FOR INDIVIDUAL SMALLHOLDERS AFTER CERTIFICATION OF INDEPENDENT SMALLHOLDERS IN INDONESIA (CASE #1), IN EUR t FFB⁻¹ AND MEANS IN EUR ha⁻¹ AND EUR FARMER⁻¹.

Cost item	Cost
Weighing	0.81
Transport	2.71
Road maintenance	0.68
Group membership	3.38
Farm operational management plan	2.71
TOTAL	10.3
Total ha ⁻¹ *	202
Total farmer ⁻¹ **	455

*At the mean yield of 19.6 t ha⁻¹ **At the mean farm size of 2.25 ha

TABLE 6. UPFRONT COSTS OF SMALLHOLDER CERTIFICATION IN EURO FOR FIVE CASES. #SMALLHOLDERS REFERS TO NUMBER OF SMALLHOLDERS INCLUDED IN THE CERTIFICATION. ICS=INTERNAL CONTROL SYSTEM, GAP=GOOD AGRICULTURAL PRACTICE, OHS=OCCUPATIONAL HEALTH AND SAFETY, FIN. LIT=FINANCIAL LITERACY, ENTR.=ENTREPRENEURSHIP, HCV=HIGH CONSERVATION VALUE, EIA=ENVIRONMENTAL IMPACT ASSESSMENT, SIA=SOCIAL IMPACT ASSESSMENT, CAR=CORRECTIVE ACTION REQUEST, N.A. NOT APPLICABLE OR UNKNOWN

Case #	1	2	3	7	8
Country	Indonesia	Indonesia	Malaysia	Ecuador	Ghana
Type of smallholders	Independent	Independent	Ind./Scheme	Scheme	Scheme
# smallholders	348	227	54	104	438
Area (ha)	763	347	357	3316	1650
Year of planting	1998-2000	n.a.	After 2003	n.a.	1995-1998
Start prep. certification	March 2012	2009	2010	June 2013	Jan 2012
Certification	July 2013	2014	Nov 2010	Sep 2013	Aug 2014
Cost item					
Farmers' documents	24751	n.a.	n.a.	n.a.	2,100
Group certification doc.	2050	n.a.	n.a.	n.a.	1,500
Hardware for ICS	n.a.	947	1111	14545	3,000
Materials & facilities	n.a.	n.a.	n.a.	n.a.	2,250
Sub-total documentation, materials	26802	947	1111	14545	8,850
Organizing ICS	604	14616	n.a.	n.a.	1,500
ICS training	5299	14887	267	909	5,400
RSPO sensitization	2288	8120	n.a.	n.a.	6,000
GAP training	7148	n.a.	267	10909	1,500
Env. sust. training	7626	5413	267	10909	6,000
OHS training	3267	8120	267	7273	6,000
Fin. lit./Entr. training	2288	9474	n.a.	909	n.a.
Administrative/overhead	0	5752	600	2182	3,999
Sub-total training & organization	28519	66382	1667	33091	30,399
EIA, including HCV's	*	704	6667	13636	15000
SIA	*	1895	24444**	4545	n.a.
Sub-total land & impact assessment	*	2598	31111	18182	15000
Internal assessment I	575	6090	***	***	6,000
Internal assessment II	68	n.a.	n.a.	n.a.	n.a.0
RSPO registration fee	254	254	n.a.	n.a.	n.a.
Pre-audit	4737	n.a.	n.a.	n.a.	n.a.
Remedial CARs	169	6767	n.a.	16364	3,900
Main audit (third party)	5413	8120	6667	45455	6,500
Sub-total certification process	11216	21231	6667	61818	31,400
TOTAL	66537	91159	40556	127636	70,649
TOTAL (EUR/smallholder)	191	402	751	1227	161
TOTAL (EUR/ha)	87	263	114	38	43

*Costs for HCV's, EIA and SIA were included in Farmers' documents **This included a satisfaction survey, baseline survey, social training and social impact study conducted by a consultant ***Smallholders were included in the internal assessment by the mill

TABLE 7. GREENPALM PREMIUMS FOR CRUDE PALM OIL (CPO) AND PALM KERNEL OIL (PKO) IN EUR TON⁻¹, AND IN EUR TON⁻¹ HECTARE⁻¹ FOR DIFFERENT SMALLHOLDER YIELD LEVELS. MINIMUM (MIN), MEAN AND MAXIMUM (MAX) GREENPALM PREMIUMS FOR ON-MARKET DEALS ARE BASED ON MONTHLY PREMIUM PRICES FOR 2013-2015 [27]. GREENPALM PREMIUMS FOR OFF-MARKET DEALS ARE LIKELY TO BE HIGHER THAN FOR ON-MARKET DEALS, VALUES OF MEDIUM AND HIGH PREMIUMS ARE INCLUDED BASED ON EXPERT JUDGEMENT. SALES OF PALM KERNEL EXPELLER (PKE) ARE NOT TAKEN INTO ACCOUNT. LOW YIELD: 2 TON CPO HA⁻¹ AND 0.3 TON PKO HA⁻¹ (FROM 10 T FFB, ASSUMING AN OIL EXTRACTION RATE OF 20% AND A PALM KERNEL OIL EXTRACTION RATE OF 2.5% [29]); MEDIUM YIELD: 3.6 TON CPO HA⁻¹ AND 0.5 TON PKO HA⁻¹ (FROM 18 T FFB); HIGH YIELD: 5 TON CPO HA⁻¹ AND 0.6 TON PKO HA⁻¹ (FROM 25 T FFB).

Yield level	Premium	On-market deal			Off-market deal	
		Min	Mean	Max	Medium	High
Low	CPO (EUR t ⁻¹)	0.1	1.7	4.4	9	23
	PKO (EUR t ⁻¹)	6	44	78	91	109
	CPO	0	3	9	18	45
	PKO	1	11	19	23	27
	Total	2	14	28	41	73
Medium	CPO	0	6	16	33	82
	PKO	2	20	35	41	49
	Total	3	26	51	74	131
High	CPO	1	8	22	45	114
	PKO	3	28	49	57	68
	Total	4	36	71	102	182

TABLE 8. MODELLED COSTS AND INCOME FOR GOOD AGRICULTURAL PRACTICE AND THREE SCENARIOS OF SMALLHOLDER OIL PALM MANAGEMENT, IN EUR HA⁻¹ OVER A 26 YEAR PERIOD, EXCEPT FOR ANNUAL NET INCOME, WHICH IS MEAN INCOME IN EUR HA⁻¹ YEAR⁻¹, AND FOR ASSUMED YIELD OF MATURE PALMS, IN T FFB HA⁻¹ YEAR⁻¹. OTHER ASSUMPTIONS INCLUDE: CPO PRICE EUR 636 TON⁻¹, OER BETWEEN 15-18%, LOSSES BETWEEN 1-25%. MAINT. = MAINTENANCE. PARTLY REPRINTED WITH PERMISSION FROM [8].

Scenario	Good agricultural practice	High input standard smallholder	Medium input standard smallholder	Low input standard smallholder
Yield (mature)	28	28	15	7
Costs				
Establishment	1078	1216	1144	878
Maint. immature	1345	1080	551	188
Maint. mature	12029	11095	6340	3186
Harvesting	4605	4721	2790	1170
Transport	2632	4655	2536	1064
Total costs	21690	22766	13361	6486
Revenue	65658	52620	24146	8376
Net income	43968	29854	10785	1889
Annual net income	1691	1148	415	73