EEPSEA
2015-RR15

Cost-Benefit Analysis of the Introduction of the Indonesian Sustainable Palm Oil Standards: A Case Study in Jambi Province, Indonesia

Ernah

WorldFish

Published by WorldFish (ICLARM) – Economy and Environment Program for Southeast Asia (EEPSEA)
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ISBN: 978-971-9994-94-7

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Suggested Citation: Ernah. 2015. Cost-benefit analysis of the introduction of the Indonesian Sustainable Oil Palm Standards: A case study in Jambi Province, Sumatra, Indonesia. EEPSEA Research Report No. 2015-RR15. Economy and Environment Program for Southeast Asia, Laguna, Philippines.

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July, 2015

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ACKNOWLEDGMENTS

This work was supported by a grant from the Economy and Environment Program for Southeast Asia (EEPSEA). I would like to express my sincere gratitude and appreciation to EEPSEA for entrusting this financial support to me. In particular, I would like to thank Dr. Herminia Francisco, EEPSEA Director and Dr. Pham Khanh Nam, EEPSEA senior economist. I am also grateful to Dr. David James and Dr. Arief Anshori Yusuf for their valuable comments and suggestions on the earlier draft of this report. I am also indebted to Dr. Priyanka Parvathi and Prof. Hermann Waibel of the Institute of Development and Agricultural Economics, Leibniz University of Hannover, for their support, guidance, and suggestions. I also want to mention Dr. Eko Ruddy Cahyadi, who had done the initial field work on which this work is based.

I want to thank the Directorate General of Higher Education at the Ministry of Education and Culture, Republic of Indonesia, for providing me with a scholarship to study for my PhD at the Leibniz University of Hannover, Germany. I also want to express my deep gratitude for the support of my home institution, the Padjadjaran University at Bandung.

Last but not least, I am very grateful to the Faculty of Agriculture of Jambi University; my field enumerators; and the respondents, who are the smallholder oil palm farmers in the study sites; for their collaboration during the survey and for providing the required information for this study. Most importantly, I want to thank my husband and my children for their patience and continuous support during my absence from home. I always miss them.

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Ernah

EXECUTIVE SUMMARY

This study presents a cost-benefit analysis of the adoption of sustainability standards by small oil palm farmers in the province of Jambi, island of Sumatra, Indonesia. Sustainability standards are defined as a set of oil palm management practices as defined by the Indonesian Sustainable Palm Oil (ISPO) scheme. A panel data set of 185 oil palm smallholders in the district of Merangin in Jambi was used in this study to distinguish the adopters from the non-adopters. Accordingly, the author identified the per-hectare benefits of ISPO adoption by comparing the oil palm yield and production costs of the two groups. The author also identified a target area in order to create a hypothetical project that introduces ISPO standards among smallholders by means of an extension campaign. Based on the literature on farmers' adoption of similar technologies and using survey data on oil palm management practices of smallholders, the author defined the adoption curve and the benefits of ISPO adoption, respectively. These were accordingly used to estimate the annual cash flow of the net benefits. The ecological benefits were also defined by comparing the difference in pesticide use between adopters and non-adopters of integrated pest management and by using data from literature on the associated external costs of pesticide use. The export parity price for palm oil was converted into fresh fruits. Two basic strategies were explored, namely, (1) introduction of ISPO standards through a conventional extension campaign and (2) introduction of ISPO standards by Farmer Field Schools (FFS). Both simulation scenarios were limited to the productivity and environmental benefits; international certification was excluded in the analysis. An additional simulation model was developed in the study, which represented a scenario with full certification and additional price benefits.

The results of the simulation showed that Strategy (1) would achieve an economic internal rate of return (EIRR) ranging from 10%–32%, assuming that adoption rates of 0.1%–5% can be reached after 10 years. In the FFS scenario, the EIRR would be within the range of 24%–37%, with corresponding adoption rates of 5%–15%. In the certification scenario, project feasibility would depend on the price premium achieved. The calculations showed that with a minimum price of 25% over the current export parity price, a modest EIRR of only 18% can be achieved.

This study concludes that the Government of Indonesia needs to undertake considerable efforts and investments if ISPO standards are to be adopted on a large scale by smallholders.

1.0 INTRODUCTION

1.1 Background

Indonesia has dramatically increased its planting of oil palm, driven by the increasing global demand for palm oil during the last three decades. To date, the oil palm area planted is over 25 times of what it was in the 1980s; it now accounts for approximately half of the world's palm oil production.

The oil palm industry is an important economic sector of Indonesia. It contributes almost 5% to the country's GDP, generates export earnings of over USD 10 billion, and employs over 3 million workers in the country (USDA 2010). Some studies have found that the expansion of oil palm production has helped to reduce poverty in rural areas of Indonesia (World Bank 2010; Susila 2004). To date, almost half of the plantations in Indonesia have not yet reached their productive stage; hence, the share of Indonesian oil palm in global production may further increase in the years to come.

There are three types of oil palm plantations in Indonesia, namely, (1) private plantations, which comprise about 50% of Indonesia's oil palm production area, (2) smallholder farmers with around 40%, and (3) production under state control with just 10%. The Government of Indonesia has actively promoted the participation of smallholder farmers in oil palm plantations in order to achieve more inclusive growth and poverty reduction in rural areas.

There are two types of smallholder production and marketing schemes. The first type involves independent smallholders who are free to market their produce, but must rely on official government extension services for technical support. The second group is the smallholders who have contractual arrangements with large private oil palm companies. Large companies require these small contractors to supply them with oil palm fruits through the company's facilities. The company, in turn, provides financial and technical services to these contractual smallholders.

Sumatra is the primary location of oil palm production in the country, comprising about 80% of national production. In recent years, however, oil palm has also expanded to include Kalimantan, Sulawesi, and Papua. The rapid expansion of oil palm plantation areas has profound socioeconomic and environmental implications. Most oil palm plantations are established in forested areas, where indigenous communities, who are dependent on the forest, have lived for centuries. Although establishing oil palm plantations offers new sources of income, converting natural forests into plantations can threaten the well-being of indigenous communities who rely on natural resources for their livelihoods (Sheil et al. 2009; Belcher, Rujehan, and Achdiawan 2004). Several studies also pointed out the negative impacts of oil palm projects on rural communities, including incidents of human rights violation, land grabbing, and ecosystem destruction (Marti 2008; Colchester, Jiwan, and Chao 2013). Although oil palm development may have contributed to poverty reduction, these effects were found to be greater for districts where poor households are engaged in agriculture (World Bank 2010).

Many smallholders have benefited from the high net revenues derived from oil palm production. However, Rist, Feintrenie, and Levang (2010) cited some of the potential conflicts that frequently emerge from oil palm plantation development, namely, weak local government, lack of clarity of the contracts signed between companies and smallholders, failure of the companies to meet either contractual or perceived obligations, and lack of clarity over land tenure. For example, Vermeulen and Goad (2006) reported that in 2000, every oil palm company in Sumatra had land disputes with local communities.

There is also a trade-off between the economic benefits generated from the oil palm industry and its negative environmental consequences, such as loss of food and natural resources for forest dependent communities, loss of biodiversity, and carbon emissions (Manurung 2001; Koh and Wilcove 2008; Tan et al. 2009; Wilcove and Koh 2010; World Bank 2010; Obidzinski et al. 2012; Schrier-Uijl et al. 2013). Obidzinski et al. (2012), for example, named oil palm development as one of the causes of deforestation, air and water pollution, and soil erosion.

In summary, similar to other changes caused by economic development, the expansion of oil palm production in Indonesia has caused externalities that need government intervention. The Government of Indonesia has responded to this challenge by developing standards that aim to make oil palm production more compatible with the paradigm of sustainable development. Several initiatives have been undertaken to introduce standards in the oil palm industry. The most well-known are the (1) Roundtable on Sustainable Palm Oil (RSPO), a multi-stakeholder voluntary international standard; (2) International Sustainability and Carbon Certification, which is a voluntary international standard related to the sustainable production of biomass for biofuels under the European Union Renewable Energy Directive; and (3) Indonesian Sustainable Palm Oil (ISPO), a mandatory government-led certification scheme.

ISPO is an obligatory government standard introduced in late 2009 that enables Indonesia to reduce greenhouse gas emissions while sustainably increasing oil palm production. The objective was to make this standard mandatory for all oil palm growers in Indonesia by 2014. A pilot ISPO study conducted in March 2011 classified oil palm plantations into five categories, following Decree No. 7/2009 of the Minister of Agriculture I: (1) Category I (very good), (2) Category II (good), (3) Category III (moderate), (4) Category IV (poor) and (5) Category V (very poor). Only plantations from Categories I, II, and III were considered for introducing ISPO. However, plantations that employ slash-and-burn methods were not considered as these are against the sustainability paradigm of the Indonesian palm oil sector. Moreover, plantations have to conform to all the guidelines prescribed by the Ministry of Agriculture, the Ministry of Environment, and the National Land Agency of Indonesia.

The ISPO Appraisal Commission is the authoritative body that decides and regulates conformity to ISPO. A study by the Deutsche Institut für Entwicklungspolitik (DIE, German Development Institute) pointed out that ISPO's credibility is problematic due to the lack of progress monitoring of the initiative (Brandi et al. 2013). In addition, as it is an obligatory standard, there is no membership fee, which, in principle, should make it attractive for growers. Notwithstanding the lack of an obvious enforcement mechanism, ISPO has the potential to make Indonesia internationally competitive, and hence is a better strategy than RSPO.

To date, little is known about the most appropriate mechanism that will encourage oil palm farmers to adopt ISPO. It is reasonable to assume that its declaration as a legal requirement will not automatically lead to producers adopting the standard, especially in the absence of effective enforcement mechanisms. Not surprisingly, Brandi et al. (2013) observed that "the certification process has not advanced on a broad scale since the standard's introduction" (p. 55). The report also recommended for the Government of Indonesia to scale-up its extension services in investment, content, quality, and frequency. In particular, Brandi et al. (2013) recommended the following actions:

1. Provide a high number and frequency of well-planned trainings.
2. Conduct practical training sessions in small groups and through demonstration plots.
3. Teach well-tailored content that emphasizes the ecological dimension of sustainability and covers a broad array of topics, including standards and their requirements, good agricultural practices and effective smallholder organization, and the benefits of certification.
4. Plan training schedules meticulously, i.e., convey content that is thematically focused on one topic, maintain high frequency of training modules with repetitions, and coordinate different topical modules of the training program.
5. Target effective scope of audience—focus training sessions on plot owners but also include hired workers.
6. Establish a system of famer-to-farmer knowledge transfer in order to scale-up adoption of ISPO.

Accordingly, this study focused on the introduction of ISPO principles as a set of oil palm management practices to smallholder oil palm farmers by means of publicly supported extension strategies.

1.2 Research Objectives

This study generally aimed to assess the costs and benefits of implementing ISPO criteria to smallholder oil palm farmers in Jambi, Sumatra in the context of a case study. Specifically, this study aimed:

1. To analyze oil palm smallholders' management practices and compare them with ISPO standards;
2. To conduct a cost-benefit analysis of the measures that facilitate the implementation of the ISPO criteria in oil palm production; and
3. To derive policy recommendations for designing strategies that could introduce ISPO standards among smallholders in Indonesia.

The remainder of this report is organized as follows. The next section discusses the methodology used for the cost-benefit analysis (CBA) of sustainability standards, including its general principles, and the study approach. Section 3 presents the data collection procedure, followed by the assumptions used in this analysis in Section 4. Section 5 discusses the results, and Section 6 concludes this report with some policy recommendations and outlook.

2.0 METHODOLOGY

2.1 General Principles

This study used the CBA method to analyze the adoption of Indonesian smallholders of the ISPO standards. Following the principle of natural resource management discussed by Zilberman and Waibel (2007), adopting ISPO standards, in theory, would lead to several benefits. The first would be market benefits (MB_t), which can be divided into three components as follows: consumers' surplus (CS_t), farmers' surplus (FS_t), and manufacturers' surplus (MS_t). These rents accrue in time *t* and must be measured over a defined period of time, practically the expected life span of technology associated with ISPO standards. The sum of this measure is MB_t, where

$$MB_t = CS_t + FS_t + MS_t \,. \qquad \text{Equation (1)}$$

The second type of benefit of ISPO introduction would be the nonmarket benefits (NMB_t), which include benefits in the form of positive human health effects from less pesticide use (NH_t), benefits from natural resources conservation like better soil management practices (NR_t), and environmental benefits such as species conservation (EB_t). Some of these benefits may be internalized by the adopters of the technology. For instance, improved farmer health from the reduced toxic chemicals is considered to be part of their willingness to pay for the technology; it is, therefore, included in FS_t. The nonmarket benefits (NMB_t) can be accounted as follows:

$$NMB_t = NH_t + NR_t + EB_t \,. \qquad \text{Equation (2)}$$

To quantify nonmarket benefits, cost accounting techniques of monetization (e.g., damage and replacement cost approaches) can be used; however, such techniques are time consuming. Alternatively, aggregate measures for externalities from literature can be used as proxies. The sum of market and nonmarket benefits at time *t* (TB_t) can then be expressed as

$$TB_t = MB_t + NMB_t \,. \qquad \text{Equation (3)}$$

The benefits must be compared with the costs of ISPO development and implementation. The full costs (TC_t) of ISPO are difficult to measure because attributing the development costs is difficult; however, it is reasonable to assume that there are specific research costs (RC_t) that can represent the costs of adopting the ISPO criteria for local conditions (DC_t). These costs will also be difficult to assess and attribute to a specific instance of ISPO introduction. Other costs include ISPO criteria diffusion through extension efforts of informing producers (EC_t). Thus, the total cost of developing and introducing ISPO criteria at time *t* can be expressed as

$$TC_t = RC_t + DC_t + EC_t \,. \qquad \text{Equation (4)}$$

Considering the timeframe of an ISPO project, the discount rate *r* must be introduced. Hence, the present value of the net benefits can be calculated as

$$NPV = \sum_{t=0}^{t=T} TB_t / (1+r)^t - \sum_{t=0}^{t=T} TC_t / (1+r)^t. \qquad \text{Equation (5)}$$

The internal rate of return (IRR) is the discount rate resulting in 0 net present value (NPV), which can be expressed as

$$NPV = \sum_{t=0}^{t=T} (TB_t - TC_t) / (1+IRR)^t = 0 \,. \qquad \text{Equation (6)}$$

Following Pearce and Turner (1990), the IRR of aggregate investments in the development and introduction of ISPO criteria can be compared with the social opportunity costs of capital or the social rate of time preference. In addition, there may be other, albeit less tangible, factors that can affect the IRR such as network externalities; social capital; prior knowledge; institutional arrangements; and social, cultural, and policy conditions. These factors may be reflected in the adoption rates of measures related to the ISPO criteria implemented by oil palm smallholders.

At the aggregate level, the increased productivity effects that can be expected from introducing improved oil palm management practices following ISPO criteria would shift the supply curves for both fresh palm fruits and crude palm oil (CPO). In addition, relative to conventional oil palm production, ISPO can generate positive nonmarket benefits that can accrue from the adoption of more environmentally benign management practices such as integrated pest management that uses lower amounts of and less toxic pesticides. In this sense, ISPO practices can create a win-win situation for smallholders and society at large.

Figure 1 illustrates the ISPO impacts from a theoretical point of view. The diagram has an upper and a lower panel. The upper panel illustrates the usual market model with a downward sloping demand curve *D* and the upward sloping supply curve *S*, where *P* is price and *Q* is quantity of fresh palm oil fruits. S_1 is the conventional oil palm management technology. S_2 is the improved technology following ISPO adoption, and leads to a downward shift of the aggregate supply curve. This ultimately results in increased supply and lower prices, considering that Indonesia is a major supplier on the world market.

The lower panel of Figure 1 defines the environmental damage associated with oil palm production. A straight line is assumed from the origin and goes downwards. This shows the increase in environmental costs with increasing oil palm quantity, denoting this damage curve as E_1. Introducing ISPO standards shifts the damage curve to E_2; thus, demonstrating a win-win situation with increasing productivity (shift from S_1 to S_2) accompanied by decreasing environmental damage. In other words, even at a higher level of palm oil production, the environmental damage would be lower when smallholders (and companies) follow the ISPO technology regime.

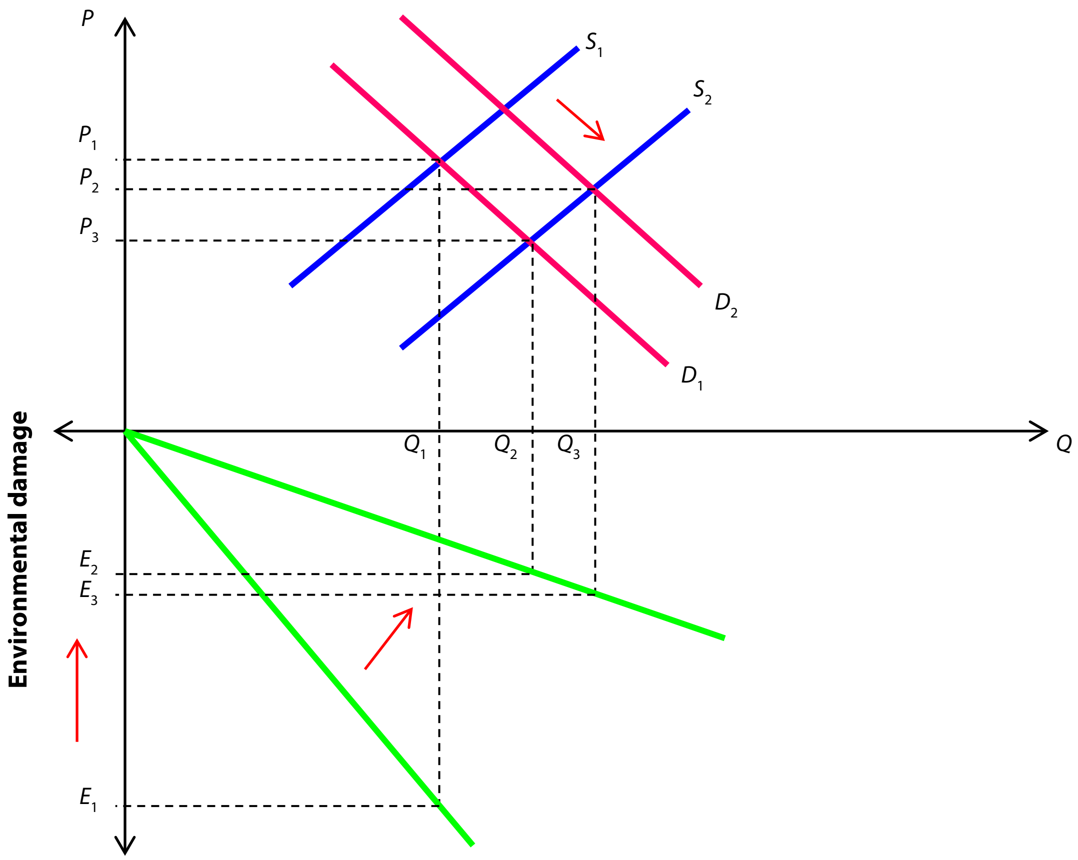


Figure 1. Theoretical effects of ISPO (with and without certification) on market and environment

The next step would be to introduce oil palm certification that is recognized by the international market. This would then result in a shift of the demand curve from D_1 to D_2. For simplicity, assume that this would not lead to further environmental benefits, although one could argue that the much stricter monitoring results under a certification scheme may justify a further upward shift in the damage curve in the lower panel of Figure 1.

In this study, the principles outlined above were followed in the CBA. Since this study primarily focused on the smallholders, the analysis concentrated on the farmer level and excluded the manufacturing (processing) level. However, the externalities of palm oil production were included in the quantification of the costs and benefits and in the estimation of the NPV, IRR, and benefit-cost ratio (BCR) under the various scenarios of ISPO introduction to oil palm smallholders. The whole analysis was done under the context of a hypothetical (albeit real-world) situation in the project target area in Jambi province, Sumatra, Indonesia.

2.2 Study Approach

This section outlines the approach taken by the author in order to conduct a CBA of introducing ISPO standards to smallholder farmers in Jambi, Indonesia. The study assumed a hypothetical project, in which ISPO standards are introduced to smallholder oil palm farmers in a hypothetical project area by means of alternative extension approaches. The project target area is a district with smallholder oil palm plantations in Jambi, Sumatra.

Two scenarios were assumed in introducing ISPO to smallholder farming. The first scenario involved a standard extension campaign with an initial five-day intensive classroom-cum-field demonstration type of training for farmers, a follow-up training in Year 2 of the project, and some low-intensity extension activities until Year 5. The second scenario involved a Farmer Field School (FFS) type of training (Feder, Murgai, and Quizon 2003), with season-long participatory practical and theoretical field-based training. Follow-up trainings or follow-up extension activities were not included in this scenario; the FFS approach usually relies on reciprocal farmer-to-farmer information exchange, which does not have additional costs.

Although ISPO is a mandatory standard, adoption is the choice of the individual smallholder since there is no enforcement mechanism. Therefore, this study assumed an adoption curve with the usual sigmoid shape. Arguably, the two extension approaches would lead to different adoption curves, with the intensive method leading to faster and higher degrees of adoption.

A project horizon of 15 years was assumed in the analysis; thereafter, the effect of the campaign would have vanished or alternative means would have become relevant. These would be subject to a separate further analysis.

The benefits of ISPO adoption consist of economic and environmental benefits. Economic benefits were defined as the difference in the yield of smallholder farmers whose crop management practices fulfill a minimum set of criteria defined in ISPO and of those who did not follow such practices. This study defined smallholder adopters as those with a threshold of more than four crop management practices; those with fewer than four practices were defined as non-adopters. The empirical base for this comparison was the three-year panel data that had been obtained from three villages in Merangin district, Jambi province (see Section 3). To obtain the gross benefits, the author multiplied the average yield difference over the three-year period between the two groups of farmers by the export parity price of crude palm oil at farm gate that had been converted into fresh fruit bunch (FFB) equivalents. The net economic benefits per hectare were then derived by deducting the difference in variable cost of production from the gross benefits, assuming that adopters have higher costs corresponding with their higher yields.

Likewise, this study defined environmental benefits based on the approach suggested by Levin et al. (2012). Specifically, Levin et al. (2012) observed that adopters of the voluntary international standards based on the RSPO had followed IPM practices, which led to their lower use of pesticides and herbicides. Accordingly, assuming that there is no difference between the management practices of ISPO and that of RSPO, the present study considered in the calculation the difference in the value of herbicides and pesticides between farmers who use at least two IPM practices and those who do not. Likewise, the author used a factor of 2:1 to account for the effect of externalities of pesticide use, such that one unit of pesticide reduction results in two units of environmental (and health) benefits. This value is based on the study of Rola and Pingali (1993) on the external effects of pesticide use in the Philippines.

This study included in the sample only those smallholders whose plantations were in the productive stage (i.e., at least seven years), with a similar tree age distribution between adopters and non-adopters. The NPV and BCR were then calculated using a discount rate equal to the interest rates for medium-term loans in Indonesia. The IRR was also calculated (i.e., economic internal rate of return [EIRR]), which was then used to analyze the different scenarios that would determine the optimal strategy for introducing ISPO into smallholder farming.

3.0 DATA COLLECTION

The province of Jambi is a major oil palm-producing area in Indonesia. It was selected as the study area due to the contribution of its oil palm industry to the provincial economy and to the province's labor market since the industry provides major employment in the province. In 2009, a total of 168,140 households in Jambi cultivated oil palm, and 55% of these households were engaged in contractual arrangements with oil palm companies (BoA 2010).

The research team conducted a household survey in January and February 2010. In total, the survey involved 245 oil palm smallholders, which were spread across three villages surrounded by a nucleus company. A total of 126 farmers were contract smallholders, whereas 119 were noncontract smallholders.

The research team employed a multistage sampling procedure in the survey. First, an oil palm nucleus company covering 15,441 hectares (ha) in Merangin district was selected as the study area because the district's oil palm area represented several stages of oil palm growth. Second, three villages were selected based on the distance criteria of the oil palm mill to the production sites. The distance was accordingly categorized into three, namely near (10 km), medium (20 km), and far (50 km). Third, households were sampled randomly, with probabilities proportional to the number of oil palm growers in each village.

Interviews were carried out by using a modularly structured questionnaire. The main modules involved household characteristics, shocks, crops, livestock, natural extraction, off-farm, household expenditures, and oil palm production. The section on oil palm inquired about the details of the farmers' production and inputs.

The enumerators conducted the baseline survey in 2010, in which all of the information asked in the survey referred to the reference period of 1 January, 2009 to 31 December, 2009. The second part of the survey was implemented in 2012, which basically collected the same information as that in 2010, but also covered an additional module on environment and natural resources. The researchers conducted a follow-up survey in 2013, which retained the basic sections of the first questionnaire (i.e., 2010 survey questionnaire) but with additional questions on management practices related to ISPO. The survey was complemented by interviews with stakeholders (i.e., village leaders and representatives of oil palm companies). Focus group discussions were also conducted in all three villages to better understand the current socioeconomic conditions as well as the opportunities and constraints in introducing sustainable oil palm production regimes.

The analysis included only those farmers whose plantations had reached productive age (i.e., seven years old). None of the plantations had reached old age; thus, the total number of households included in the three-year panel was 185.

4.0 ASSUMPTIONS

This section specifies the assumptions used in the CBA. First, the economic and environmental benefits assumed to be attributable to the management of oil palm practices under the ISPO regime are quantified in this section. The analysis subsequently specifies the costs of the hypothetical project to introduce ISPO standards to smallholder oil palm farmers. This section also presents the assumptions made for the adoption curves of both the economic and environmental benefits based on plausibility considerations, and provides the reason for the choice of the discount rate. The calculations were performed in several scenarios, which are reflected in the assumptions on costs, benefits, and adoption rate.

4.1 Benefits

4.1.1 Economic benefits

The research team selected 185 households engaged in oil palm plantations from the sample of 295 households in four villages in Jambi province. As explained in Section 3, the selected households are located at the three villages in Merangin district and had plantations in productive age. The 2013 household survey included questions regarding management practices. These practices were compared with the ISPO standards in order to define the number of farmers that meet a minimum number of ISPO criteria.

Table 1 shows that nearly 90% of the farmers in the study meet at least two ISPO criteria, although this percentage declines rapidly as the threshold increases. The author chose a threshold of four criteria, and defined ISPO adopters as those households that follow almost half of the maximum number of criteria. A higher threshold number could be argued, but this would have left fewer households among adopters and less variation among management practices. By choosing a threshold of four criteria, the study was able to include 115 adopters and 70 non-adopters.

The author took the average yield values across the three-year panel data set, and compared the fresh fruit yield between adopters and non-adopters. As shown in Table 2, the mean difference between the two groups is 1,278 kg/ha. This is equivalent to a yield increase of 10% on average, albeit with considerable variation over the three years. In 2010, yields between adopters and non-adopters were almost equal; in 2013, adopters enjoyed an increase of well over 15%. Generally, the observed yield difference is a conservative estimate. For example, Levin et al. (2012) reported an increase of up to 180%, which the author considered to be a very optimistic estimate. Levin et al. (2012) noted, however, that the yields of smallholders ranged from 14 to 17 t/ha of palm oil, which is equivalent to about 3–3.5 t/ha of CPO. These values were reported to be quite comparable with the yields observed in other studies, and therefore indicate that smallholder oil palm farmers may be no less productive than the other plantations.

Table 1. Threshold chosen for adopting ISPO criteria, in percentage (n = 185)

No. of ISPO Criteria	Frequency	% of Total Households Interviewed
2	165	89.19
3	147	79.46
4	115	62.16
5	90	48.65
6	64	34.59
7	32	17.30
8	16	8.65
9	5	2.70

Source: Household survey (2013)

Table 2. Yields of fresh fruit palm of adopters and non-adopters of ISPO standards

Year	FFB yield (in kg/ha)				
	Adopters (n = 115)	Non Adopters (n = 70)	Difference	t-stat	p-values
2010	14,853.03	14,938.91	–85.88	0.120	0.905
2012	16,106.04	14,403.83	1,702.21	–1.106	0.270
2013	17,057.02	14,838.04	2,218.98	–1.002	0.318
Mean	**16,005.36**	**14,726.93**	**1,278.43**	**–1.378**	**0.169**

Source : Household survey (2010, 2012, 2013)

The author did not use the observed average price of FFB as paid to oil palm smallholders in the sample to estimate the economic benefits of oil palm farming. This price is a financial price; thus, it is not consistent with the requirements of a CBA. Instead, the author derived the export parity price of FFB at farm gate from the world market price of CPO, considering real resource use for processing, loading, transportation, and retribution costs (Table 3). Taxes were eliminated as transfer payments that do not affect real resource use of the economy. Table 3 summarizes the assumptions used in the calculation of the export parity price used in the study. These assumptions include a processing factor of 21% for palm oil and 3.5% for palm kernel. Hence, an export parity price of IDR 1,261.77/kg of FFB was derived. This was then multiplied by the observed yield difference between adopters and non-adopters from Table 2. As the ISPO regime has not yet gained recognition by the international markets for CPO, the study excluded price benefits and produced an identical output price for both adopters and non-adopters.

To calculate the net benefits of ISPO adoption, the author took into further account the observed differences in variable cost of production between adopters and non-adopters. The study was based on the premise that ISPO adopters would apply farm inputs more judiciously and as a function of need. Consequently, farm inputs would approach optimum levels and be more highly variable over time. Table 4 shows that, on average over the three years of the panel data, the difference is small—just about IDR 170,000/ha. However, in 2013, adopters had lower variable costs and yet achieved higher yields (see Table 2), which indicates higher efficiency.

Table 3. Calculation of export parity price at farm gate for FFB (in IDR/kg)

Item	Value (IDR/kg)	Conversion Factor (%)	Value per Kilogram of Fresh Fruit (IDR/kg)
Value			
Crude Palm Oil (FOB)	6,218.80	21.00	1305.95
Palm Kernel	2,627.00	3.50	91.95
Costs			
Processing CPO	400.00	21.00	84.00
Processing Kernel	400.00	3.50	14.00
Retribution CPO	10.00	21.00	2.10
Retribution Kernel	2.00	3.50	0.07
Transportation	150.00	21.00	31.50
Others CPO	20.00	21.00	4.20
Others Kernel	7.50	3.50	0.26
Sum of Conversion Cost			**136.13**
Export parity price for FFB at farm gate (IDR/kg)			**1,261.77**

Source: Own survey data and data from Bureau of Estate Crops (2009)
Notes: (1) USD 1 = IDR 10,000; (2) FOB = Free on Board

Table 4. Variable cost of oil palm production for adopters and non-adopters of ISPO standards

Year	Costs (in '000 IDR/ha)				
	Adopter (n = 115)	Non-adopters (n = 70)	Difference	t-stat	p-values
2010	7,250.76	6,392.45	858.31	–0.603	0.547
2012	9,297.72	8,240.13	1,057.59	–0.806	0.421
2013	2,354.42	3,738.95	–1,384.53	1.982	0.050*
Mean	**6,300.97**	**6,122.56**	**178.41**	**–0.250**	**0.802**

Source : Household survey (2010, 2012, 2013)
Note: * is significant at 10% level

4.1.2 Environmental benefits

Full adoption of ISPO standards may also result in environmental and health benefits. Using potentially harmful external inputs (e.g., chemical fertilizer and chemical pesticides) more judiciously and following science-based technical recommendations will not only result in higher productivity but can also reduce harm to the environment and people. For example, correct application of fertilizers would minimize the danger of polluting groundwater resources in rural villages, where public and private wells are often the sources of drinking water. Applications of fewer, less frequent, and less toxic pesticide and herbicide compounds will reduce the risks to occupational health and decrease the potential for water contamination. Measuring the environmental effects of improved input management is difficult without detailed studies, such as groundwater quality monitoring, and can therefore hardly be based on assumptions derived from the quantity of use.

In this case, farmers were asked about their use of the IPM concept based on a number of specific practices, such as identifying weeds or pests before applying pesticides and observing specific safety rules. Similar to the procedure for determining the economic benefits, the study analyzed environmental (human health) benefits by defining an adoption threshold of two IPM practices. The costs of pesticides were subsequently compared between adopters and non-adopters of IPM practices (Table 5).

Table 5. Cost of pesticides for adopters and non-adopters of IPM

Year	Costs ('000 IDR/ha)				
	Adopter (n = 29)	Non-adopters (n = 156)	Difference	t-stat	p-values
2010	471.65	541.37	69.72	0.264	0.792
2012	487.85	438.97	–48.88	–0.322	0.749
2013	288.70	419.83	131.13	1.402	0.164
Mean	**416.07**	**466.72**	**50.65**	**0.478**	**0.632**

Source : Household survey (2010, 2012, 2013)

On average over the three observed years, adopters spent approximately IDR 50,000/ha less on pesticides than the non-adopters did. Variations were nevertheless observed over the years, as in year 2012 when adopters had used more pesticides than the non-adopters did; whereas in year 2013, some adopters had used considerably less. The author argues that this variation is reasonable because ISPO standards would make farmers more efficient with their pesticide application. To account for external costs, the study attributed a factor of 2, based on the study of Rola and Pingali (1993) on pesticide use in the Philippines. The observed mean difference was therefore multiplied by 2 to estimate the unitary environmental benefits of ISPO adoption.

With the information displayed in Tables 2–5, the author was able to calculate the unit net benefits for a minimum rate of adoption of ISPO standards, with the addition of environmental benefits as explained above. Net benefits are composed of the economic benefits, and these were calculated in this study as the difference in yield multiplied by the export parity price less the difference in variable costs. The author calculated this on a per-hectare basis in order to make the numbers comparable with the cost assumptions.

4.2 Costs and Adoption Rates

The discussion for the costs of introducing ISPO standards to smallholder farming are based on two different strategies. The first strategy analyzed in this study was that of a conventional extension campaign that included traditional training and communication approaches. The second strategy was the introduction of ISPO by an intensive method (i.e., FFS). The FFS concept, which started in Indonesia in the early 1980s with initial great success, has been applied in numerous extension projects around the world for complex technologies (Braun and Duveskog 2008).

4.2.1 Conventional campaign

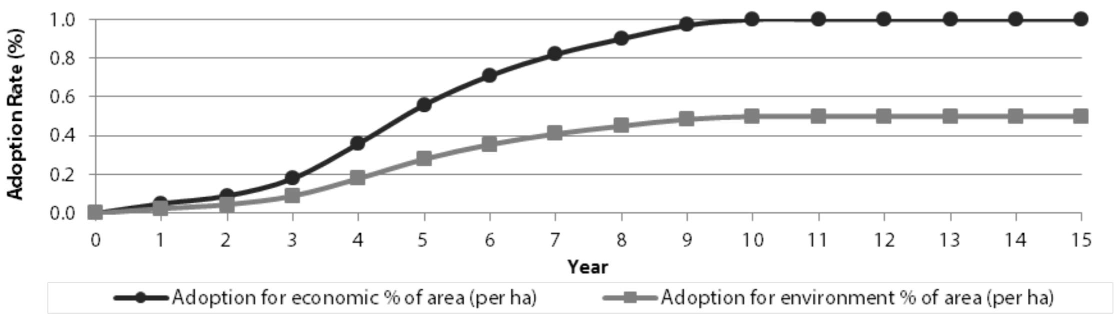
The assumptions incorporated in the conventional extension approach were based on the study of Levin et al. (2012), in which the authors analyzed the incremental financial costs and benefits of the international RSPO standards. In their study, the costs at smallholder level, including training and monitoring costs, were given a range of USD 2.82–11.51 per hectare (equivalent to IDR 28,200–115,100 at USD 1 ≈ IDR 10,000). In this study, this figure was considered as the direct costs of introducing ISPO standards, without the costs of land assessment and environmental and social impact assessment otherwise incurred by oil palm companies during RSPO certification. It can be argued that despite the difference between RSPO and ISPO, farmer training and monitoring costs would be similar. Nevertheless, certification costs were ignored, as the researcher assumed higher initial prices resulting from nonrecognition of the ISPO standards by the international market.

The study assumed three levels of intensity associated with the conventional extension strategy. This strategy defined an initial campaign cost of IDR 20,000/ha, and the same amount in Year 2 for a follow-up activity. Succeeding years would incur monitoring and extension costs of IDR 10,000/ha until Year 5 of the project, at which point no additional external extension activities would take place.

The study assumed a very low rate of adoption for the first-intensity level (Figure 2). This is in consideration of the complexity of the technology and the fact that despite being a mandatory standard, the Government of Indonesia has virtually no enforcement mechanism in place to make farmers follow ISPO practices. Hence, as the technology is knowledge-intensive, adoption would depend on the degree of investment in providing information and training to farmers.

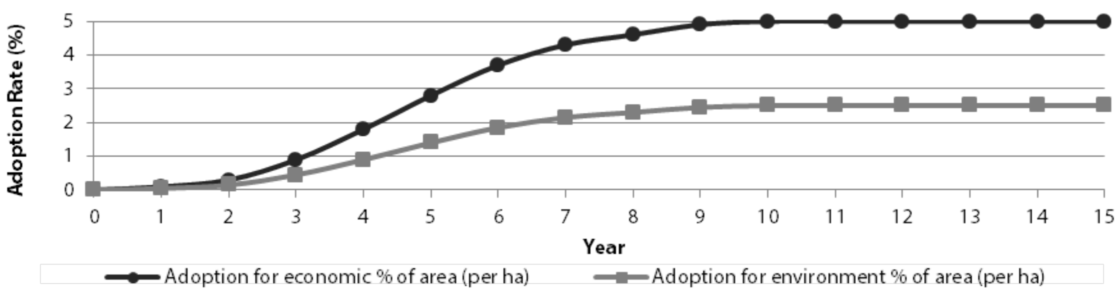
In the low-level intensity extension campaign, the author assumed that 10 years after the campaign, only 1% of the target area would have converted to ISPO practices and only 0.5% would have adopted IPM. It was further assumed that beyond Year 10, no further adoption would occur, although no dis-adoption would take place either. The author believed that these conservative adoption rates are realistic for NRM technologies, in contrast to other technologies related to seeds, fertilizers, or pesticides.

The second variant of the conventional extension strategy assumed that the initial campaign costs would amount to IDR 50,000/ha at Year 0, which would be repeated at Year 2 with the same level of intensity. Monitoring and extension costs would be IDR 10,000/ha until Year 5. These costs are the same as those under the low-intensity scenario. In fact, these would mirror the additional costs for a regular extension worker to address ISPO issues in his/her regular work. In this scenario, the adoption rate was set at a maximum of 5% after 10 years without dis-adoption. In addition, in order to realize environmental benefits, the smallholders were assumed to adopt IPM practices at a rate half that assumed for adoption due to economic benefits (Figure 3).



Note: The figure represents the without certification scenario, with adoption rates for campaign cost amounting to IDR 20,000

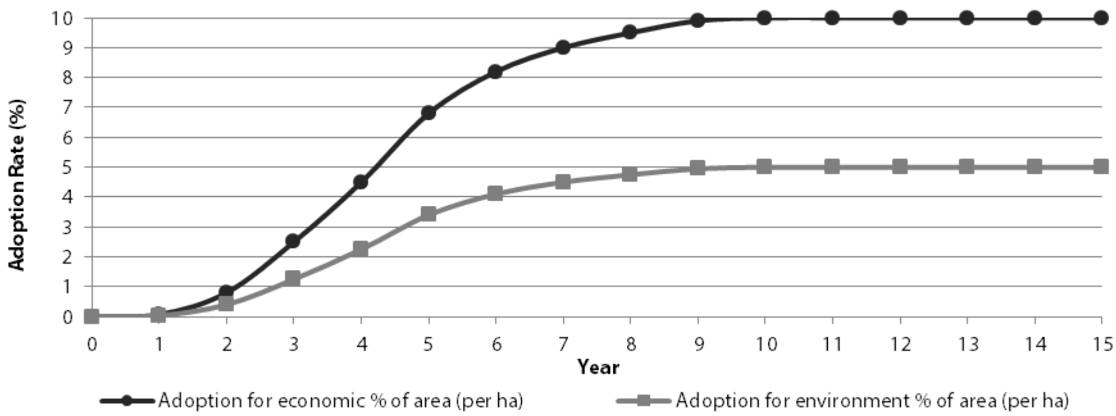
Figure 2. ISPO adoption with low-intensity extension campaign



Note: The figure represents the without certification scenario, with adoption rates for campaign cost amounting to IDR 50,000

Figure 3. ISPO adoption with medium-intensity extension campaign

Finally, the study assumed a more sophisticated extension campaign in the third-intensity level. Initial campaign costs in this scenario would incur about IDR 100,000/ha in Years 0 and 2; it would otherwise have the same conditions as the two other variants (i.e., additional costs for regular extension attributable to ISPO at IDR 10,000/ha). The third level assumed a maximum adoption rate of 10% by Year 10; IPM adoption was again assumed to be half this at 5%. Both rates were assumed to remain at maximum after Year 10 (i.e., no dis-adoption will take place), and are expected to experience the usual sigmoid increase between Years 1 and 10 (Figure 4).



Note: The figure represents the without certification scenario, with adoption rates for campaign cost amounting to IDR 100,000

Figure 4. ISPO adoption with high-intensity extension campaign

4.2.2 Farmer Field Schools

The Farmer Field School approach was designed originally as a way to introduce knowledge on IPM to irrigated rice farmers in Asia. The first country that successfully implemented an FFS was Indonesia. Subsequently, FFS activities have been implemented in many developing countries, although only a few operate FFS as a nationwide system. The World Bank has incorporated FFS in some of its agricultural projects. At present, a typical FFS educates farmer participants on agro-ecosystems analysis, or what is generally described as integrated pest and crop management. This management system includes practical aspects of "...plant health, water management, weather, weed density, disease surveillance, plus observation and collection of insect pests and beneficials" (Indonesian National IPM Program Secretariat 1991, p. 5). The FFS approach relies on participatory training methods to convey knowledge to field school participants to make them into "…confident pest experts, self-teaching experimenters, and effective trainers of other farmers" (Wiebers 1993, p. 20). An FFS usually entails 8–12 half-day sessions of hands-on, farmer experimentation, and nonformal training to a group of 20–25 farmers during a cropping season.

Well-educated, professional trainers implement training programs that focus on problem-solving approaches in pest and crop management. Through group interactions, attendees sharpen their decision-making abilities and are empowered by learning leadership, communication, and management skills (van de Fliert 1993).

The FFS approach is a relatively effective, albeit expensive, method of introducing complex technologies to small-scale farmers. When implemented with high standards, FFS costs can reach around USD 50 (i.e., IDR 500,000) per farmer (Feder, Murgai, and Quizon 2004). The author therefore assumed three FFS scenarios with costs starting from approximately IDR 250,000/ha, a medium-level point that costs IDR 350,000/ha, and a high-quality FFS with costs of IDR 500,000/ha. Figure 5 illustrates the corresponding adoption curves with maximum values of 5%, 10%, and 15 % after 10 years, and without decline thereafter. Since FFS is particularly effective for IPM, identical adoption rates for IPM and other ISPO technology components were assumed.

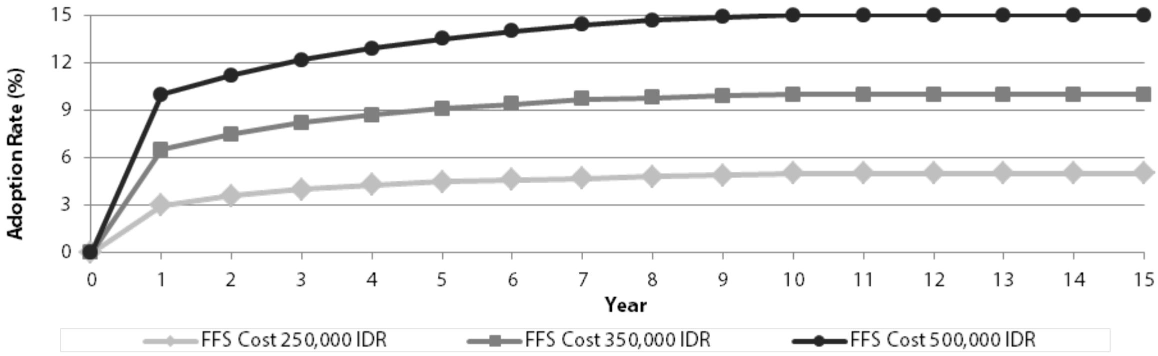


Figure 5. ISPO Adoption rates under three levels of FFS introduction

4.3 Certification

The ultimate goal of ISPO is to be acknowledged by the international market and to receive the same recognition as RSPO. Such recognition would then result in a price benefit for smallholder ISPO adopters. In the certification scenario, the author hypothesized ISPO introduction via a campaign strategy, but at a higher level of intensity. The certification scenario assumed initial campaign costs of IDR 250,000/ha, a follow-up with the same level of intensity in Year 2, plus regular marginal extension costs of IDR 10,000 per annum until Year 5. Following the information obtained from the study of Levin et al. (2012), certification results in initial costs of approximately IDR 35,000/ha; corrective costs in Year 2 of approximately IDR 400,000/ha; and maintenance and monitoring costs of IDR 130,000/ha. These high costs of certification have often been cited in literature as a constraint to adoption. This study calculated a benefit equivalent of IDR 1,577/kg FFB to the certification scenario by assuming the same difference in yield, but accounting for a price benefit of 25%. Figure 6 presents the adoption curves for the certification scenario.

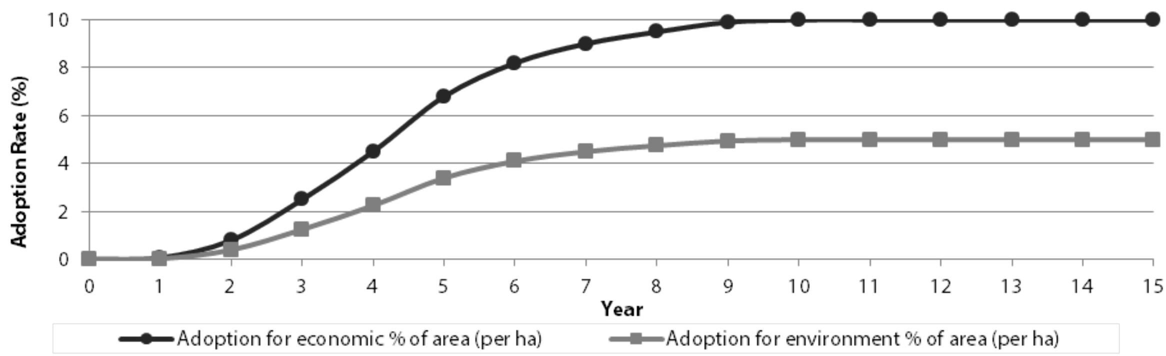


Figure 6. Rates for ISPO adoption with certification

4.4 Discount Rate

In social CBA, the discount rate—referred to as the social rate of time preference—is assumed to reflect the preferences of society (Pearce and Turner 1990). This social rate of time preference can be argued to be lower than the private discount rate partly because private investors carry higher risks than society does. Promoting and introducing sustainability standards can therefore be considered as being in the public interest and would yield benefits that accrue to society at large, and not only to a specific group of people with business interests. On the other hand, the empirical analysis undertaken in this study has shown that under the prevailing conditions of ISPO, the majority of benefits would be market benefits and only a minor share would be attributed to environmental effects.

Consequently, this study used the medium-term lending rate in Indonesia as a five-year average. This rate corresponds to about 13% per annum (World Bank 2010). Hence, all hypothetical future cost and benefit values were discounted by 13%.

5.0 RESULTS AND DISCUSSION

5.1 Extension Campaign

The study assumed that the most plausible scenario for introducing ISPO criteria in Indonesia was through an extension campaign using traditional methods of farmer training. The previous section specified the basic assumptions for this scenario. Based on plausibility considerations, a relationship was assumed to exist between the intensity of the investment campaign and the rate of ISPO adoption; a significantly higher adoption would result when more money (in actual terms, not on paper) is spent for the campaign. The results of this calculation are shown in Table 6.

Table 6. Investment efficiency of ISPO introduction, by campaign strategy, by level of intensity

Campaign Strategy	Campaign Cost (IDR)	NPV (IDR)	BCR	EIRR (%)
Low-Intensity	20,000	–11,820	0.81	10
Medium-Intensity	50,000	138,843	2.19	27
High-Intensity	100,000	341,126	2.66	32

Introducing ISPO standards by means of a low-intensity campaign would not be economical. At a 13% discount rate, the NPV is expected to become negative. Correspondingly, the BCR would be below 1, while the economic internal rate of return (EIRR) would be lower than the discount rate. These values associated with the low-intensity campaign would render the investment inefficient. However, results would change dramatically when campaign efforts are intensified and investments are increased by a factor of 2.5. Under this high-investment strategy, the NPV would turn highly positive and a decent BCR of 2.19 and an EIRR of 27% would be achieved. These medium-intensity values would make the project an attractive investment. Note that public investment in ISPO introduction at this latter level of intensity would be efficient even if only 5% of the target smallholders would adopt the specified minimum number of ISPO practices.

Although effective spending of more money on the campaign would improve the investment outcome, doubling the investment amount as compared to the medium-intensity level does not seem to be justified. The EIRR is expected to increase by just 5 percentage points and, while the BCR would go up to 2.66, it would still be below the ratio of 3 often demanded by investors.

Further insights can be derived from Figure 7, which shows the cash flows of the three campaign scenarios. Logically, the cash flow of the low-intensity campaign would stay negative while the medium- and high-level intensity yields would have a pay-off period of seven and six years, respectively. In other words, the breakeven point for the investment would be reached after a reasonable period of time, and below the respective maximum level of adoption. This would suggest that, even at lower levels of adoption, it would be reasonable for the Government of Indonesia to spend public money for introducing ISPO standards to smallholder oil palm farmers.

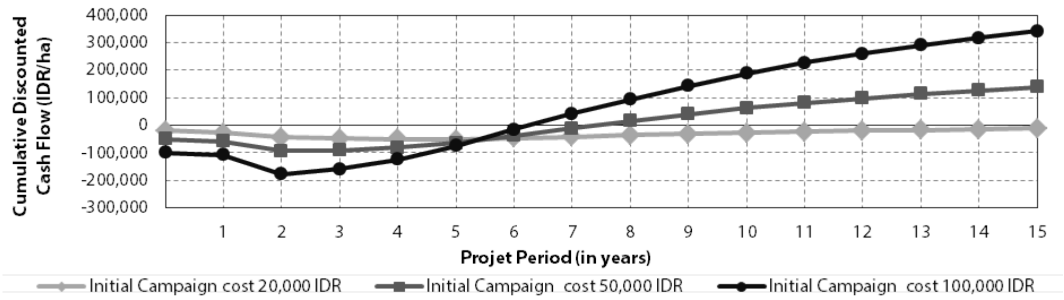


Figure 7. Cash flow for ISPO introduction using three intensity levels of the campaign strategy

Figure 7 suggests that the high-intensity campaign would be the most desirable from an economic point of view. However, using the area between the curve and the x-axis as a measure, this would only be true if absolute measures are applied. Since the adoption rates of ISPO standards would be highest under this strategy, political considerations may also make this strategy attractive for the Government of Indonesia. However, considerable budget would have to be provided and a high degree of quality control would have to be exercised in order to achieve the expected results.

5.2 Farmer Field School Strategy

Numerous studies have been published about the economics of the FFS approach in agriculture (e.g., Feder, Murgai, and Quizon 2004; Witt, Pemsl, and Waibel 2008; Praneetvatakul, Waibel, and Meenakanit 2007; Praneetvatakul and Waibel 2007). Many of these studies acknowledged the high quality of the FFS approach; but at the same time, these studies pointed out that it may be too expensive and unsustainable from a fiscal perspective. On the other hand, this extension and training method would be suitable and economically justifiable if complex and knowledge-intensive technologies must be introduced, as in the case of ISPO standards. The FFS strategy is therefore considered to be a feasible option. As compared to the extension campaign strategy, the FFS would be advantageous such that costs would occur only once, at the beginning of the project. Thereafter, due to strong institution-building effects among members of the field school, no follow-up extension activities would be required; farmer-to-farmer reciprocal information service would emerge from the network activities promoted as part of the school.

Table 7 shows that even a low-cost FFS would already be economical. The low-intensity FFS level, which assumes the initial cost of IDR 250,000/ha and a pessimistic adoption rate of only 5%, would result in a decent EIRR of 24%. This EIRR is well above the discount rate of 13%. The medium-intensity level would incur IDR 350,000/ha, which is a mere IDR 100,000 more expensive than the low-investment intensity campaign strategy. This would yield very good investment parameters, with an EIRR of 35% and a BCR of 2.48. The latter is lower than the 2.66 BCR of the extension campaign because for FFS, all costs would occur in year zero. The full cost FFS would result in a further increase in EIRR, BCR, and NPV. However, the marginal improvement in outcome may not justify the full cost variant.

Table 7. NPV, BCR, and EIRR of three levels of FFS strategy to introduce ISPO

FFS Strategy	Cost (IDR)	NPV (IDR)	BCR	EIRR (%)
Low-Intensity	250,000	174,292	1.70	24
Medium-Intensity	350,000	517,996	2.48	35
High-Intensity	500,000	799,600	2.60	37

As shown in Figure 8, the advantage of adopting the FFS strategy would be its low pay-off period, which is between three and four years for the medium and costly FFS version, and seven years for the cheap version. This positive result is due to the fact that no further investment costs would occur, other than the initial season-long training in Year 0. Again, the lesson from the FFS scenario is that already moderate adoption rates of 5% would render public investment to be efficient, and the adoption of the ISPO standards by 10% of target smallholders makes the project a safe investment. A further increase in initial investment would enhance the profitability of the project in absolute terms. However, as this improvement would be small, it may be more efficient for the government to focus its efforts on increasing the number of FFS rather than on achieving their highest quality. After all, the FFS diffusion mechanism would offer the possibility that selected FFS graduates may implement further field schools in their village and carry out follow up activities.

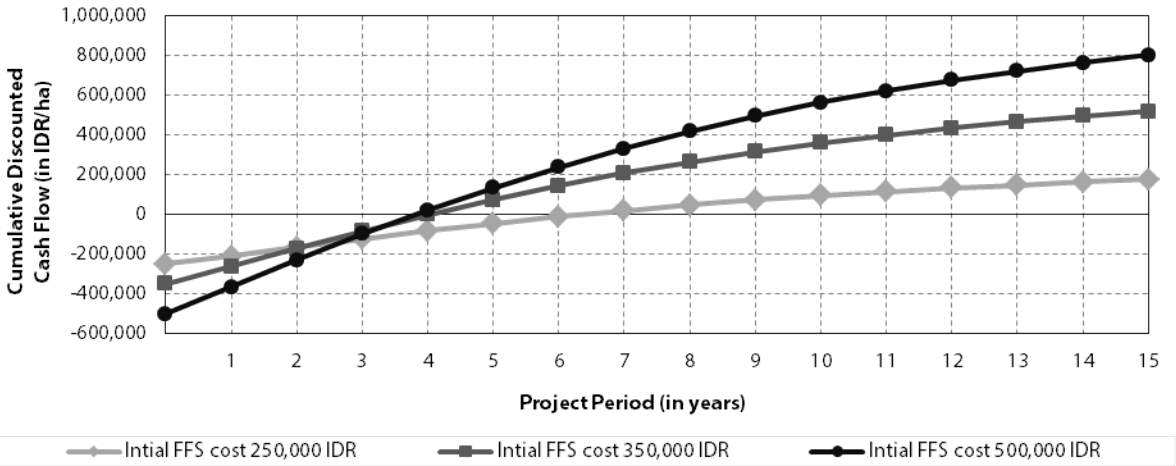


Figure 8. Cash flow of ISPO introduction for three intensity levels of the FFS strategy

5.3 Certification Scenario

Although certification is part of ISPO, it is not yet recognized as an international standard that meets the sustainability criteria. However, it may be regarded as a step toward reaching international recognition in the same stature as that of RSPO (Brandi et al. 2013). Therefore, the author developed an additional scenario that includes certifications, with equivalent costs and benefits as described above. Table 8 defines this scenario, and includes a positive NPV, a greater than 1 BCR, and an EIRR of 18%. While the assumptions used may be debated, the study notes that under current gains in productivity from ISPO adoption (as observed in our sample), the path toward international recognition may be a difficult one for Indonesia. Government subsidies on certification may attract adoption by smallholders, but the efficiency of public investment would remain unchanged.

Table 8. Certification scenario

Parameter	Estimate
Investment cost (IDR/ha)	250,000
Initial certification cost (IDR/ha)	35,000
Correction cost (IDR/ha)	400,000
Annual maintenance and monitoring costs (IDR/ha)	130,000
Adoption rate for economic benefits	10%
Adoption rate for environmental benefits	5%
NPV	174,083
BCR	1.33
EIRR	18%

As shown in Figure 9, the cash flow only turns positive after almost 11 years, which is attributable to the high certification costs. From a public choice perspective, this would not seem justifiable, as the benefits of certification would mainly accrue to oil palm producers and be purely economic. As compared to the ISPO introduction without international certification, the environmental, and possibly social, benefits would remain unchanged. This would suggest that ISPO introduction without certification, as shown in the previous simulation, may be the better choice. Hence, the Government of Indonesia may be well-advised to strengthen ISPO adoption by designing effective extension campaigns or FFS training in order to improve productivity, reduce negative environmental externalities, and reduce human health hazards in smallholder oil palm farming.

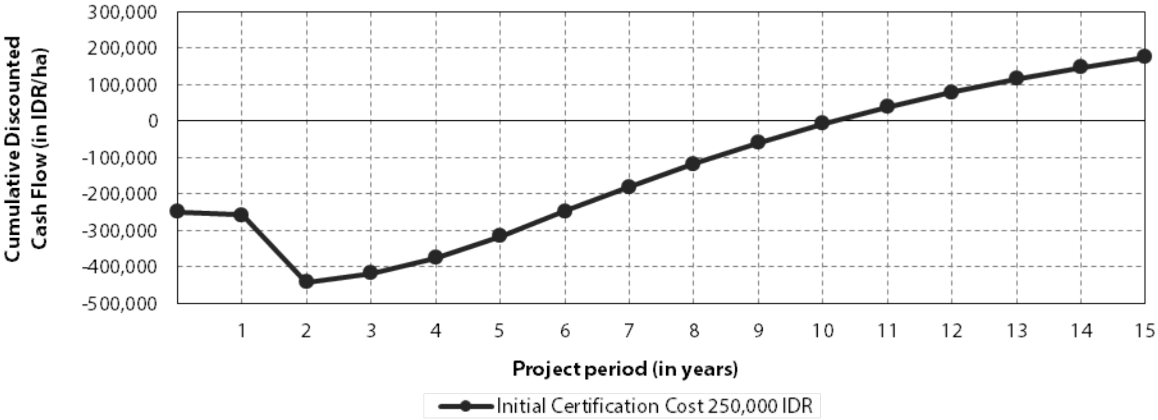


Figure 9. Cash Flow of ISPO introduction for the certification scenario

6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

In the palm oil industry, different initiatives for setting sustainability standards have evolved through the years. The most well-known of these is the RSPO, which is a voluntary, internationally recognized standard for the production and marketing of palm oil. In 2011, the Indonesian government introduced ISPO, which is a mandatory certification scheme that aims to certify all oil palm producers in Indonesia by 2014. ISPO is less strict than the international RSPO, and only has basic requirements for compliance with Indonesian laws and regulations. Introducing ISPO to smallholders is expected to raise productivity and enable compatibility of oil palm management with the sustainability paradigm.

On the other hand, oil palm farmers are not familiar with the mechanisms for the adoption of ISPO. It is reasonable to assume that its declaration as a legal requirement would not automatically lead to adoption by producers, especially in the absence of effective enforcement mechanisms. Not surprisingly, Brandi et al. (2013, p. 55) observed that "the certification process has not advanced on a broad scale since the standard's introduction." The authors then recommended for the Government of Indonesia to scale-up its extension services in terms of investment, content, quality, and frequency.

Against this background, this study presented a CBA for the introduction of ISPO standards to small oil palm farmers in Indonesia. In the absence of information on a well-designed extension strategy by the Government of Indonesia in introducing ISPO standards, a hypothetical project was defined that focused on smallholder oil palm farmers in Jambi province in Sumatra. Two extension strategies were defined. The first strategy was a conventional extension campaign, in principle following the recommendations of Brandi et al. (2013). The second strategy was the FFS approach that aims to establish a farmer-to-farmer knowledge-transfer system. Both strategies target the improvement of crop management practices toward the need-based and judicious use of external inputs and promote practices that are compatible with sustainability goals. However, these strategies do not imply international certification that would provide additional price benefits. The latter has been included in an additional scenario calculation where both certification costs and output price benefits were accounted for.

The benefits of ISPO were defined as both economic and environmental. The economic benefits were defined as the difference in yield observed from a panel data set collected from approximately 245 smallholder farmers in three villages in Merangin district in Jambi, Sumatra. The results of a survey of crop management practices enabled the distinction between farmers closer to ISPO standards and those who were not, which defined the adoption threshold. The positive difference in FFB yields was then multiplied by the export parity price of FFB at farm gate, which itself was derived from the FOB price for CPO. Similarly, the environmental benefits of ISPO adoption were derived from a threshold for IPM and by using the difference in pesticide costs between adopters and non-adopters. The cost difference was multiplied by a factor to reflect externalities.

The results of the scenario analysis can be summarized as follows:

1. Low-investment and poor-quality extension campaigns would result in poor investment performance and would not justify public funds.
2. A medium-level intensity extension campaign could already provide a decent EIRR even at a moderate adoption level of just 5% by Year 10.
3. A high-investment extension campaign would increase investment performance only moderately, but may be attractive from a political point of view as the ISPO adoption rate would be much higher, thereby making the standard more attractive at the international level.
4. An FFS strategy to introduce ISPO would be economically justifiable even for a low-cost FFS regime. The low-cost variant with an adoption rate of only 5% would achieve an EIRR of 24%, which is well above the discount rate of 13%. The USD 35/ha variant gives a good investment EIRR of 35%, and the full cost FFS would result in a further increase in investment performance. The FFS strategy is also expected to be attractive because of its low pay-off period. It would also have the potential to generate additional ISPO projects by farmer-to-famer transfer, with lower costs of additional FFS implemented by farmer trainers.
5. The international certification scenario with an assumed price benefit of 25% would not yield very attractive investment performance; the certification costs would be prohibitive relative to the economic benefits.

There are at least two important conclusions from these simulation exercises. First, the Indonesian Government would be well-advised to provide adequate investment for extension services to enable the introduction of ISPO standards among smallholders. This could be done by implementing sufficient number of well-designed and well-targeted, small-scale extension projects. Second, it appears that the current strategy of the Government of Indonesia to use the national ISPO regime as a step toward international certification would be a reasonable strategy. Jumping straight into RSPO level may only be justifiable from a welfare economics point of view if the economic and environmental benefits from ISPO standards can be increased. Having the political will to strengthen the extension capacities in oil palm areas would increase the benefits to be realized from ISPO, considering the existing and observable variation in crop management practices among smallholder oil palm farmers, which would support the apparent willingness to adopt IPM, and therefore ISPO, practices.

It cannot be denied that the study has some limitations. First, some debatable assumptions had to be made in the absence of practical ISPO adoption criteria and due to the lack of scientific studies on the environmental and natural resources effects of sustainability in oil palm production. Second, the study is limited to the smallholder plantation level and excluded the estate or oil palm industry production and processing levels. Nevertheless, the author believes that the study allows some recommendations to be proposed to the Government of Indonesia with regard to how it can make "the dream of sustainable palm oil" a reality within a foreseeable period of time.

In particular, the following measures are recommended:

1. Draw-up a national extension strategy for introducing ISPO standards. As shown by numerous adoptions studies of agricultural technologies and as economic theory suggests, farmers will only adopt such practices if the economic benefits are obvious and the technology is comprehensible. Hence, there needs to be a national plan with targets, time frame, and sufficient resources to introduce ISPO crop management practices to smallholders.
2. Design a location-specific crop management set of practices by incorporating existing farmer knowledge. As shown by the survey, there is a great deal of variation in crop management practices. In addition, farmers have probably used their own experiences to experiment with various alternative methods, especially as smallholder farmers are aware of the changes that have come with large-scale oil palm implementation. Hence, the study suggests taking account of spatial variation in oil palm plantation management and incorporating farmer knowledge and experience in the implementation of ISPO. This would increase the likelihood of adoption and raise the economic and environmental benefits from ISPO.
3. Design appropriate policy incentives and specify a time frame to achieve international certification after a sufficient level of ISPO adoption has been achieved. The idea of using ISPO as an intermediate step

before going to the more stringent RSPO standards has some merit, and the Government of Indonesia is correct in taking this stepwise approach. On the other hand, there needs to be a clearly formulated vision and strategy on how the smallholders can level up to international standards, achieve international recognition for their fully certified plantations, and realize not only productivity benefits but also premium price effects for certified products and processes.

4. Finally, this study suggests for independent research organizations to conduct more cost-benefit studies, including at the company level; these studies should incorporate processing and marketing. This requires some effort by the Government to urge companies to be cooperative and to provide data for such undertakings.

LITERATURE CITED

Belcher, B.; Rujehan, N.I.; and Achdiawan, R. 2004. Rattan, rubber, or oil palm: Cultural and financial considerations for farmers in Kalimantan. Economic Botany, 58(1), S77–S87.

Brandi, C.; Cabani, T.; Hosang, C.; Schirmbeck, S.; Westermann, L.; and Wiese, H. 2013. Sustainability certification in the Indonesian palm oil sector: Benefits and challenges for smallholders. DIE Studies No. 14. Deutsches Institut für Entwicklungspolitik, Bonn, Germany.

Braun, A. and Duveskog, D. 2008. The farmer field school approach: History, global assessment, and success stories. IFAD Rural Poverty Report. International Fund for Agricultural Development, Rome, Italy.

Bureau of Agriculture (BoA). 2010. Statistics of crop estates in Jambi. Bureau of Agriculture, Jambi, Indonesia.

Bureau of Estate Crops. 2009. Statistics of crop estates in province of Jambi. Bureau of Estate Crops, Jambi, Indonesia.

Colchester, M.; Jiwan, N.; and Chao, S. 2013. Conflict or consent? Oil palm expansion and community rights? Presented at the Annual World Bank Conference on Land and Poverty, 8–11 April, 2013, Washington, D.C., VA. The World Bank. Washington D.C., VA.

Feder, G.; Murgai, R.; and Quizon, J. 2003. Sending farmers back to school: The impact of farmer field schools in Indonesia. World Bank Policy Research Working Paper No. 3022. The World Bank, Washington, D.C., VA.

———. 2004. The acquisition and diffusion of knowledge: The case of pest management training in farmer field schools, Indonesia. Journal of Agricultural Economics, 55(2), 221–243.

Indonesian National IPM Program Secretariat. 1991. Farmers as experts: The Indonesian National IPM Program. Indonesian National IPM Program, Jakarta, Indonesia.

Koh, L.P. and Wilcove, D.S. 2008. Is oil palm agriculture really destroying tropical biodiversity? Conservation Letters, 1(2), 60–64.

Levin, J.; Ng, G.; Fortes, D.; Garcia, S.; Lacey, S.; and Grubba, D. 2012. Profitability and sustainability in palm oil production: Analysis of incremental financial costs and benefits of RSPO compliance. WWF Report March 2013 Issue. World Wide Fund for Nature, Washington, D.C., VA.

Manurung, E.G.T. 2001. Analisis valuasi ekonomi investasi perkebunan kelapa sawit di Indonesia. Natural Resources Management Program, Bogor, Indonesia.

Marti, S. 2008. Losing ground: The human rights impacts of oil palm plantation expansion in Indonesia. Friends of the Earth/Life Mosaic/Sawit Watch, London, UK.

Obidzinski, K.; Andriani, R.; Komarudin, H.; and Andrianto, A. 2012. Environmental and social impacts of oil palm plantations and their implication for biofuel production in Indonesia. Ecology and Society, 17(1), 25.

Pearce, D.W. and Turner, R.K. 1990. Economics of natural resources and the environment. The Johns Hopkins University Press, Baltimore, MD.

Praneetvatakul, S. and Waibel, H. 2007. Investments in training farmers to reduce excessive pesticide use in agriculture. *In* Kunstadter, P., ed., Pesticides in South East Asia. Sanga Sabhasari Research Foundation, Silkworm Books, Bangkok, Thailand. 301–314.

Praneetvatakul, S.; Waibel, H.; and Meenakanit, P. 2007. Farmer field schools in Thailand: History, economics and policy. University of Hannover, Hannover, Germany.

Rist, L.; Feintrenie, L.; and Levang, P. 2010. The livelihood impacts of oil palm: Smallholders in Indonesia. Biodiversity and Conservation, 19(4), 1009–1024.

Rola, A. and Pingali, P.L. 1993. Pesticides, rice productivity, and farmers' health: An economic assessment. International Rice Research Institute, Laguna, Philippines.

RSPO (Roundtable on Sustainable Palm Oil). 2007. RSPO principles and criteria for sustainable palm oil production. http://www.rspo.org/file/RSPO%20Principles%20&%20Criteria%20Document.pdf (Retrieved 27 February, 2013).

Schrier-Uijl, A.P.; Silvius, M.; Parish, F.; Lim, K.H.; Rosediana, S.; and Anshari, G. 2013. Environmental and social impacts of oil palm cultivation on tropical peat. Roundtable on Sustainable Palm Oil, Kuala Lumpur, Malaysia.

Sheil, D.; Casson, A.; Meijaard, E.; van Nordwijk, M.; Gaskell, J.; Sunderland-Groves, J.; Wertz, K.; and Kanninen, M. 2009. The impacts and opportunities of oil palm in Southeast Asia: What do we know and what do we need to know? CIFOR Occasional Paper No. 51. Center for International Forestry Research, Bogor, Indonesia.

Susila, W.R. 2004. Contribution of oil palm industry to economic growth and poverty alleviation in Indonesia. Jurnal Litbang Pertanian, 23(3), 107–114.

Tan, K.T.; Lee, K.; Mohammed, A.R.; and Bathia, S. 2009. Palm oil: Addressing issues and towards sustainable development. Renewable and Sustainable Energy Reviews, 13(2), 420–427.

USDA (United States Department of Agriculture). 2010. Indonesia rising global demand fuels palm oil expansion. USDA, Washington, D.C., VA.

van de Fliert, E. 1993. Integrated pest management: Farmer field schools generate sustainable practices. A case study in Central Java evaluating IPM training. Agricultural University Wageningen, Wageningen, The Netherlands.

Vermeulen. S. and Goad, N. 2006. Towards better practice in smallholder palm oil production. Natural Resource Issues Series No. 5. International Institute for Environment and Development, London, UK.

Wiebers, U.C. 1993. Integrated pest management and pesticide regulation in developing Asia. World Bank Technical Paper No. 211. Asia Technical Department Series, The World Bank, Washington, D.C., VA.

Wilcove, D.S and Koh, L.P. 2010. Addressing the threats to biodiversity from oil-palm agriculture. Biodiversity and Conservation, 19(4), 996–1007.

Witt, R.; Pemsl, D.E.; and Waibel, H. 2008. The farmer field school in Senegal: Does training intensity affect diffusion of information? Journal of International Agricultural and Extension Education, 15(2), 47–60.

World Bank. 2010. Environmental, economic, and social impacts of oil palm in Indonesia: A synthesis of opportunities and challenges. World Bank Discussion Paper. The World Bank, Washington, D.C., VA.

———. 2012. Lending interest rate. http://data.worldbank.org/indicator (Retrieved 27 February, 2013).

Zilberman, D. and Waibel, H. 2007. Chapter 3: Productivity enhancement and natural resource management. *In* H. Waibel and D. Zilberman, eds., International research on natural resources management: Advances in impact assessment. CABI Publishers, Wallingford, UK. 21–55.

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