An Economic Analysis of Shifting Cultivation and Bush-Fallow in Lowland Sumatra

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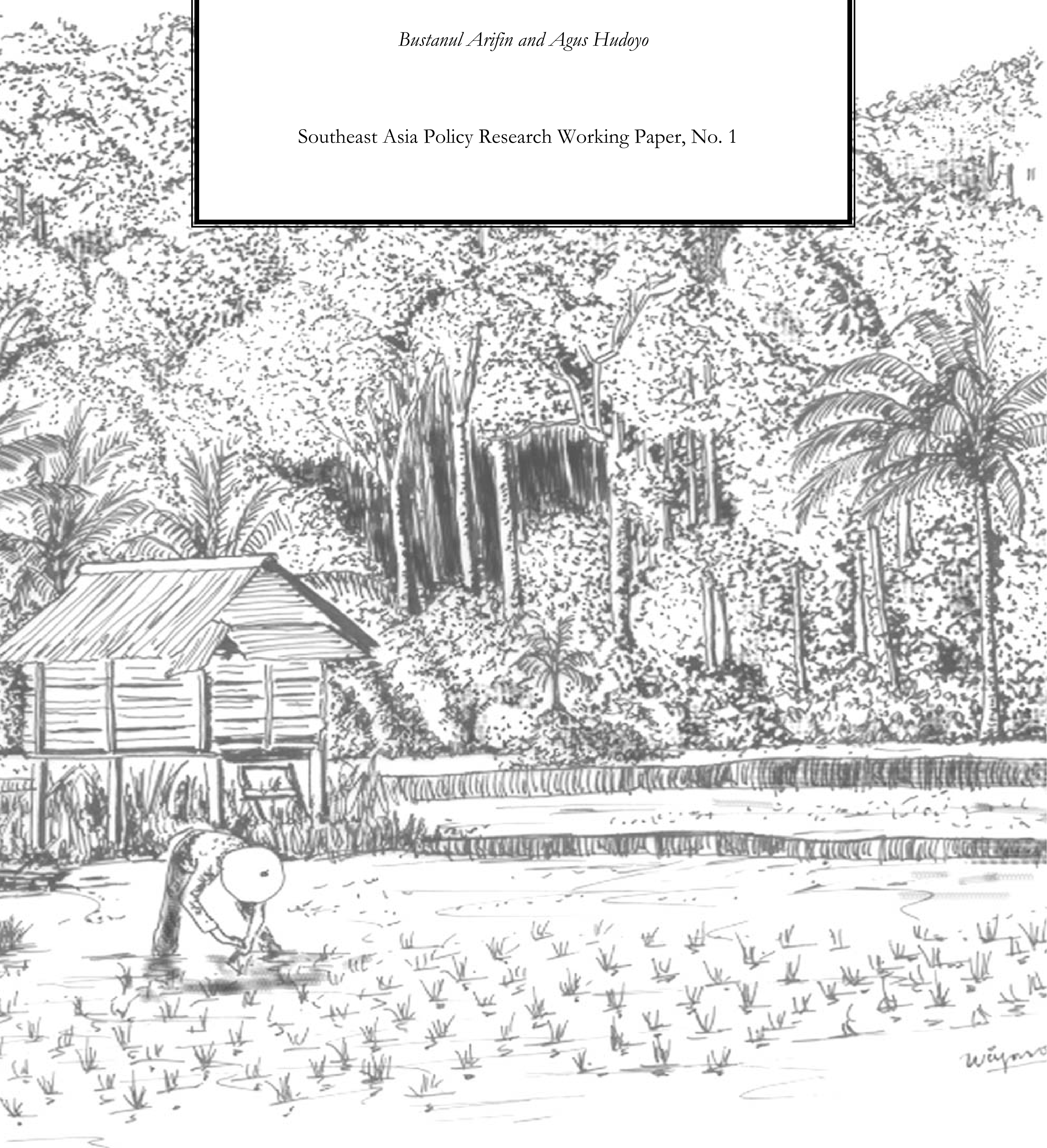
Southeast Asia Policy Research Working Paper, No. 1



Acknowledgement

This report is part of the ASB Project in Indonesia. The Asian Development Bank, under RETA 5711, financially supported this specific work.

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Research Report submitted to
Alternatives to Slash-and-Burn
Indonesia Consortium

AN ECONOMIC ANALYSIS OF SHIFTING CULTIVATION AND BUSH-FALLOW IN LOWLAND SUMATRA

by

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February 15, 1998

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1. INTRODUCTION

(a) Scientific and Policy Relevance

Shifting cultivation is often associated with forest clearing, leading to a decline of forest area or deforestation. Negative consequences of deforestation are widely known. Deforestation is one of the major factors of land degradation, loss of biological diversity and endangered species, thereby contributing to global warming. In the literature, shifting cultivation has played a central role in the debate of deforestation. Most studies blame shifting cultivation practices as the main cause of deforestation, but overlook policy-induced incentives that might drive that behavior (Gillis, 1988, Dick, 1991). Even the World Commission on Environment and Development (WCED, 1987) suggests that deforestation and other environmental destruction especially in developing countries is positively correlated with poverty and the presence of shifting cultivators. According to the report, those who are poor and hungry will often destroy their immediate environment in order to survive, they will cut down forests, they overuse marginal land, etc.

This is clearly a case of "blaming the victim" since the smallholder seems to be the only immediate responsible party for environmental degradation. This argument is trapped in a simple-deterministic paradigm such as Neo-Malthusian or Neo-Marxian paradigm. The Neo-Malthusian paradigm suggests that population growth causes poverty inducing environmental degradation, while Neo-Marxian paradigm postulates that poverty causes population growth resulting in environmental destruction. If blame must be appointed, it is equally, if not more, appropriate to charge the rural land tenure system that allows rich landlords to monopolize the best resources in the region and often to use them wastefully (Arifin, 1993).

The extent of deforestation in developing countries is actually far beyond the presence of shifting cultivators. A more holistic and interdisciplinary approach suggests that deforestation or environmental degradation in general is not a simple technical issue, but a more complex problems involving institutional and political structures within the overall economic system. Several policies, both in the forestry and non-forestry sectors, significantly contribute to forest destruction. These policies include: the ban on log exports; fees and taxation in the forestry sector; the forest concession policy; and timber-plantation industry (HTI) policy, and transmigration or agricultural colonization (see Arifin, 1995)

Shifting cultivation actually differs from a simple forest clearing which normally involves slash-and-burn, logging and other related timber-production activities. Shifting cultivation could be considered as an early stage in the evolution of agricultural systems. Initially, the system is based on cutting and burning vegetation in the dry season. Declining soil productivity and increasing weed problems lead farmers to abandon fields after few years. Other types of vegetation take over, and the field eventually grows into secondary forest or bush-fallow, before the cycle is repeated. The length of bush-fallow varies considerably, generally 5 - 20 years but sometimes not even five years, and inversely correlates with population pressure and the level of technology (Boserup, 1989). Shifting cultivation has low productivity in terms of output per hectare, compared to most other "modern" agricultural systems, but relatively high return to labor (Angelsen, 1995).

Whether or not the presence of shifting cultivators really cause deforestation still depends on the type of forest. The Indonesian government has designated the 120 million hectares of government forest land into conservation forest, natural parks and nature reserves (13%), watershed protection forest (21%), limited and regular production forest (35%), and conversion forest (21%) (see Arifin, 1993). In addition, there is a considerable zone of overlap (and conflict) between these "government forest lands" and "village land" which is owned by villagers. It may be that shifting cultivators or smallholders in general account for much of the conversion at the margins of conservation and protection forests, where large-scale actors (at least formally) are not supposed to operate. Conversion may also occurs because of interaction between policy-induced activities or logging companies that build roads and the smallholders occupying this land as spontaneous migrants; or the activities of shifting cultivation really take place at the conversion forests.

However, one should note that "conversion forest" is government forest that has been officially designated for conversion to other uses, usually involving agricultural production, such as transmigration projects and large-scale plantation agriculture. To large extent, the "conversion forest" policy problem rests with a greater problem of market failure: lack of mechanisms to compensate resource users (including national governments, companies, and smallholders) for supplying the (global) externalities. The present study is, of course, not trying to address this global problem, rather is an attempt to digest the complexity of shifting cultivation systems in relation to the loss of forest cover, including the conversion forest.

Despite the great interest in this issue, there has been surprisingly little empirical work about the economic mechanism of shifting cultivation system. Most of the studies that have been published on this issue are case studies of particular communities or regions that provide valuable insights, but do not provide a basis for comparative analysis or statistical testing of hypothesis and policy formulation regarding the alternatives to shifting cultivation in forest land. The present research, using a more grounded survey in the field, is an attempt to address this gap in empirical knowledge. The case of shifting cultivation in forest area in Rantau Pandan, Bungo Tebo of Jambi Province provides an exemplary opportunity to devote an economic and environmental policy analysis on the complexity of shifting cultivation, and deforestation issues, under conditions typical of many Indonesian uplands and in other developing world as well.

(b) Objectives

The overall objective of the research project is to acquire knowledge and develop models on economic mechanism behind the application of shifting cultivation practices in forest area, and on the economic adjustment process of how shifting cultivators might adopt bush-fallow rotation system as a means to naturally improve agricultural productivity *or* apply more intensive land-use systems as a response to increasing real wages and growing market economy in the Lowland Sumatra, Indonesia. More specifically, the research project intends to:

(1) empirically analyze the system of shifting cultivation practices in the Lowland Sumatra, Indonesia;

(2) examine economic profitability of the following land-use systems: shifting cultivation and bush-fallow, and permanent cultivation of lowland rice-paddy;

(3) perform sensitivity analysis of relevant policies affecting land-use system using Policy Analysis Matrix (PAM) framework; and

(4) offer economic-policy reforms having short-run impacts on the sustainability of agro-forestry system in Indonesia and other developing economies in general.

(c) Significant Contribution

The present study will contribute to a better understanding on the complexity of shifting cultivation, deforestation mechanism, the length of bush-fallow period and other related issues on alternatives to shifting cultivation in forest area. Moreover, this study improve the analytical frameworks and policy implications of shifting cultivation and deforestation literature in general, and strategy formulation towards the dissemination of intensive land-use systems as alternatives to shifting cultivation. A new thrust of approach in the present study includes consideration of economic adjustment of the farming systems in response to increasing real wages and growing market economy.

2. THEORETICAL FRAMEWORK

(a) Loss of Forest Cover

Classical literature on forest ecology suggests that human intervention threatens the balance of nature of forest ecology. For example, Mikesell (1960) suggests that the major causes of deforestation have been and continue to be: domestic and industrial consumption of wood, burning to clear land for cultivation, and destruction of palatable plants by livestock. Sauer (1967) suggests tropical rain forests are not resistant to penetration and modification by agricultural practices, which are usually preceded by the use of fire. Even in modern literature, major causes of deforestation are believed to include population pressure inducing forest conversion into agricultural land and the demand for fuelwood, development project, logging and forest concession and fire loss (World Bank, 1990;World Resources Institute, 1991).

The generalization about population pressures and poverty being the root cause of deforestation would distract the attention from other issues about which it is often much more possible to do something in a relatively short time. Bromley (1990) argues that simply blaming population growth would allows inept or corrupt governments to shift the blame for either their behavior or their inaction, as the case may be - to "promiscuous" peasants. It further allows governments to appear helpless in the face of forces beyond their control. And, it allows them to attract international assistance for projects to correct certain resource insults, the better to appear more beneficent to their citizenry.

For the case of deforestation in Indonesia, there are essentially two extremes in the on-going debate over the causes of deforestation. On the one hand, deforestation is argued to have been driven by the growing number of shifting cultivation, smallholder production activities (FAO, 1990; World Bank, 1990; Barbier, et al., 1993; and Fraser, 1996) such as in the classical ecology arguments. On the other hand, deforestation has been driven by the government policies and its development, and particularly misdirected policies in the timber sector industry, while also acknowledging the important contribution of shifting cultivation in the forest-cover removal (Dick, 1991; WALHI, 1992; Angelsen, 1995; and Arifin, 1996).

(b) Shifting Cultivation

Studies of shifting cultivation in relation to forest-pioneer continuum and to loss of forest cover in Indonesia are not well documented. Weinstock and Sunito (1989) even suggest a distinction between shifting cultivators and forest pioneers. Shifting cultivators are defined as people who practice a form of rotational agriculture with a fallow period, longer than the period of cultivation. Unless faced with population pressure or other constraints, land is used only one to three years and fallowed for a relatively long period. Forest pioneers are defined as people who may utilize slash-and-burn of the existing vegetation but with the primary intention of establishing permanent or semi-permanent agricultural production. They choose primarily cash crops (mostly perennial), although they grow food crops for subsistence purposes.

The growing debate on a continuum of farming systems in Indonesia in terms of policy implication results in two extremes as well. One extreme refers to traditional shifting cultivation's which involve very long fallows and long-term conservation of forest land, as has been practiced by traditional people of Semendoe and Ogan in Jambi, Dayak in Kalimantan, etc. The other extreme refers to forest pioneer cultivation which involve long-term degradation and deforestation. This extreme often associated with spontaneous transmigration which may also correlates with government policies to boost regional development in some remote areas. The government position condemns forest pioneer cultivation as environmentally destructive, even it does not differentiate it from traditional shifting cultivation. While the non-governmental organization (NGO) activists insist that if the government is serious about forest conservation, then it must support those traditional farming systems that are consistent with the aim of long-term forest conservation (see Sunderlin and Resosudarmo, 1996).

Empirical estimates show a significant variation in the share of shifting cultivation in deforestation in Indonesia, primarily because of the definition differences of shifting cultivation and the specific (political) purposes of a particular study regarding shifting cultivation practices. The World Bank (1990) estimates that the shifting cultivation for three provinces in 1990 was 14 million hectare in Sumatra, 11 million hectare in Kalimantan and 2 million hectare in Irian Jaya. The total area of 27 million hectare expands at the annual rate of 2 percent, implying deforestation of roughly 500 thousand hectare per year, by far the largest cause of deforestation.

Dick (1991) criticizes the World Bank estimates and suggests that traditional shifting cultivators account for 21 percent of total deforestation, rather than the largest share. The main reason is that many forests being cleared are part of long-standing rotation on clan-lands (*tanah marga*), and the traditional cultivators lack the tools necessary to convert all but the most open primary forest. Then, at the latest report, the World Bank (1994) acknowledges that shifting cultivation may be less damaging than previously thought. A thorough observation on shifting cultivation in Kecamatan Siberida of Riau Province, Sumatra by Angelsen (1995) suggests that simply increasing population is not necessarily the main cause of deforestation. Changing proportion of households practicing swidden accounts for 7 percent of the total forest clearing; the total population of households account for 23 percent of the total; and the average size of swiddens accounts for 7 percent of the total forest clearing.

For Indonesia as a whole, the area of shifting cultivation increases at a rate of 2.9 percent per year in the last decade. The increase occurred primarily because of a vast increase in the area of rice and secondary food crops (*palawija*) in the upland land. Sumatra and Kalimantan experienced a rapid increase, 9.1 and 4.4 percent per year and upland rice and secondary food crops are extensively grown in these islands. A similar increase is also found in Sulawesi, Bali-Nusa Tenggara and Java which experienced a change in upland cultivation of 1.1, 0.8 and 0.1 percent per year respectively (CBS, various issues). However, these data should be interpreted with cautions. The term shifting cultivation used by the Central Bureau of Statistics (CBS) for the Statistical Yearbook of Indonesia refers to either simply upland cultivation (*ladang*) which might be as a permanent basis or actual shifting cultivation (*huma*). It is very unfortunate that the CBS data available do not provide enough information to distinguish between these categories. Consequently, the term "shifting cultivation" by itself cannot be used specifically to examine the environmental consequences of agricultural operations that shift the land base or use forest fallow to restore fertility. One can assume that in Java, Bali and part of Sumatra, the term "shifting cultivation" will refer to *ladang* but outside these areas it refers to *huma* or the actual shifting cultivation (see Arifin, 1995).

(c) Land-Rent-Capture

The approach of land-rent-capture developed by Angelsen (1995, p: 1716-1717) is relevant to explain the mechanism of shifting cultivation and deforestation under an open economy argument. Land rent is defined as the surplus or profit to the owner of the land, that is the gross value of production minus all costs of production, except for land. In this case, the costs related to the *location* of the land (von Thunen hypothesis) such as transport of output, walking distance back and forth, as the main factors, rather than the costs associated with the *quality* of the land (Ricardo hypothesis) which are difficult to quantify. The land rent increase with land accessibility, primarily because the location or distance costs are directly correlated with the distance form the village center. The land rent can be formally defined as follows:

$$r = pX - wL - qD$$

where r is land rent per hectare; p price per unit of output; X output per hectare (reflecting the technological level, soil fertility, etc.); w opportunity cost per unit of labor (wage in alternative employment); L labor input per hectare; q costs per hectare and per kilometer distance or location of field; and D distance in kilometer from the village center to the field.

Therefore, the land rent declines as distance increases, and eventually reaches zero. The distance at which land rent is zero declines the agricultural frontier or margin of cultivation. Given that people are free to move and open new land, the basic premise is that all forest land with a positive land rent will be cleared and transformed to agricultural production. The policy implication of this approach can be formulated as follows: any changes in the variables which increase the profitability of frontier agriculture will augment deforestation. This includes higher output price (p); technological progress (X up and/or L down); lower opportunity cost of labor (w), including self employment, wage labor and income of farming; and lower transport cost (q), also influenced by the availability of roads and other infrastructures.

Further implication of the land-rent-capture into the property rights issues could be incorporated. As clearing gives property rights, farmers not only look at the immediate benefits, but also at the future surplus from production. In economic terms, this future surplus is formulated in the net present value (NPV). The expected NPV, at a particular time k, of an infinite stream of expected rents r_t^e , discounted at a rate i, can be written as follows:

$$NPV_k^e = \int_{t=k}^{\infty} (1+i)^{-t} r_t^e$$

As a result, competition among farmers for new land will ensure that all forest with a positive NPV is cleared. Forest is cleared even if it has a negative rent the first years. This loss will be outweighed through a positive land rent some time in the future. Early clearing is necessary to establish property rights; otherwise the land would be taken by others.

Even though the land-rent capture approach is useful in explaining the economic mechanism of shifting cultivation system of particular communities or regions, the concept does not provide a basis for comparative analysis of the profitability of the system compared to other land uses. The comparative analysis becomes so important that the policy formulation could be directed towards searching the alternatives to a more sustainable land-use and forest management. Given that the previous studies on shifting cultivation were generally based on the absence of trade and international markets and other types of close economy argument, the present study is relaxing the close-economy assumption and viewing the changes in land-use system as the economy is more opened to international markets and even to government-policies. The policy formulation on land-use alternatives would be more comprehensive once the policy options are more thoroughly examined, and the sensitivity of scenarios are carefully analyzed.

Therefore, the hypotheses to be tested in the present study are:

(1) Shifting cultivation followed by bush-fallow system performs as a means to naturally restore vegetation and improve land productivity, but the system does not provide an optimal economic return to land resources.

(2) An agro-forestry system in forest area combined with intensive land-use system in a more sedentary land is farmers' rational response to increasing real wages and growing market economy.

3. METHODOLOGY

(a) Data Collection

This study employs a field survey to collect primary data and to verify secondary data collected a wide range of sources. The field survey has been undertaken in July of 1997 and focused on collecting information on shifting cultivation activities in the forest area of Bungo Tebo District of Jambi Province for the 1996-1997 crop season. These data include cropping patterns and activities in crop production, i.e. the use of land, labor, capital and the yield, amount of works and labor calendar spent on on-farm and off-farm, type of off-farm activities, and other physical and socio-economic information.

In addition, the historical aspects of shifting cultivation systems were investigated carefully, such as where and how long the farmers cultivate the previous farms before the current site, the length and types of bush fallow, factors affecting the farmers' choice in the previous cropping patterns and the next choice to cultivate, etc. The study interviewed directly both shifting cultivators and permanent farmers living in the piedmont area of conservation forest of Kerinci Seblat National Park which is administered by Kecamatan Rantau Pandan, Kabupaten Bungo Tebo, Jambi Province.

Secondary and supporting data were collected from a wide range of secondary sources such as Central Bureau and Regional Offices of Statistics, Department of Agriculture, of Forestry, of Public Works, the World Bank, ICRAF, CIFOR and related agencies and organizations, and from previous studies of shifting cultivation and deforestation. Time series data on population and labor force participation in the region will come from the Central Bureau of Statistics; yield and cultivated area of particular crops will be obtained from the Department of Agriculture. Information on the performance of forest-cover loss will be obtained from the Department of Forestry and Agency for Environmental Impact Assessment.

(b) Analytical Framework

The data collected and other related information were analyzed thoroughly using both quantitative and qualitative frameworks. The standard method of land rent calculation for shifting cultivation system will be employed to obtain the economic returns on output after taking into account all costs and related expenses, and in light of the travel cost from the field to village center. Qualitative information such as property rights regimes and institutional factors relating to "the working rules of going concerns" on shifting cultivation practices and social arrangements of labor force were evaluated using previous studies and available information. Additional interviews with key informants were conducted with at the village level, district level and the provincial level.

For policy analysis on the economic profitability of respective land-use system will be analyzed under the framework of Policy Analysis Matrix (PAM) developed by Monke and Pearson (1989). The purpose of PAM approach is to measure the impact of government policy on the private profitability of agricultural systems and on efficiency of resource use. In the case of shifting cultivation - as a principal agricultural system -- and other land-use system in the study area, the PAM approach is useful to construct accounting matrices of revenues, costs and profits. The PAM is also very useful to investigate further the impact of policy on competitiveness and farm-level profits, the influence of investment policy on economic efficiency and comparative advantage, and the effects of agricultural and research policy on changing technology.

Therefore, the determination of profit received by farmers also implies which farmers are currently competitive and how their profits might change if price policies were changed. Also, investment policy to allocate capital budgets could be formulated to increase efficiency and speed the growth of national income. Here, the concept of social profits as a measure of economic efficiency is introduced in the analysis, which is simply the difference between revenues and costs for a system, valued in social prices. Finally, the approach could answer questions on how best to determine the most fruitful directions for the alternatives to raise crop yields and reduce social costs, thereby increasing social profits of the overall land-use systems.

The basic structure of PAM is presented in Table 1. Profits are shown on the right-hand column and could be calculated by subtracting revenue in the left-hand column with two middle columns of cost. Each PAM normally consists of two cost columns, one for tradable inputs and the other for domestic factors. Intermediate inputs such as fertilizer, pesticide, purchased seed, compound feeds, electricity, transportation and fuels are divided into their tradable input and domestic factor components. The private profitability refers to the observed revenue and costs reflecting actual market prices received or paid by farmers or processors in agricultural system. As mentioned previously, the social profits measure the comparative advantage or the efficiency in the agricultural systems.

Table 1. Basic Structure of Policy Analysis Matrix

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effects of divergences and efficient policy	I	J	K	L

Notes: Private profits : D=A-B-C Input transfer: J=B-F
Social profits : H=E-F-G Factor transfer: K=C-G
Output transfer : I = A-E Net transfer: L=D-H

The second identity in the matrix concerns the differences between private and social valuations of revenues, costs and profits. Recall that social prices correct for the effects of distorting policies, which lead to an inefficient use of resources. However, one needs to distinguish distorting policies which cause loss of potential income, from efficient policies, which offset the effects of market failures and thus create greater income. Because efficient policies correct divergences, they reduce the differences between private and social valuations (see Monke and Pearson, 1989, p:23). Therefore, an expanded version of the PAM to include additional three rows of the effect of divergences can be seen in the following Table 2.

Table 2. Expanded Version of Policy Analysis Matrix

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effects of divergences and efficient policy	I	J	K	L
Effects of market failures	M	N	O	P
Effects of distorting policies	Q	R	S	T

Effects of efficient policies	U	V	W	X

Notes: Output transfer: I=A-E, or I=M+Q+U
Input transfer: J=B-F, or J=N+R+V
Factor transfer: K=C-G, or K =O+S+W
Net transfer: L=D-H, or L=P+T+X

A dynamic comparative advantage, inherent within the Policy Analysis Matrix (PAM) approach employed in the present study, could lead to policy formulation on the ability of a land-use system to compete without distorting government policies. This could be strengthened or eroded by changes in economic conditions, because the competitiveness of a land-use system that occurs over time is influenced by three important economic factors: long-run world prices of tradable outputs and inputs, social opportunity costs of domestic factor of production (labor, capital and labor), and production technologies being used. In addition, the provision of modern inputs, rural infrastructure, and non-farm employment in rural areas are important in formulating the alternatives to slash-and-burn in forest area. The use of PAM would tackle these issues and simulate in such a way in accordance with a more opened to international markets of agricultural commodities. The policy formulation on alternatives to shifting cultivation is more comprehensive since the policy options are more thoroughly examined and the sensitivity of scenarios are carefully analyzed.

(c) Variables and Measurements

Several variables and their measurements for the present study are defined and explained as follows:

- Shifting cultivation is a land-use system involving a form of rotational agriculture with a bush-fallow period, longer than the period of cultivation. The land is used for growing food crop, particularly upland rice for only one to a maximum of three years and fallowed for a relatively long period.
- Forest-pioneer cultivation is a system involving slash-and-burn of the existing forest vegetation but with the primary intention of establishing permanent or semi-permanent agricultural production, primarily cash crops. Forest pioneer cultivation usually involves long-term deforestation and land degradation.

- Deforestation is a process leading to a decline in forest area and destruction of forest ecosystem which cause the forest to loss its function ecologically and economically.
- Intensive land-use system is a cultivation system with more agricultural input and labor per unit of land, and other non-extensive activities of using land resources.
- Agro-forestry is a land-use system which combine a food crop activities and tree crop and wood production at the immediate land.
- Land rent is the surplus or profit to the owner of the land, that is the gross value of production minus all costs of production, except for land, measured in Rupiah.
- Output is an amount of production from particular food and cash crops, reflecting the technological level, soil fertility, measured in kilogram equivalent.
- Farm-gate price is the current or yearly actual price of agricultural production at the farmers' level, measured in Rupiah per Kilogram.
- Agricultural input is the total of non-labor inputs employed in the production process, consisting mainly of traditional and modern inputs, both bio-chemical (seed, fertilizer, pesticide, herbicide, etc.) and mechanical inputs (hand-tractor, etc.), measured normally in the respected input units (kilogram, liter, units, etc.)
- Input price is the farm-gate price of all agricultural inputs, measure in Rupiah.
- Labor input is the total working days spent by both family and hired labor in agricultural production, measured in man-day equivalent.
- Wage rate is the level of actual wages, measured in Rupiah per man-day. In the case of gender segregation in wage rate, necessary adjustment will be made.
- Distance is the duration of travel time from the village center to the field, measured in kilometers and/or walking hours.

4. IMPORTANT RESEARCH FINDINGS

(a) Features of the Study Region

The study region is located in the subdistrict (Kecamatan) of Rantau Pandan, the district of Bungo Tebo at Jambi Province of Sumatra. The distance from city center of Muara Bungo, the Capital of Bungo Tebo, is about 31 km, and from Jambi City is about 267 km by a very good quality state road. The study location was selected for a number of reasons. It provides a good example of shifting cultivation in different length of fallow system, of changing forest area to dryland agriculture with rapidly increasing population, and adaptation of more permanent agriculture along with fast improvements in the living standards of the people in the last decades or so. In addition, the district of Bungo Tebo is a primary study region of the project of Alternatives-to Slash-and-Burn (ASB) where ICRAF Indonesia takes a major lead.

Based on the information available currently, Kecamatan Rantau Pandan consists of 21 villages. The total population of this subdistrict (Kecamatan) in 1995 are 22,884 (11,084 men and 11,800 women) and the total households are 5,238, most of which are involved in agricultural activities. The area of the whole subdistrict is about 1,278,140 square kilometer, implying that population density of Rantau Pandan is only about 18 per square kilometer (Bungo Tebo Regional Office of Statistics, 1997), which is quite common for an outside-Java standard.

Population growth in Rantau Pandan has increased tremendously in the last decade. Based on the data of national census, the population growth in the period of 1980-1990 was 1.42 percent per year. This amount is actually far below the national average of growth, which was 1.97 percent per year. In the period of 1990-1995, the population growth in Rantau Pandan has risen to 1.70 percent per year or about similar to the 1.69 percent growth of national average. This increase could affect the cropping pattern and the length of bush-fallow in the shifting cultivation practices.

Kecamatan Rantau Pandan is located in the piedmont zone, ranging from 100 to 500 meters above sea level (asl). Soils of the area are composed of latosol-litosol complex with fine texture. During the last decade, annual rainfall varied from 1,656 to

2,868 mm where December and January are the wettest and June and July are the driest (van Nordwijk, *et al*. 1995). Typical for this type of soil, the largest part of the area is dominated by secondary or logged-over forest where large-scale (and notably illegal) logging practices have taken place for years. However, most of the forest area in the southern part or upper portion of Rantau Pandan were claimed as a part of Kerinci Seblat National Park (KNSP). In fact, local people have grown rubber in that forest area long before the government declared the area as a conservation forest. In addition, given the ecological function of rubber, cinnamon and other tree crops around the National Park, the watershed protection functions of the Park may be adequately covered.

Major food crops in Rantau Pandan are upland and lowland rice, corn and soybean. The productivity of these crops is about the average of which in other regions of Sumatra. According to the Official Statistics, the productivity of upland rice in Rantau Pandan is only 1.2 ton/ha, and that of lowland rice and corn is about 4.2 ton/ha and 3.2 ton/ha respectively. While the productivity figure of upland rice is about comparable with that of observed figure in the present study, the official productivity of lowland rice is overestimated by about three degrees of magnitude. Even though the productivity is only 0.8 ton/ha, soybean is becoming more popular among farmers in Rantau Pandan recently and could be prospective in the future.

Major cash crops in Rantau Pandan are rubber, coffee, cassiavera and tall coconut. The area of these crops spread over the subdistrict, reaching more than 14 thousands hectare of rubber, more than 900 hectare of coffee and about 230 and 160 hectare of cassiavera and tall coconut, respectively. As explained above, local people have been accustomed to planting the rubber with local varieties since many years within the forest, particularly for property right purposes. In addition, market information and other pressing factors have caused local farmers in Rantau Pandan to become more alert and allocate their lands to a more prospective cash crops such as cassiavera (cinnamon).

Field observation for this study has focused on two villages in the subdistrict: Muarabuat and Senamat Hulu and some additional information along the road in the village of Laman Panjang. Muarabuat and Senamat Hulu has been known for typical *ladang* land use of Sumatra using a shifting cultivation for upland rice, with bush-fallow system, where more than 60 and 90 percent, respectively of the households in these two villages are involved. The village center of Muarabuat is located in the main road of the subdistrict, adjacent to the village of Rantau Pandan, the main village or the capital of the subdistrict. The land-use observed in study sites for economic analysis of shifting cultivation system in the lowland Sumatra can be summarized in the following Table 3.

Table 3. Land Use Observed and Other Key Variables for the Study Sites

Key Variables \ Villages	**Muarabuat**	**Laman Panjang**	**Senamat Hulu**
Land-Use Observed	Shifting Upland Lowland Rice	Lowland Rice	Shifting Upland
Distance to Market (km)	10	14	26
Total Population	696	697	578
Population Density (pop/km)	28	7	6
Total Household	158	171	161
Household practicing shifting cultivation system (%)	60	20	90
Distance to shifting area (in hour walking distance)	1-2	0	2-4

Source: Field Observation and Bungo Tebo Regional Office of Statistics, 1997

(b) Land-Use System

As explained briefly above, major land-use systems in the subdistrict of Rantau Pandan consists of annual crops for food security purpose and perennial crops for cash income and other purposes. Land-use system for annual crops is mostly lowland rice cultivation (*sawah*) and shifting cultivation of upland rice (*ladang*) using a bush-fallow rotation system. Land-use system for perennial crops is mostly local rubber, coffee and cinnamon (*kebun*). The physical boundary between these cash crops land-use system and the (natural and communal) forest is not clearly established because these crops are grown within the forest area. This complex system of land used is sometimes called "jungle rubber" given that the tree crops have been planted for years and no major crop care, except weeding, has been allocated for these trees.

Lowland Rice

Lowland rice fields could represent the most "modern" land-use system in Rantau Pandan, and notably in most places in Sumatra. Even though the majority of farmers do not have certificate for their land in a formal manner, rice fields could be traded freely in land market, especially those located along the main road. The market price for land ranges between Rp 450,000 to Rp 500,000 per hectare, and tends to increase gradually depending on the market forces. However, the land market for lowland rice field does not take place "normally" since the majority of the land could fall in to "conservation forest status" boundary under the National Park.

As commonly found in the matrilineal system such as in the majority of Minang ethnic in West Sumatra, the lowland rice field is normally inherited by women. Other forms of land transfer include a gift or charity (*tanah wakaf*) for religious purposes, and regular selling and purchasing involving the outsiders. Significant influence of "modernization" has changed the attitude of people of Jambi regarding the rice field. Ten years ago or so, selling the land was considered against the rules of *adat* law because the land was deliberately considered as "*harta berat*", normally controlled by the communal land system. It implies that the food security of the society was in danger and the sustainability of agricultural system and of the livelihood in the area was in trouble. The complete institutional mechanism of the communal system in land-use allocation is probably an interesting subject for future research in this area.

Average lowland rice farmers in Rantau Pandan normally use local variety of rice (*padi panjang*), under the reason of easier to manage and better in taste. Some farmers have applied modern technology such as fertilizer (Urea) and some new high-yielding variety of rice such as IR-64 and IR-50 (*padi Bimas*). Other modern inputs such as pesticide and herbicide have been known by the farmers in Rantau Pandan, but most farmers do not use them in the 1996/1997 planting season because of unavailability in the surrounding area. The growing period of local variety of lowland rice is about six months, therefore farmers are only able to cultivate their field once a year. Some farmers have grown corn and other secondary food crops at the same field such as soybean.

The average area of rice-field holding in the subdistrict ranges from 0.4 to 2.0 hectares, using mostly their-own family labor. The average yield of rice field in Rantau

Pandan is only 1.5 ton/ha, or about one-third lower than the official statistics reported by the local government. This productivity is also about or below the subsistence level of the society in the subdistrict, while the rate of rice consumption increases steadily due to population growth and increasing income in other sectors of the economy. The "modern" notion of lowland-rice farmers is also shown by the fact that the majority of farmers in fulfill their food need by buying the rice in local market around the sites such as in July and August when the field observation for this study took place. During regular harvest season, the price of milled rice is about Rp 1,000 per kilogram, while during planting season or long-drought such as at the present time, the price of rice could reach as high as Rp 1,400 per kilogram or may be more.

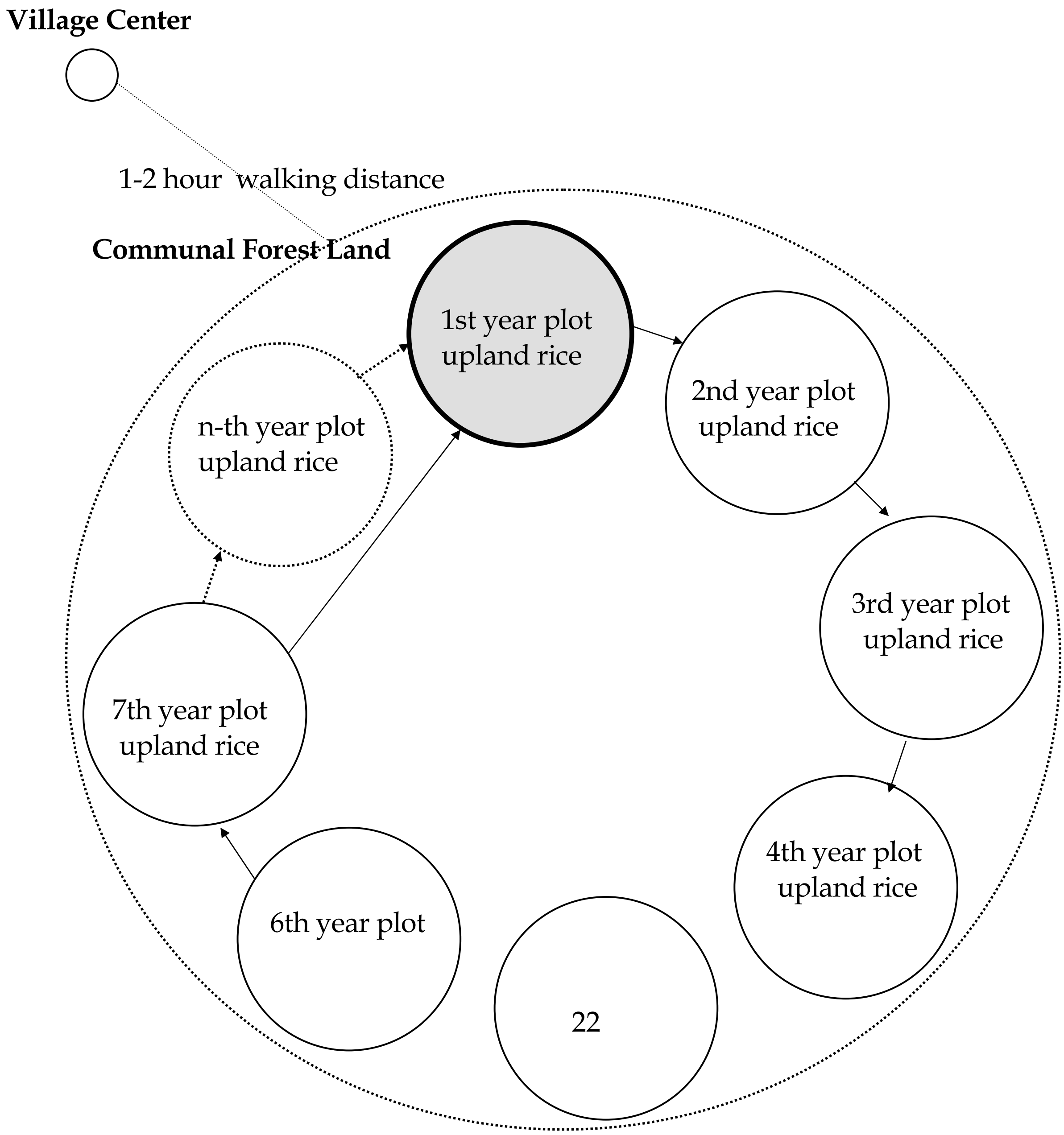
Shifting Cultivation

The term shifting cultivation used in this study refer to the standard definition developed by the Alternative to Slash-and-Burn (ASB) Indonesia consortium. Shifting cultivation is a land-use system involving a form of rotational agriculture with a bush-fallow period, longer than the period of cultivation. The land, locally known as *ladang*, is used for growing food crop, particularly upland rice, for only one to a maximum of three years and fallowed for a relatively long period. The particular argument for the above definition is that the length of fallow period becomes shorter as population pressures continue.

In the study sites of subdistrict Rantau Pandan, there are is a large amount of communal forest land, more precisely it is shrub land, or locally called *sesap*. These lands have been designated for shifting cultivation, particularly for upland rice, and some presently are left fallow and covered by small trees and bush/shrub. It is not clear whether or not the area of communal forest land, overlap with the state-owned forest land under concession of forest plantation (HTI) or the conservation forest of the Kerinci Seblat National Park, or even with newly developed for oil-palm plantation.

According to the rural standard, this land is relatively fertile, located nearby the village, about 1-2 hour walking distance from the village center. Local people believe that the lands located further from the village center, or about 4-6 hour walking distance, thus it is a natural forest, are more fertile than their present land. In the village of Muarabuat, tenurial security is strongly enforced, in order to maintain the existing *ladang* system and the availability of rice production, as a part of food security strategy in rural area. About 1,000 hectares of communal forest land have been "preserved" for upland rice field under shifting cultivation practices. No tree crops are allowed in this particular communal land, and shifting cultivation system is managed by the community. Members within the community are free to use it, but those who do not have inherited land get priority. Outsiders have to get permission from the customary leader to use it.

The mechanism of shifting cultivation system, followed by a bush-fallow rotation in the communal forest land could be summarized in the following Figure 1.



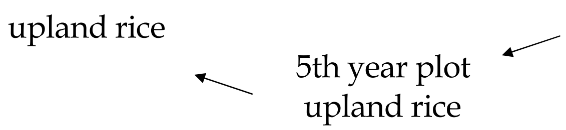


Figure 1. Shifting Cultivation System in Communal Forest Land in Sumatra: Upland Rice followed by Bush-Fallow

Generally, one household is able to cultivate about 1-2 hectares of upland rice per year by shifting cultivation system in the communal land. Bush-fallow rotation ranges between 5-10 years or could be short, medium and long depending on the labor allocation decision among household and on the land availability to support the shifting cultivation system. At present, it is very difficult to employ a long fallow of 20 years or more such as it was commonly found in the last ten or twenty years. Agricultural or rural sector in general has experienced a serious labor shortage since the opportunity cost of labor has increased tremendously in the last decades.

Meanwhile, in the village of Senamat Hulu communal property of forest land under the shifting cultivation system is not strongly enforced. The community can freely buy and sell their land, such it has happened in the last decade or so. Probably, in addition to the communal land, this village has a number of private plots of bush land belong to clans or families. The owners usually plant upland rice for 1-2 seasons and then move to another plot within the bush land. However, there has been some changes in land-use patterns in the last decades after the second rotation of shifting cultivation. The choice of not adapting the bush-fallow system is more open, meaning that farmers could replace the land allocated for shifting cultivation into a more attractive land use system. If the land is suitable for planting rubber or cassiavera, these tree crops are interplanted in the first or second year of cropping.

Most likely, the land-use change from rotational system into a more permanent land-use system takes place in the private and family lands, rather than in the communal forest lands. Once the land-use changes, the land becomes more tradable and the market price for land increase significantly. The market price for the land ranges from about Rp 420,000 per hectare for *sesap* or for upland *ladang* under shifting cultivation and about Rp 2 million per hectare for tree crops such as rubber, cassiavera and probably for oil-palm plantation. However, interpretation for the land-use change phenomena should be made with caution, given that the present study does not attempt to identify factors affecting the change in a comprehensive way. This should be a leading priority in the future research about land-use change.

The mechanism of shifting cultivation system in the private and family land, which is likely to be transformed the system to a more permanent cash-crop practices after second rotation, could be summarized in the following Figure 2.

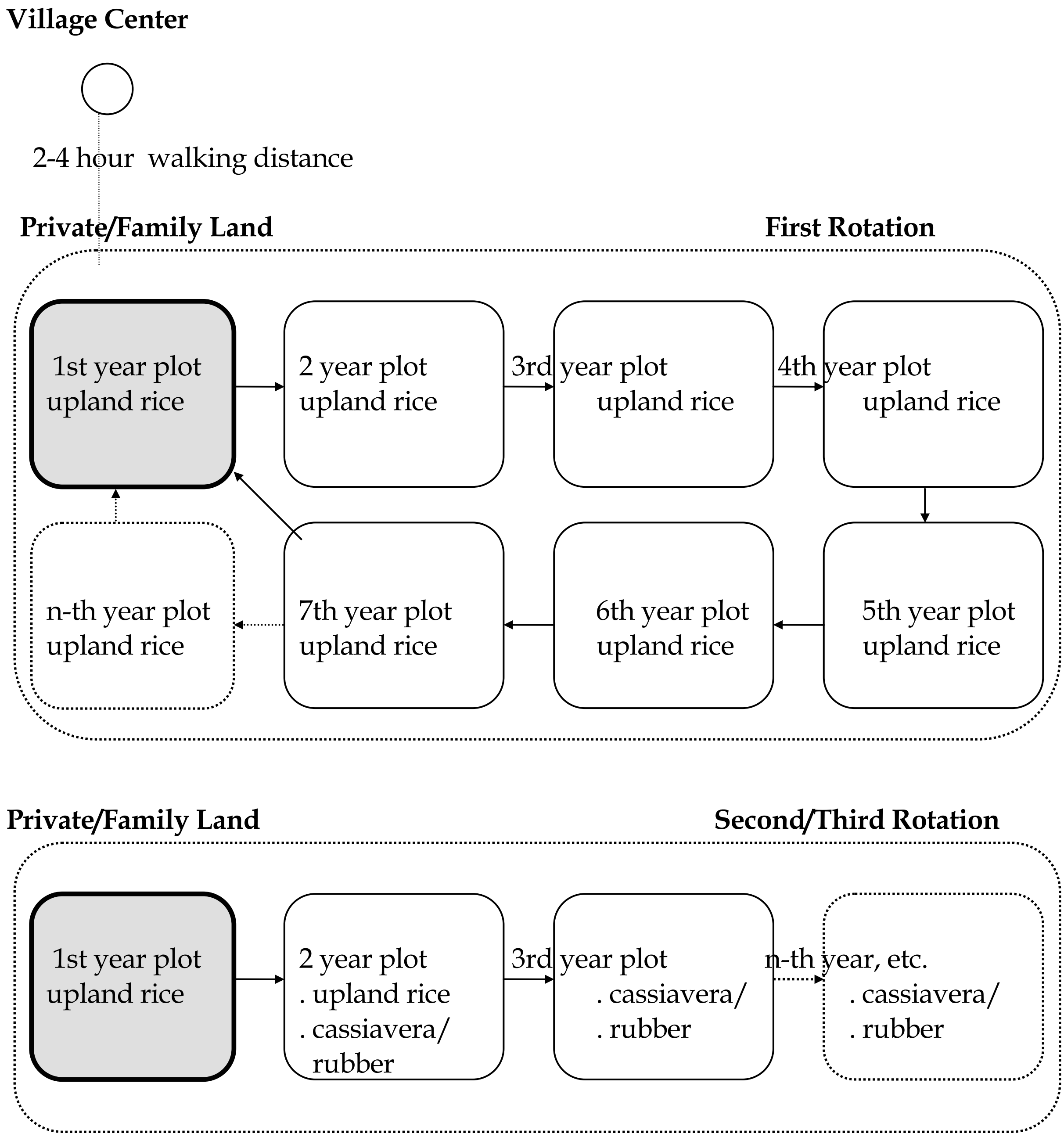


Figure 2. Shifting Cultivation System in Private/Family Land in Sumatra:
First rotation: upland rice followed by regular bush-fallow
Second or third rotation: upland rice changed into tree crop

Figure 2 above is probably a typical case of land-use change from a traditional shifting cultivation system into more permanent agricultural practices in response of a growing market economy and other external economic forces. In the system where markets exist and all prices, including the wage rate are parametrically given, the decision to increase the area of cultivation and to change to existing land use system are primarily determined by the relative profitability of expected farming practices, including those in the frontier with the expense of natural forest. Also, if labor can be sold or hired at a constant wage, the land-use change and production decisions by a rational and utility-maximizing household can be analyzed by a typical profit-maximizing production behavior. A higher relative price of rubber and cinnamon than that of rice, a better road and transportation infrastructure, and an open-access like tenurial land rights are among important factors contributing to the change.

The recent tendency is an increased tension between the tenurial system of communal forest land or related customary (*adat*) rights on land and a more uniform or centralized "modern" legal system on forest land. According to the Basic Forestry Act of 1967, all forest in Indonesia is state property, while the customary law on land gives usufruct rights to forested land planted with perennials crops after clearance. In the absence of clear boundary between state forest and communal forest land, and due to weak management of communal forest , a large portion of Indonesian forest could fall into an open-access like tenurial land rights. Consequently, the attractiveness of economic profitability of tree crops combined with a property-rights security purpose on forested land have also lead to land-use change into a more permanent cash crop practices in the last decade or so.

The average yield of upland rice in Rantau Pandan is about 1.3 ton/ha, or similar to the official statistics published by the local government. In this study, the following category was used to classification the length of bush-fallow period. A five-year fallow or less is considered a short fallow; 5-10 year is medium, and more than ten year is classified as long-bush fallow system. As expected, the yield of long fallow is higher than that of medium and short fallow. Therefore under existing condition of input use and market price for input and output, the shifting cultivation under long-bush fallow is the most promising for food security purposes. The question is then "is it still possible to adopt the long-fallow system of shifting cultivation given the land is not unlimited anymore and a more permanent land use system is more attractive for the household and has been adapted by some household in the village?" Table 4 shows the performance of shifting cultivation system under different length of fallow.

Table 4. Performance of Shifting Cultivation under Different Length of Fallow System

Important Characteristics	Shifting Cultivation		
	Short Fallow	**Medium Fallow**	**Long Fallow**
Input use:			
Seed (kg/ha)	25	25	25
Labor (man-day/ha)	152	167	167
Working Capital (Rp/ha)	140,600	153,600	171,600
Yield (kg/ha)	1,200	1,333	1,800
Profit excluding land (Rp/ha)	596,400	678,000	1,130,400

Source: Field observation and authors' calculation

One should note that a detailed information on long fallow system is difficult to obtaine because most of current plots are under a short-fallow system. A seven-year bush-fallow could be a maximum possibility that could be materialized by farmers in Rantau Pandan, given the availability of land and other production factors. In the present study, respondents were asked a historical-type of question -- but somewhat hypothetical -- such as how much the yield were obtained by their parents at the very same land, and what the yield of upland rice would be if the current cultivation in the bush (*sesap*) land took place 15 or 20 years ago, etc. In the future research, a more comprehensive methodology, involving an extensive exploration of available data and documents on particular plots should be employed in order to draw more complete and reliable information on estimated yield of shifting cultivation system.

(c) Crop and Labor Calendar

In this section, crop and labor calendar is analyzed, emphasizing on the labor allocation by household on particular crops and activities. As commonly found in traditional agricultural practices, crop watching from the pig and from the bird, and forest/bush clearing or land preparation take time the most. In the study sites, the normal average working hour is between 7-8 hour, starting at 7:30 and ending at 4.00 pm with one hour break for day-time praying and lunch between 11:30 and 1:00 pm.

This schedule is normally imposed for non-family labor force; while the schedule for family labor could be far more intensive, though not necessarily more flexible.

One should note, however, that the standard working hour explained above is for arithmetic calculation only and for the purpose of economic analysis. It does not imply a rigid formal schedule such as in the office or factory working hour. Villagers hardly put a monetary value on their own labor, even though their labor allocation decisions are driven by rational economic principles of allocation. Some activities in the shifting cultivation system such as crop watching from the pig could continue, even more intensively during night times. The villagers might think that both upland rice under shifting cultivation and permanent lowland rice cultivation have taken their labor the most. Heavy duty of crop care, and labor shortage in rural areas, combined with rice availability for consumption in the local market due to tremendous development of road and transportation infrastructure could be among the reasons of land-use change into a more permanent tree crop types of activities.

Average wage rate for forest clearing, land preparation and other man-job in Rantau Pandan is about Rp 5,000 per man-day, including lunch, coffee and cigarette. This wage rate is actually a lot higher compared to that two-three years ago, averaging only Rp 3,500 - Rp 4,000 per man-day. In the subdistrict, wage differentials are imposed according to particular types of job, meaning no gender segregation in wage rate. If a man does a woman's job such as weeding, planting/replanting, he would receive a wage rate as high Rp 4,000 as what was received by a woman.

Table 5 summarizes the crop and labor calendar of a household in the study sites of Rantau Pandan subdistrict in Jambi Province. A full month shade in the table does not imply that the labor is spent for the whole month, rather it represents the period of activities or labor allocation. The detailed amount of man-day could be found in the Input-Output Table (I-O Table) of the policy analysis matrix in the Table Appendix A-1. In any of these months, farmers in Rantau Pandan could have spare times for weeding in their rubber or cassiavera field, rubber tapping, and harvesting the wood of cassiavera for cash income, collecting non-timber forest product, working in someone's less field or in off-farm employment, or simply migrating temporarily to the nearby town of Muarabungo as laborers in other sectors of the economy.

Table 5. Crop and Labor Calendar of Farmers' Household in Rantau Pandan

Labor allocation	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nop	dec
<u>Lowland Rice</u>												
Land Preparation				■								
Seedbed Preparation					■							
Planting/Replanting					■	■						
Weeding							■	■	■	■		
Crop care/fertilizing						■		■				
Crop watching (pig)									■	■	■	
Crop watching (bird)										■	■	
Harvesting												■
Drying	■	■										
<u>Upland Rice Shifting</u>												
Land Clear/Preparation				■	■							
Planting/Replanting						■						
Weeding							■	■	■	■	■	
Crop watching (pig)								■	■	■	■	
Crop watching (bird)									■	■	■	
Harvesting												■
Drying	■	■										

Notes: The figure for upland rice shifting cultivation is for short and medium bush fallow. Labor calendar for long fallow system is about the same, except that land clearing and preparation takes more time and weeding takes less time than that in short and medium fallow.

5. POLICY ANALYSIS MATRIX

(a) Private Profitability

Under the system of shifting cultivation, farmers adopting a short and medium bush fallow receive only Rp 1.4 and 1.6 million gross revenue respectively for one-hectare land. This amount is much less than that received by those adopting a long-fallow system who could obtained at Rp 2.2 million and those under wetland rice. The cost structure among upland shifting cultivation and lowland rice land-use does not differ very much, except for long-fallow shifting cultivation. The cost structure for land preparation differs as much as RP 60,000 because wetland rice system requires a seedbed preparation.

Weeding activities in upland rice take a cost of Rp 100,000 in average, or a Rp 40,000 higher than that in wetland rice. In addition to weed problem, the degree of sensitivity of pest attacks in upland rice shifting cultivation is also higher than that in lowland rice field. Labor allocation for applying the fertilizer does not contribute significantly to the farm cost structure. In the study sites, fertilizer is only used in the lowland rice. It is applied at 15 days after planting/replanting and few days before the period of generative growth or before the rice grain is ready to fill up. Of course this crop-production management is far below the standard or recommended best management practices in rice production. Normally, during the phase of generative growth, NPK fertilizer application is necessary to ensure the growth of grain and to increase the yield.

The cost of other crop care activities, in general, are lower in a more permanent lowland rice cultivation. Crop watching from the pig and the bird is less extensive in the rice field close to housing compound than those located 1-2 hour away from human settlement. Therefore the total cost of farm-production activities in lowland rice field is about Rp 810 thousand, which is lower than all types of different length bush-fallow system. The total cost of short-fallow system is about Rp 844 thousand per hectare, while the cost of medium and long fallow system is Rp 922 and 1,030 thousands respectively .

The private profitability of different land-use system can be summarized as follows. The profit, excluding land, for lowland rice cultivation is the higher than that in shifting cultivation, except for long bush-fallow. This is mostly because the yield in lowland rice is 1.5 ton/ha, which is higher than 1.2 ton/ha and 1.3 ton/ha, the yield of short fallow and medium fallow, respectively. However, these yield measurements are lower than the yield of long-bush fallow which is 1.8 ton/ha. Therefore, the profit excluding land of lowland rice is Rp 990 thousand, which is also higher than that of short and medium fallow which are Rp 596 thousand, Rp 678 thousand respectively; but lower than the profit of the long bush fallow system which is Rp 1.1 million.

Table 6. Private Profitability of Lowland Rice and Shifting Cultivation (Rupiah)

Items	Lowland Rice	Shifting Cultivation		
		Short Fallow	**Medium Fallow**	**Long Fallow**
Total Revenue	1,800,000	1,440,000	1,599,600	2,160,000
Total Cost	809,880	843,600	921,600	1,029,600
Land Price	470,000	450,000	420,000	400,000
Profit, excl. land	990,120	596,400	678,000	1,130,400
Net Profit	520,120	146,400	258,000	730,400

Source: Authors' calculation

(b) Social Profitability

The concept of social profitability is necessary to compare the profitability of particular land-use with its competitive situation. As explained in the analytical framework in Chapter 3, one way of comparing them is by considering the parity prices at the international markets of input and output and other components affecting farm-production process. This mechanism was performed primarily under an assumption that the world market is the most competitive market or where no single country can significantly affect the market behavior.

Three important factors affecting the calculation of social budgets are the world price of commodities imported by Indonesia, i.e. rice and the seed; and the world price of urea, which is exported by Indonesia. The data for this calculation were the average annual data of 1997 from January to July; which were obtained from the World Bank Commodity Price Data (Pink Sheet of July 1997). After some adjustment with freight and insurance, exchange rate and handling/processing costs, the social price of rice used in this calculation is Rp 570/kg; seed is Rp 943/kg and fertilizer is Rp 457/kg.

The social price for labor was set at Rp 5,000/man-day, as this amount could represent an opportunity cost of labor in the study area of giving up an agricultural activities to obtain different types of job, either on-farm, off-farm or outside the agricultural sector. Under similar circumstances with the situation in the private profitability analysis, the total revenue could be achieved by lowland rice farmers is Rp 836 thousands, which is higher than Rp 684 and Rp 760 thousand, the amount achieved by short and medium fallow shifting cultivators, respectively. This amount is also lower than the revenue from long-fallow system of shifting cultivation, which is slightly above Rp 1 million.

Given that the social cost structure is about the same across four-different of land use system, the positive profit then could be achieved by the lowland rice and long bush-fallow under shifting cultivation system. For complete information, please refer to the following Table 7.

Table 7. Social Profitability of Lowland Rice and Shifting Cultivation (Rupiah)

Items	Lowland Rice	Shifting Cultivation		
		Short Fallow	Medium Fallow	Long Fallow
Total Revenue	855,588	684,470	760,332	1,026,705
Total Cost	836,533	889,028	973,778	987,278
Land Price	0	0	0	0
Profit, excl. land	19,054	-204,558	-213,446	39,427
Net Profit	19,054	-204,558	-213,446	39,427

Source: Authors' calculation

(c) Effect of Divergence

In the concept of policy analysis matrix, effect of divergence refers to the policy effects and market failures in all components of production process. In this study, policy effects of tradable outputs and tradable inputs of each land-use system are positive, shown by a higher private value than social value. The positive divergence in tradable output indicate that farmers in Rantau Pandan are receiving more than the social value for their crop. There is a subsidy on the production process of rice as much as Rp 944 thousand for lowland rice, which is lower than the subsidy for long-fallow shifting cultivation amounting at Rp 1.13 million. The amount of subsidy is still higher than the subsidy for short fallow and medium fallow, respectively of Rp 755 and Rp 839 thousands.

The positive divergence on tradable inputs reflects a taxing effect to farmers for the use of seed and fertilizer. Farmers in Rantau Pandan pay more than the social value of inputs; and this divergence should represent an income to the government. Given that only farmers in the lowland rice land-use system use the fertilizer, the amount of taxing effect on tradable input in lowland rice is Rp 9,227, which is higher than that in upland rice shifting cultivation. An amount of Rp 6,422 tax in upland rice shifting cultivation in all types of bush fallow system is primarily due to the use of paddy seed. Farmers would have received a better value if the government allocate the budget for establishing a seed-multiplication center around the study area.

The higher social cost of labor also reflects the low wage rate in agriculture. Farmers in Rantau Pandan would have received a higher return on labor if they are working outside agricultural sector. The gender issue of labor does not significantly affect the labor-cost structure in the field, because there is no gender segregation in wage rate. Even, the man labor is paid less than the standard if he is performing a woman-job such as weeding, planting, etc. This high social labor cost also causes the negative profits in social value of short-fallow and medium fallow upland shifting cultivation system, reaching as high as Rp 205 and Rp 213 thousands respectively.

Therefore, the patterns of net effects are also the same with the other patterns of production activities, where lowland rice has a higher value than the short and medium fallow, but lower than the long-bush fallow system. A complete version of the tables of Policy Analysis Matrix (PAM) could be in the Table A-6 Appendix. The following Table 8 will present the ratio tables of protection and efficiency for lowland rice and upland shifting cultivation.

Table 8. Ratios of Protection for Lowland Rice and Shifting Cultivation

Land Use System	**NPC**			
	Output	**Input**	**EPC**	**DRC**
Lowland Rice	2.10	1.29	2.14	0.98
Short Bush-Fallow	2.10	1.27	2.13	1.31
Medium Bush-Fallow	2.10	1.27	2.13	1.29
Long Bush-Fallow	2.10	1.27	2.12	0.96

Notes: NPC is Nominal Protection Coefficient
EPC is Effective Protection Coefficient
DRC is Domestic Resource Cost Coefficient

As can be inferred from previous explanation, the extent of commodity and factor market divergence in the production process of different land-use system could reveal the nominal protection coefficient (NPC). In other words, the comparison between private commodity prices and social commodity prices and the impact of government policy or of market failures that are not corrected by efficient policies. The NPC values both for output and for input are greater than one, respectively 2.10 and 1.29 for lowland rice; and respectively 2.10 and 1.27 for each different length of fallow system of upland rice shifting cultivation. These reflect that market price for the output exceeds the social price, meaning that farmers in Rantau Pandan receive an implicit output subsidy from policies affecting crop prices. However, farmers also being taxed by a very high market prices for inputs, primarily fertilizer and seed.

The positive effect of rice subsidy is also shown by the value of Effective Protection Coefficient (EPC) for all land-use system which are higher than two. As the EPC indicates the combined effects of policies in the tradable commodities markets the floor-price policy on rice could affect the decision made by farmers in the study sites. In this case, the taxing effect of fertilizer and seed could be offset by the output subsidy. This is interesting because Indonesia that has been known for a very protective policy on fertilizer subsidy, in fact, does not employ the subsidy anymore.

Finally, the efficient or the comparative advantage of rice production in four different land-use system is shown by the value of domestic resource cost coefficient (DRC). Shifting cultivation system under short and medium bush-fallow have a DRC value 1.31 and 1.29 respectively. This indicates that the domestic resources used to produce the rice exceed its value added in social prices. It also implies that rice production activities in these two land-use systems do not represent an efficient use of the resource endowments available in the study sites. The lowland rice and long fallow shifting cultivation of upland rice have a DRC of 0.98 and 0.96, respectively. This implies that both systems have a comparative advantage or an efficient use of resources in rice production process.

(d) NPV-PAM and Sensitivity Analysis

This section is a complementary for the previous analysis on a single-year policy analysis matrix (PAM) on lowland rice and shifting cultivation system. A net present value (NPV) PAM was established in order to examine the profitability and efficiency of particular land-use system within the 25-year cycle. A 20 percent discount rate was set up -- comparable to market interest rate due to economic uncertainty since July of 1997 -- to calculate the present value of revenue, cost and profit of each land use system.

About similar to the structure of private and social profitability in a single year PAM, lowland rice is more profitable than the short and medium fallow, but less profitable than the long fallow of shifting cultivation. Based on the ratios of efficiency the in the 25 year cycle, lowland rice system is at the point of domestic comparative advantage; while the long fallow is relatively efficient in using the available resources. A detailed result of the NPV-PAM could be seen in Table Appendix B-9.

Sensitivity analysis of some components in the rice production process results in different policy implication. An increase of exchange rate up to Rp 3,400 for one US dollar results in different characteristics of each land-use system. All four land-use show an efficient domestic resource uses, shown by a DRC lower than one. The increase in exchange rate has sensitively changed all values of NPC for input to be lower than one, implying that the market price for inputs fall below the prices that would result in the absence of policy. The subsidy of tradable inputs for farmers also represents the cost to the government, because of the exchange rate increase.

The impact is also very significant when the exchange rate reach the value of Rp 5,000 for every US dollar. All the components of social value would exceed the those of private value, implying that distorting polices (and notably uncorrected market failures) and in appropriate exchange rate exist in the Indonesian economy. For an open economy model, exchange rate is very sensitive and affecting almost all of the economic activities in the country.

6. CONCLUDING REMARKS: POLICY REFORMS?

The study shows the profitability of a more permanent lowland rice, compared to a short and medium fallow system of shifting cultivation. A long fallow system is also profitable and an indication of domestic resource use efficiency, but probably not a wise choice given the pressure on land have increased over time. Under an open economy argument, farmers are trying to adopt a more permanent and more intensive land-use practices in accordance with the increasing pressure and the existence of market forces and the growing market economy in rural area.

Since the bush-fallow system is hardly found in the lowland Sumatra at present time, the policy challenge is then how well-prepared the supporting systems such as transportation infrastructure, irrigation, provision of modern inputs, etc. that could maintain the efficiency and profitability of lowland rice cultivation system? Or this preliminary finding could be another assured indication that farmers adopting an upland shifting cultivation under "normal length" of bush fallow (short and medium) is a pre-requisite to establish the property rights on land under a tree crop or cash crop system such as rubber and cassiavera.

Unfortunately, the present study does not focus on the profitability and efficiency of the smallholder rubber (or jungle rubber) and cassiavera land-use system, including those of more modern cultivation system of such cash crops. Another intriguing issue is that shifting cultivation system, continued by cash crops system could represent the "real" agroforestry system which is economically productive and ecologically viable for the formerly forest land.

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Table A-1 Input-Output Tables for Lowland Rice and Shifting Cultivation

I-O				Dry Paddy	
	Quantities	Wet Paddy	Short Fallow	Medium Fallow	Long Fallow
Tradables	Fertilizer: Urea (kg/ha)	25	0	0	0
	Seed (kg/ha)	22	25	25	25
Factors	Labor (man-day/ha)				
	Land Clearing/Preparation	30	25	30	40
	Seedbed Preparation	12	0	0	0
	Planting/Replanting	10	15	15	15
	Weeding	15	25	30	20
	Spraying/Crop Care	5	0	0	0
	Crop watching from pig	30	40	40	40
	Crop watching from bird	20	25	30	30
	Harvesting	15	20	20	20
	Drying	4	2	2	2
	Capital				
	Working Capital (Rp/ha)	662,400	703,000	768,000	858,000
	Land (ha)	1	1	1	1
Output	(kg/ha)	1,500	1,200	1,333	1,800

Table A-2. Private Prices Tables for Lowland Rice and Shifting Cultivation

P-Prices				Dry Paddy	
	Quantities	Wet Paddy	Short Fallow	Medium Fallow	Long Fallow
Tradables	Fertilizer: Urea (kg/ha)	600	600	600	600
	Seed (kg/ha)	1,200	1,200	1,200	1,200
Factors	Labor (man-day/ha)				
	Land Clearing/Preparation	5,000	5,000	5,000	7,000
	Seedbed Preparation	5,000	5,000	5,000	5,000
	Planting/Replanting	4,000	4,000	4,000	4,000
	Weeding	4,000	4,000	4,000	4,000
	Spraying/Crop Care	4,000	4,000	4,000	4,000
	Crop watching from pig	5,000	5,000	5,000	5,000
	Crop watching from bird	4,000	4,000	4,000	4,000
	Harvesting	4,000	4,000	4,000	4,000
	Drying	4,000	4,000	4,000	4,000
	Capital				
	Working Capital (Rp/ha)	0	0	0	0
	Land (Rp/ha)	470,000	450,000	420,000	400,000
Output	(Rp/kg)	1,200	1,200	1,200	1,200

Table A-3. Private Budget Tables for Lowland Rice and Shifting Cultivation

P-Budget				Dry Paddy	
	Quantities	Wet Paddy	Short Fallow	Medium Fallow	Long Fallow
Tradables	Fertilizer:Urea (kg/ha)	15,000	0	0	0
	Seed (kg/ha)	26,400	30,000	30,000	30,000
Factors	Labor (man-day/ha)				
	Land-Clearing	150,000	125,000	150,000	280,000
	Seedbed Prep	60,000	0	0	0
	Planting/Replanting	40,000	60,000	60,000	60,000
	Weeding	60,000	100,000	120,000	80,000
	Spraying/Crop Care	20,000	0	0	0
	Crop watching from pig	150,000	200,000	200,000	200,000
	Crop watching from bird	80,000	100,000	120,000	120,000
	Harvesting	60,000	80,000	80,000	80,000
	Drying	16,000	8,000	8,000	8,000
	Capital				
	Working Capital (Rp/ha)	132,480	140,600	153,600	171,600
	Land (Rp/ha)	470,000	450,000	420,000	400,000
Output	Total Revenue (Rp/ha)	1,800,000	1,440,000	1,599,600	2,160,000
	Total Costs (excluding land) (Rp/ha)	809,880	843,600	921,600	1,029,600
	Profit (excluding land) (Rp/ha)	990,120	596,400	678,000	1,130,400
	Net Profit (including land) (Rp/ha)	520,120	146,400	258,000	730,400

Table A-4. Social Price Tables for Lowland Rice and Shifting Cultivation

S-Prices				Dry Paddy	
	Quantities	Wet Paddy	Short Fallow	Medium Fallow	Long Fallow
Tradables	Fertilizer: Urea (kg/ha)	457	457	457	457
	Seed (kg/ha)	943	943	943	943
Factors	Labor (man-day/ha)				
	Land Clearing/Preparation	5,000	5,000	5,000	5,000
	Seedbed Preparation	5,000	5,000	5,000	5,000
	Planting/Replanting	5,000	5,000	5,000	5,000
	Weeding	5,000	5,000	5,000	5,000
	Spraying/Crop Care	5,000	5,000	5,000	5,000
	Crop watching from pig	5,000	5,000	5,000	5,000
	Crop watching from bird	5,000	5,000	5,000	5,000
	Harvesting	5,000	5,000	5,000	5,000
	Drying	5,000	5,000	5,000	5,000
	Capital				
	Working Capital (Rp/ha)	0	0	0	0
	Land (Rp/ha)	0	0	0	0
Output	(Rp/kg)	570	570	570	570

Table A-5. Social Budget Tables for Lowland Rice and Shifting Cultivation

S-Budget				Dry Paddy	
	Quantities	Wet Paddy	Short Fallow	Medium Fallow	Long Fallow
Tradables	Fertilizer (kg/ha)	11,425	0	0	0
	Seed (kg/ha)	20,748	23,578	23,578	23,578
Factors	Labor (man-day/ha)	0	0	0	0
	Land-Clearing	150,000	125,000	150,000	200,000
	Seedbed Prep	60,000	0	0	0
	Planting/Replanting	50,000	75,000	75,000	75,000
	Weeding	75,000	125,000	150,000	100,000
	Spraying/Crop Care	25,000	0	0	0
	Crop watching from pig	150,000	200,000	200,000	200,000
	Crop watching from bird	100,000	125,000	150,000	150,000
	Harvesting	75,000	100,000	100,000	100,000
	Drying	20,000	10,000	10,000	10,000
	Capital				
	Working Capital (Rp/ha)	99,360	105,450	115,200	128,700
	Land (Rp/ha)	0	0	0	0
Output	Total Revenue (Rp/ha)	855,588	684,470	760,332	1,026,705
	Total Costs (excluding land) (Rp/ha)	836,533	889,028	973,778	987,278
	Profit (excluding land) (Rp/ha)	19,054	-204,558	-213,446	39,427
	Net Profit (including land) (Rp/ha)	19,054	-204,558	-213,446	39,427

Table A-6. Policy Analysis Matrices and Ratios of Protection and Efficiency for Lowland Rice and Shifting Cultivation

Policy Analysis Matrix: Wet Paddy					
	Tradables		Domestic Resources		
	Output	Inputs	Labor	Capital	Profits
Private	1,800,000	41,400	636,000	132,480	990,120
Social	855,588	32,173	705,000	99,360	19,054
Divergences	944,412	9,227	(69,000)	33,120	971,066

Policy Analysis Matrix: Short Fallow - Dry Paddy					
	Tradables		Domestic Resources		
	Output	Inputs	Labor	Capital	Profits
Private	1,440,000	30,000	673,000	140,600	596,400
Social	684,470	23,578	760,000	105,450	(204,558)
Divergences	755,530	6,422	(87,000)	35,150	800,958

Policy Analysis Matrix: Medium Fallow - Dry Paddy					
	Tradables		Domestic Resources		
	Output	Inputs	Labor	Capital	Profits
Private	1,599,600	30,000	738,000	153,600	678,000
Social	760,332	23,578	835,000	115,200	(213,446)
Divergences	839,268	6,422	(97,000)	38,400	891,446

Policy Analysis Matrix: Long Fallow - Dry Paddy					
	Tradables		Domestic Resources		
	Output	Inputs	Labor	Capital	Profits
Private	2,160,000	30,000	828,000	171,600	1,130,400
Social	1,026,705	23,578	835,000	128,700	39,427
Divergences	1,133,295	6,422	(7,000)	42,900	1,090,973

Ratios of Protection and Efficiency for Wet Paddy and Shifting Cultivation				
	NPC		EPC	DRC
	Outputs	Inputs		
Wet Paddy - AYV	2.10	1.29	2.14	0.98
Short Fallow - Dry Paddy	2.10	1.27	2.13	1.31
Medium Fallow - Dry Paddy	2.10	1.27	2.13	1.29
Long Fallow - Dry Paddy	2.10	1.27	2.12	0.96

Table A-7. Ratios of Protection and Efficiency for Wet Paddy and Shifting Cultivation

Ratios of Protection and Efficiency				
	NPC		EPC	DRC
	Outputs	Inputs		
Wet Paddy - AYV	2.10	1.29	2.14	0.98
Short Fallow - Dry Paddy	2.10	1.27	2.13	1.31
Medium Fallow - Dry Paddy	2.10	1.27	2.13	1.29
Long Fallow - Dry Paddy	2.10	1.27	2.12	0.96

Table A-x. Social Import Parity Price for Rice and Seed and Social Export Parity Price for Urea

	Output	Input
Social Import Parity Prices	Rice	PaddySeed
F.o.b. ($/ton)	329.8	329.8
Freight & Insurance ($/ton)	21	21
C.i.f. price at Indonesian port ($/ton)	350.8	350.8
Exchange rate (Rp/$)	2400	2400
Exchange rate premium (%)	10%	10%
Equilibrium exchange rate (Rp/$)	2640	2640
C.i.f. in domestic currency (Rp/ton)	926112	926112
Weight conversion factor (kg/ton)	1000	1000
C.i.f. in dom. currency and weight units (Rp/kg)	926	926
Transportation costs (Rp/kg)	5	5
Handling costs (Rp/kg)	7	7
Value before processing (Rp/kg)	938	938
Processing conversion factor (%)	0.64	1
Import parity value at wholesale (Rp/kg)	600	938
Processing costs (Rp/kg)	25	0
Distribution costs to farm (Rp/kg)	5	5
Import parity value at farm gate (Rp/kg)	570	943

Social Export Parity Prices	Urea
C.i.f. ($/ton)	205
Freight & Insurance ($/ton)	30
F.o.b. price at Indonesian port ($/ton)	175
Exchange rate (Rp/$)	2400
Exchange rate premium (%)	10%
Equilibrium exchange rate (Rp/$)	2640
F.o.b. in domestic currency (Rp/ton)	462000
Weight conversion factor (kg/ton)	1000
F.o.b. in dom. currency and weight units (Rp/kg)	462
Transportation costs (Rp/kg)	7
Handling costs (Rp/kg)	8
Value before processing (Rp/kg)	447
Processing conversion factor (%)	1
Export parity value at wholesale (Rp/kg)	447
Processing costs (Rp/kg)	0
Distribution costs to farm (Rp/kg)	10
Export parity value at farm gate (Rp/kg)	457

Private Export Parity Prices	Urea
C.i.f. ($/ton)	280
Freight & Insurance ($/ton)	30
F.o.b. price at Indonesian port ($/ton)	250
Exchange rate (Rp/$)	2400
Depreciation	42%
Post-Depreciation Exchange rate (Rp/$)	3408
F.o.b. in domestic currency (Rp/ton)	852000
Weight conversion factor (kg/ton)	1000
F.o.b. in dom. currency and weight units (Rp/kg)	852
Net Trade Tax (%)	5%
Domestic Subsidy (%)	30%
Domestic Tax (%)	0%
Domestic Price (Rp/kg)	1,065
Transportation costs (Rp/kg)	7
Handling costs (Rp/kg)	8
Value before processing (Rp/kg)	1050
Processing conversion factor (%)	1
Export parity value at wholesale (Rp/kg)	1050
Processing costs (Rp/kg)	0
Distribution costs to farm (Rp/kg)	10
Export parity value at farm gate (Rp/kg)	1060

Assumptions Table		Rate
Macro-Economic Assumptions		
	Nominal interest rate (%)	20%
	Social interest rate (%)	15%
	Official exchange rate (Rp/$)	2,400
	Exchange premium (%)	10%
	Percent depreciation (%)	42%
Commodity Policies		
	Rice tariff (%)	0%
	Urea export tax (%)	5%

P-Budget NPV for Wet Rice																				
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Discount rate	20.00%																		
Tradables	Fertilizer:Urea (kg/ha)	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
	Seed (kg/ha)	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400
Factors	Labor (man-day/ha)																			
	Land-Clearing	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Seedbed Prep	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Planting/Replanting	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
	Weeding	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Spraying/Crop Care	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
	Crop watching from pig	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Crop watching from bird	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
	Harvesting	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Drying	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000
	Capital																			
	Working Capital (Rp/ha)	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480
	Land (Rp/ha)	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000
Output	Output	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
	Total Revenue	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
	PV Total Revenue	1,800,000	1,500,000	1,250,000	1,041,667	868,056	723,380	602,816	502,347	418,622	348,852	290,710	242,258	201,882	168,235	140,196	116,830	97,358	81,132	67,610
	Total PV of Total Revenue	10,705,657																		
	Input Cost	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400
	PV Input Cost	41,400	34,500	28,750	23,958	19,965	16,638	13,865	11,554	9,628	8,024	6,686	5,572	4,643	3,869	3,225	2,687	2,239	1,866	1,555
	Total PV of Input Cost	246,230																		
	Labour Cost	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000
	PV Labour Cost	636,000	530,000	441,667	368,056	306,713	255,594	212,995	177,496	147,913	123,261	102,718	85,598	71,332	59,443	49,536	41,280	34,400	28,667	23,889
	Total PV of Labour Cost	3,782,665																		
	Capital Cost	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480
	PV Capital Cost	132,480	110,400	92,000	76,667	63,889	53,241	44,367	36,973	30,811	25,676	21,396	17,830	14,859	12,382	10,318	8,599	7,166	5,971	4,976
	Total PV of Capital Cost	787,936																		
	Land Cost	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000
	PV Land Cost	470,000	391,667	326,389	271,991	226,659	188,882	157,402	131,168	109,307	91,089	75,908	63,256	52,714	43,928	36,607	30,506	25,421	21,184	17,654
	Total PV of Land Cost	2,795,366																		
	Total Costs (exc. land)	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880
	PV Total Costs	809,880	674,900	562,417	468,681	390,567	325,473	271,227	226,023	188,352	156,960	130,800	109,000	90,833	75,695	63,079	52,566	43,805	36,504	30,420
	Total PV of Total Costs	4,816,832																		

Table B-1. Present Value of Private Budget Tables for Lowland Rice

Private-Budget NPV for Wet Rice																											
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discount rate	20.00%																									
Tradables	Fertilizer:Urea	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
	Seed	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400
Factors	Labor																										
	Land-Clearing	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Seedbed Prep	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Planting/Replanting	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
	Weeding	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Spraying/Crop Care	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
	Crop watching from pig	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Crop watching from bird	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
	Harvesting	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Drying	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000
	Capital																										
	Working Capital (Rp/ha)	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480
	Land (Rp/ha)	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000
Output	Output (kg/ha)	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
	Total Revenue	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
	PV Total Revenue	1,800,000	1,500,000	1,250,000	1,041,667	868,056	723,380	602,816	502,347	418,622	348,852	290,710	242,258	201,882	168,235	140,196	116,830	97,358	81,132	67,610	56,342	46,951	39,126	32,605	27,171	22,642	18,869
	Total PV of Total Revenu	10,705,657																									
	Input Cost	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400
	PV Input Cost	41,400	34,500	28,750	23,958	19,965	16,638	13,865	11,554	9,628	8,024	6,686	5,572	4,643	3,869	3,225	2,687	2,239	1,866	1,555	1,296	1,080	900	750	625	521	434
	Total PV of Input Cost	246,230																									
	Labour Cost	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000	636,000
	PV Labour Cost	636,000	530,000	441,667	368,056	306,713	255,594	212,995	177,496	147,913	123,261	102,718	85,598	71,332	59,443	49,536	41,280	34,400	28,667	23,889	19,907	16,589	13,825	11,520	9,600	8,000	6,667
	Total PV of Labour Cost	3,782,665																									
	Capital Cost	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480	132,480
	PV Capital Cost	132,480	110,400	92,000	76,667	63,889	53,241	44,367	36,973	30,811	25,676	21,396	17,830	14,859	12,382	10,318	8,599	7,166	5,971	4,976	4,147	3,456	2,880	2,400	2,000	1,666	1,389
	Total PV of Capital Cost	787,936																									
	Land Cost	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000
	PV Land Cost	470,000	391,667	326,389	271,991	226,659	188,882	157,402	131,168	109,307	91,089	75,908	63,256	52,714	43,928	36,607	30,506	25,421	21,184	17,654	14,711	12,260	10,216	8,514	7,095	5,912	4,927
	Total PV of Land Cost	2,795,366																									
	Total Costs (exc. land)	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880	809,880
	PV Total Costs	809,880	674,900	562,417	468,681	390,567	325,473	271,227	226,023	188,352	156,960	130,800	109,000	90,833	75,695	63,079	52,566	43,805	36,504	30,420	25,350	21,125	17,604	14,670	12,225	10,188	8,490
	Total PV of Total Costs	4,816,832																									
	Profit (excluding land)	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120	990,120
	NPV Profit (exc. land)	990,120	825,100	687,583	572,986	477,488	397,907	331,589	276,324	230,270	191,892	159,910	133,258	111,049	92,540	77,117	64,264	53,554	44,628	37,190	30,992	25,826	21,522	17,935	14,946	12,455	10,379
	Total NPV of Profit	5,888,825																									
	Net Profit (including land)	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120	520,120
	NPV Net Profit (including	520,120	433,433	361,194	300,995	250,829	209,025	174,187	145,156	120,963	100,803	84,002	70,002	58,335	48,612	40,510	33,759	28,132	23,443	19,536	16,280	13,567	11,306	9,421	7,851	6,543	5,452
	Total NPV of Net Profit	3,093,459																									

Table B-2. Present Value of Private Budget Tables for Short-Fallow Shifting Cultivation of Upland Rice

Private-Budget NPV for Short-Fallow Dry Rice																											
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discount rate	20.00%																									
Tradables	Fertilizer:Urea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Factors	Labor																										
	Land-Clearing	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000
	Seedbed Prep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Planting/Replanting	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Weeding	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
	Spraying/Crop Care	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crop watching from pig	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Crop watching from bird	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
	Harvesting	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
	Drying	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
	Capital																										
	Working Capital (Rp/ha)	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600
	Land (Rp/ha)	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000
Output	Output (kg/ha)	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
	Total Revenue	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
	PV Total Revenue	1,440,000	1,200,000	1,000,000	833,333	694,444	578,704	482,253	401,878	334,898	279,082	232,568	193,807	161,506	134,588	112,157	93,464	77,887	64,905	54,088	45,073	37,561	31,301	26,084	21,737	18,114	15,095
	Total PV of Total Revenue	14,324,525																									
	Input Cost	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
	PV Input Cost	30,000	25,000	20,833	17,361	14,468	12,056	10,047	8,372	6,977	5,814	4,845	4,038	3,365	2,804	2,337	1,947	1,623	1,352	1,127	939	783	652	543	453	377	314
	Total PV of Input Cost	298,428																									
	Labour Cost	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000	673,000
	PV Labour Cost	673,000	560,833	467,361	389,468	324,556	270,464	225,386	187,822	156,518	130,432	108,693	90,578	75,481	62,901	52,418	43,681	36,401	30,334	25,279	21,065	17,555	14,629	12,191	10,159	8,466	7,055
	Total PV of Labour Cost	6,694,726																									
	Capital Cost	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600	140,600
	PV Capital Cost	140,600	117,167	97,639	81,366	67,805	56,504	47,087	39,239	32,699	27,249	22,708	18,923	15,769	13,141	10,951	9,126	7,605	6,337	5,281	4,401	3,667	3,056	2,547	2,122	1,769	1,474
	Total PV of Capital Cost	1,398,631																									
	Land Cost	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000
	PV Land Cost	450,000	375,000	312,500	260,417	217,014	180,845	150,704	125,587	104,656	87,213	72,678	60,565	50,470	42,059	35,049	29,207	24,340	20,283	16,902	14,085	11,738	9,782	8,151	6,793	5,661	4,717
	Total PV of Land Cost	4,476,414																									
	Total Costs (exc. land)	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600	843,600
	PV Total Costs	843,600	703,000	585,833	488,194	406,829	339,024	282,520	235,433	196,194	163,495	136,246	113,538	94,615	78,846	65,705	54,754	45,629	38,024	31,686	26,405	22,005	18,337	15,281	12,734	10,612	8,843
	Total PV of Total Costs	8,391,784																									
	Profit (excluding land)	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400	596,400
	NPV Profit (exc. land)	596,400	497,000	414,167	345,139	287,616	239,680	199,733	166,444	138,704	115,586	96,322	80,268	66,890	55,742	46,452	38,710	32,258	26,882	22,401	18,668	15,557	12,964	10,803	9,003	7,502	6,252
	Total NPV of Profit	5,932,741																									
	Net Profit (including land)	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400
	NPV Net Profit (including land)	146,400	122,000	101,667	84,722	70,602	58,835	49,029	40,858	34,048	28,373	23,644	19,704	16,420	13,683	11,403	9,502	7,918	6,599	5,499	4,582	3,819	3,182	2,652	2,210	1,842	1,535
	Total NPV of Net Profit	1,456,327																									

Table B-3. Present Value of Private Budget Tables for Medium-Fallow of Shifting Cultivation of Upland Rice

Private Budget NPV for Medium-Fallow Dry Rice																											
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discount rate	20.00%																									
Tradables	Fertilizer:Urea (kg/ha)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed (kg/ha)	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Factors	Labor (man-day/ha)																										
	Land-Clearing	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Seedbed Prep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Planting/Replanting	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Weeding	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000
	Crop Care	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crop watching from pig	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Crop watching from bird	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000
	Harvesting	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
	Drying	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
	Capital																										
	Working Capital (Rp/ha)	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600
	Land (Rp/ha)	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000
Output	Output	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333
	Total Revenue	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600	1,599,600
	PV Total Revenue	1,599,600	1,333,000	1,110,833	925,694	771,412	642,843	535,703	446,419	372,016	310,013	258,344	215,287	179,406	149,505	124,587	103,823	86,519	72,099	60,083	50,069	41,724	34,770	28,975	24,146	20,122	16,768
	Total PV of Total Revenue	15,912,160																									
	Input Cost	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
	PV Input Cost	30,000	25,000	20,833	17,361	14,468	12,056	10,047	8,372	6,977	5,814	4,845	4,038	3,365	2,804	2,337	1,947	1,623	1,352	1,127	939	783	652	543	453	377	314
	Total PV of Input Cost	298,428																									
	Labor Cost	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000	738,000
	PV Labor Cost	738,000	615,000	512,500	427,083	355,903	296,586	247,155	205,962	171,635	143,029	119,191	99,326	82,772	68,976	57,480	47,900	39,917	33,264	27,720	23,100	19,250	16,042	13,368	11,140	9,283	7,736
	Total PV of Labor Cost	7,341,319																									
	Capital Cost	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600	153,600
	PV Capital Cost	153,600	128,000	106,667	88,889	74,074	61,728	51,440	42,867	35,722	29,769	24,807	20,673	17,227	14,356	11,963	9,969	8,308	6,923	5,769	4,808	4,007	3,339	2,782	2,319	1,932	1,610
	Total PV of Capital Cost	1,527,949																									
	Land Cost	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000	420,000
	PV Land Cost	420,000	350,000	291,667	243,056	202,546	168,789	140,657	117,214	97,679	81,399	67,832	56,527	47,106	39,255	32,712	27,260	22,717	18,931	15,776	13,146	10,955	9,129	7,608	6,340	5,283	4,403
	Total PV of Land Cost	4,177,987																									
	Total Costs (exc. land)	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600	921,600
	PV Total Costs	921,600	768,000	640,000	533,333	444,444	370,370	308,642	257,202	214,335	178,612	148,844	124,036	103,364	86,136	71,780	59,817	49,847	41,540	34,616	28,847	24,039	20,033	16,694	13,911	11,593	9,661
	Total PV of Total Costs	9,167,696																									
	Profit (excluding land)	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000	678,000
	NPV Profit (exc. land)	678,000	565,000	470,833	392,361	326,968	272,473	227,061	189,217	157,681	131,401	109,501	91,251	76,042	63,369	52,807	44,006	36,672	30,560	25,466	21,222	17,685	14,737	12,281	10,234	8,529	7,107
	Total NPV of Profit	6,744,464																									
	Net Profit (including land)	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000	258,000
	NPV Net Profit (including land)	258,000	215,000	179,167	149,306	124,421	103,684	86,404	72,003	60,003	50,002	41,668	34,724	28,936	24,114	20,095	16,746	13,955	11,629	9,691	8,076	6,730	5,608	4,673	3,894	3,245	2,705
	Total NPV of Net Profit	2,566,477																									

Table B-4. Present Value of Private Budget Tables for Long-Fallow Shifting Cultivation of Upland Rice

Private-Budget NPV for Long-Fallow Dry Rice																											
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discount rate	20.00%																									
Tradables	Fertilizer:Urea (kg/ha)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed (kg/ha)	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Factors	Labor (man-day/ha)																										
	Land-Clearing	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000
	Seedbed Prep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Planting/Replanting	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Weeding	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
	Spraying/Crop Care	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crop watching from pig	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Crop watching from bird	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000
	Harvesting	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
	Drying	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
	Capital																										
	Working Capital (Rp/ha)	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600
	Land (Rp/ha)	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000
Output	Output (kg/ha)	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
	Total Revenue	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000
	PV Total Revenue	2,160,000	1,800,000	1,500,000	1,250,000	1,041,667	868,056	723,380	602,816	502,347	418,622	348,852	290,710	242,258	201,882	168,235	140,196	116,830	97,358	81,132	67,610	56,342	46,951	39,126	32,605	27,171	22,642
	Total PV of Total Revenue	21,486,788																									
	Input Cost	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
	PV Input Cost	30,000	25,000	20,833	17,361	14,468	12,056	10,047	8,372	6,977	5,814	4,845	4,038	3,365	2,804	2,337	1,947	1,623	1,352	1,127	939	783	652	543	453	377	314
	Total PV of Input Cost	298,428																									
	Labour Cost	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000	828,000
	PV Labour Cost	828,000	690,000	575,000	479,167	399,306	332,755	277,296	231,080	192,566	160,472	133,727	111,439	92,866	77,388	64,490	53,742	44,785	37,321	31,101	25,917	21,598	17,998	14,998	12,499	10,416	8,680
	Total PV of Labour Cost	8,236,602																									
	Capital Cost	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600	171,600
	PV Capital Cost	171,600	143,000	119,167	99,306	82,755	68,962	57,468	47,890	39,909	33,257	27,714	23,095	19,246	16,038	13,365	11,138	9,281	7,735	6,445	5,371	4,476	3,730	3,108	2,590	2,159	1,799
	Total PV of Capital Cost	1,707,006																									
	Land Cost	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000
	PV Land Cost	400,000	333,333	277,778	231,481	192,901	160,751	133,959	111,633	93,027	77,523	64,602	53,835	44,863	37,386	31,155	25,962	21,635	18,029	15,024	12,520	10,434	8,695	7,246	6,038	5,032	4,193
	Total PV of Land Cost	3,979,035																									
	Total Costs (exc. land)	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600	1,029,600
	PV Total Costs	1,029,600	858,000	715,000	595,833	496,528	413,773	344,811	287,342	239,452	199,543	166,286	138,572	115,476	96,230	80,192	66,827	55,689	46,407	38,673	32,227	26,856	22,380	18,650	15,542	12,951	10,793
	Total PV of Total Costs	10,242,036																									
	Profit (excluding land)	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400	1,130,400
	NPV Profit (exc. land)	1,130,400	942,000	785,000	654,167	545,139	454,282	378,569	315,474	262,895	219,079	182,566	152,138	126,782	105,652	88,043	73,369	61,141	50,951	42,459	35,382	29,485	24,571	20,476	17,063	14,219	11,850
	Total NPV of Profit	11,244,752																									
	Net Profit (including land)	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400	730,400
	NPV Net Profit (including land)	730,400	608,667	507,222	422,685	352,238	293,531	244,609	203,841	169,868	141,556	117,964	98,303	81,919	68,266	56,888	47,407	39,506	32,921	27,435	22,862	19,052	15,876	13,230	11,025	9,188	7,656
	Total NPV of Net Profit	7,265,718																									

Table B-5. Present Value of Social Budget Tables for Lowland Rice

Social-Budget NPV for Wet Rice																											
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discount rate	20.00%																									
Tradables	Fertilizer:Urea	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425
	Seed	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748	20,748
Factors	Labor																										
	Land-Clearing	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Seedbed Prep	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
	Planting/Replanting	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
	Weeding	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
	Spraying/Crop Care	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
	Crop watching from pig	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Crop watching from bird	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
	Harvesting	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
	Drying	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
	Capital																										
	Working Capital (Rp/ha)	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360
	Land (Rp/ha)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Output	Output (kg/ha)	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
	Total Revenue	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533
	PV Total Revenue	836,533	697,111	580,926	484,105	403,421	336,184	280,153	233,461	194,551	162,126	135,105	112,587	93,823	78,186	65,155	54,296	45,246	37,705	31,421	26,184	21,820	18,183	15,153	12,627	10,523	8,769
	Total PV of Total Revenue	8,321,485																									
	Input Cost	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173	32,173
	PV Input Cost	32,173	26,811	22,342	18,619	15,516	12,930	10,775	8,979	7,482	6,235	5,196	4,330	3,608	3,007	2,506	2,088	1,740	1,450	1,208	1,007	839	699	583	486	405	337
	Total PV of Input Cost	320,044																									
	Labour Cost	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000	705,000
	PV Labour Cost	705,000	587,500	489,583	407,986	339,988	283,324	236,103	196,753	163,960	136,634	113,861	94,885	79,070	65,892	54,910	45,758	38,132	31,777	26,481	22,067	18,389	15,324	12,770	10,642	8,868	7,390
	Total PV of Labour Cost	7,013,049																									
	Capital Cost	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360	99,360
	PV Capital Cost	99,360	82,800	69,000	57,500	47,917	39,931	33,275	27,730	23,108	19,257	16,047	13,373	11,144	9,287	7,739	6,449	5,374	4,478	3,732	3,110	2,592	2,160	1,800	1,500	1,250	1,042
	Total PV of Capital Cost	988,392																									
	Land Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PV Land Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total PV of Land Cost	0																									
	Total Costs (exc. land)	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533	836,533
	PV Total Costs	836,533	697,111	580,926	484,105	403,421	336,184	280,153	233,461	194,551	162,126	135,105	112,587	93,823	78,186	65,155	54,296	45,246	37,705	31,421	26,184	21,820	18,183	15,153	12,627	10,523	8,769
	Total PV of Total Costs	8,321,485																									
	Profit (excluding land)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NPV Profit (exc. land)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total NPV of Profit	0																									
	Net Profit (including land)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NPV Net Profit (including land)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total NPV of Net Profit	0																									

Table B-6. Present Value of Social Budget Tables for Short-Fallow Shifting Cultivation of Upland Rice

Social-Budget NPV for Short-Fallow Dry Rice																											
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discount rate	20.00%																									
Tradables	Fertilizer:Urea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578
Factors	Labor																										
	Land-Clearing	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000
	Seedbed Prep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Planting/Replanting	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
	Weeding	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000
	Spraying/Crop Care	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crop watching from pig	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Crop watching from bird	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000
	Harvesting	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
	Drying	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
	Capital																										
	Working Capital (Rp/ha)	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450
	Land (Rp/ha)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Output	Output (kg/ha)	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
	Total Revenue	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470	684,470
	PV Total Revenue	684,470	570,392	475,326	396,105	330,088	275,073	229,228	191,023	159,186	132,655	110,546	92,121	76,768	63,973	53,311	44,426	37,022	30,851	25,709	21,425	17,854	14,878	12,398	10,332	8,610	7,175
	Total PV of Total Revenue	6,808,825																									
	Input Cost	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578
	PV Input Cost	23,578	19,648	16,374	13,645	11,371	9,475	7,896	6,580	5,483	4,570	3,808	3,173	2,644	2,204	1,836	1,530	1,275	1,063	886	738	615	513	427	356	297	247
	Total PV of Input Cost	234,544																									
	Labour Cost	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000	760,000
	PV Labour Cost	760,000	633,333	527,778	439,815	366,512	305,427	254,522	212,102	176,752	147,293	122,744	102,287	85,239	71,033	59,194	49,328	41,107	34,256	28,546	23,789	19,824	16,520	13,767	11,472	9,560	7,967
	Total PV of Labour Cost	7,560,166																									
	Capital Cost	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450	105,450
	PV Capital Cost	105,450	87,875	73,229	61,024	50,854	42,378	35,315	29,429	24,524	20,437	17,031	14,192	11,827	9,856	8,213	6,844	5,704	4,753	3,961	3,301	2,751	2,292	1,910	1,592	1,326	1,105
	Total PV of Capital Cost	1,048,973																									
	Land Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PV Land Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total PV of Land Cost	0																									
	Total Costs (exc. land)	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028	889,028
	PV Total Costs	889,028	740,857	617,381	514,484	428,736	357,280	297,734	248,111	206,759	172,300	143,583	119,652	99,710	83,092	69,243	57,703	48,086	40,071	33,393	27,827	23,189	19,325	16,104	13,420	11,183	9,319
	Total PV of Total Costs	8,843,683																									
	Profit (excluding land)	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558
	NPV Profit (exc. land)	-204,558	-170,465	-142,054	-118,378	-98,649	-82,207	-68,506	-57,088	-47,574	-39,645	-33,037	-27,531	-22,943	-19,119	-15,932	-13,277	-11,064	-9,220	-7,683	-6,403	-5,336	-4,446	-3,705	-3,088	-2,573	-2,144
	Total NPV of Profit	-2,034,859																									
	Net Profit (including land)	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558	-204,558
	NPV Net Profit (including land)	-204,558	-170,465	-142,054	-118,378	-98,649	-82,207	-68,506	-57,088	-47,574	-39,645	-33,037	-27,531	-22,943	-19,119	-15,932	-13,277	-11,064	-9,220	-7,683	-6,403	-5,336	-4,446	-3,705	-3,088	-2,573	-2,144
	Total NPV of Net Profit	-2,034,859																									

Table B-7. Present Value of Social Budget Tables for Medium-Fallow Shifting Cultivation of Upland Rice

Social-Budget NPV for Medium-Fallow Dry Rice																											
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discount rate	20.00%																									
Tradables	Fertilizer:Urea (kg/ha)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed (kg/ha)	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578
Factors	Labor (man-day/ha)																										
	Land-Clearing	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Seedbed Prep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Planting/Replanting	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
	Weeding	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
	Crop Care	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crop watching from pig	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Crop watching from bird	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Harvesting	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
	Drying	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
	Capital																										
	Working Capital (Rp/ha)	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200
	Land (Rp/ha)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Output	Output	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333	1,333
	Total Revenue	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332	760,332
	PV Total Revenue	760,332	633,610	528,008	440,007	366,672	305,560	254,634	212,195	176,829	147,357	122,798	102,332	85,276	71,064	59,220	49,350	41,125	34,271	28,559	23,799	19,833	16,527	13,773	11,477	9,564	7,970
	Total PV of Total Revenue	7,563,469																									
	Input Cost	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578
	PV Input Cost	23,578	19,648	16,374	13,645	11,371	9,475	7,896	6,580	5,483	4,570	3,808	3,173	2,644	2,204	1,836	1,530	1,275	1,063	886	738	615	513	427	356	297	247
	Total PV of Input Cost	234,544																									
	Labor Cost	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000
	PV Labor Cost	835,000	695,833	579,861	483,218	402,681	335,568	279,640	233,033	194,194	161,829	134,857	112,381	93,651	78,042	65,035	54,196	45,163	37,636	31,363	26,136	21,780	18,150	15,125	12,604	10,504	8,753
	Total PV of Labor Cost	8,306,235																									
	Capital Cost	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200
	PV Capital Cost	115,200	96,000	80,000	66,667	55,556	46,296	38,580	32,150	26,792	22,327	18,605	15,505	12,920	10,767	8,973	7,477	6,231	5,192	4,327	3,606	3,005	2,504	2,087	1,739	1,449	1,208
	Total PV of Capital Cost	1,145,962																									
	Land Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PV Land Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total PV of Land Cost	0																									
	Total Costs (exc. land)	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778	973,778
	PV Total Costs	973,778	811,482	676,235	563,529	469,607	391,340	326,116	271,764	226,470	188,725	157,271	131,059	109,216	91,013	75,844	63,204	52,670	43,891	36,576	30,480	25,400	21,167	17,639	14,699	12,249	10,208
	Total PV of Total Costs	9,686,741																									
	Profit (excluding land)	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446
	NPV Profit (exc. land)	-213,446	-177,872	-148,226	-123,522	-102,935	-85,779	-71,483	-59,569	-49,641	-41,367	-34,473	-28,727	-23,939	-19,949	-16,625	-13,854	-11,545	-9,621	-8,017	-6,681	-5,568	-4,640	-3,866	-3,222	-2,685	-2,237
	Total NPV of Profit	-2,123,273																									
	Net Profit (including land)	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446	-213,446
	NPV Net Profit (including land)	-213,446	-177,872	-148,226	-123,522	-102,935	-85,779	-71,483	-59,569	-49,641	-41,367	-34,473	-28,727	-23,939	-19,949	-16,625	-13,854	-11,545	-9,621	-8,017	-6,681	-5,568	-4,640	-3,866	-3,222	-2,685	-2,237
	Total NPV of Net Profit	-2,123,273																									

Table B-8. Present Value of Social Budget Tables for Long-Fallow Shifting Cultivation of Upland Rice

Social Budget NPV for Long-Fallow Dry Rice																											
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discount rate	20.00%																									
Tradables	Fertilizer:Urea (kg/ha)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed (kg/ha)	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578
Factors	Labor (man-day/ha)																										
	Land-Clearing	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Seedbed Prep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Planting/Replanting	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
	Weeding	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
	Spraying/Crop Care	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crop watching from pig	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Crop watching from bird	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
	Harvesting	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
	Drying	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
	Capital																										
	Working Capital (Rp/ha)	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700
	Land (Rp/ha)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Output	Output (kg/ha)	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
	Total Revenue	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705	1,026,705
	PV Total Revenue	1,026,705	855,588	712,990	594,158	495,132	412,610	343,841	286,535	238,779	198,982	165,819	138,182	115,152	95,960	79,967	66,639	55,532	46,277	38,564	32,137	26,781	22,317	18,598	15,498	12,915	10,763
	Total PV of Total Revenue	10,213,237																									
	Input Cost	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578	23,578
	PV Input Cost	23,578	19,648	16,374	13,645	11,371	9,475	7,896	6,580	5,483	4,570	3,808	3,173	2,644	2,204	1,836	1,530	1,275	1,063	886	738	615	513	427	356	297	247
	Total PV of Input Cost	234,544																									
	Labour Cost	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000	835,000
	PV Labour Cost	835,000	695,833	579,861	483,218	402,681	335,568	279,640	233,033	194,194	161,829	134,857	112,381	93,651	78,042	65,035	54,196	45,163	37,636	31,363	26,136	21,780	18,150	15,125	12,604	10,504	8,753
	Total PV of Labour Cost	8,306,235																									
	Capital Cost	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700	128,700
	PV Capital Cost	128,700	107,250	89,375	74,479	62,066	51,722	43,101	35,918	29,932	24,943	20,786	17,321	14,435	12,029	10,024	8,353	6,961	5,801	4,834	4,028	3,357	2,798	2,331	1,943	1,619	1,349
	Total PV of Capital Cost	1,280,254																									
	Land Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PV Land Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total PV of Land Cost	0																									
	Total Costs (exc. land)	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278	987,278
	PV Total Costs	987,278	822,732	685,610	571,341	476,118	396,765	330,637	275,531	229,609	191,341	159,451	132,876	110,730	92,275	76,896	64,080	53,400	44,500	37,083	30,903	25,752	21,460	17,883	14,903	12,419	10,349
	Total PV of Total Costs	9,821,034																									
	Profit (excluding land)	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427
	NPV Profit (exc. land)	39,427	32,856	27,380	22,817	19,014	15,845	13,204	11,003	9,169	7,641	6,368	5,306	4,422	3,685	3,071	2,559	2,133	1,777	1,481	1,234	1,028	857	714	595	496	413
	Total NPV of Profit	392,204																									
	Net Profit (including land)	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427	39,427
	NPV Net Profit (including land)	39,427	32,856	27,380	22,817	19,014	15,845	13,204	11,003	9,169	7,641	6,368	5,306	4,422	3,685	3,071	2,559	2,133	1,777	1,481	1,234	1,028	857	714	595	496	413
	Total NPV of Net Profit	392,204																									

Table B-9. NPV-PAM for Lowland Rice and Shifting Cultivation, under a 25-year Planning Cycle

Net Present Value of Policy Analysis Matrix: NPV-PAM Wet Paddy					
	Tradables		Domestic Resources		
	Output	Inputs	Labor	Capital	Profits
Private	10,705,657	246,230	3,782,665	787,936	5,888,825
Social	8,321,485	320,044	7,013,049	988,392	(0)
Divergences	2,384,172	(73,814)	(3,230,384)	(200,456)	5,888,825

Net Present Value Policy Analysis Matrix: NPV-PAM Short Fallow - Dry Paddy					
	Tradables		Domestic Resources		
	Output	Inputs	Labor	Capital	Profits
Private	14,324,525	298,428	6,694,726	1,398,631	5,932,741
Social	6,808,825	234,544	7,560,166	1,048,973	(2,034,859)
Divergences	7,515,700	63,883	(865,440)	349,658	7,967,599

Net Present Value Policy Analysis Matrix: NPV-PAM Medium Fallow - Dry Paddy					
	Tradables		Domestic Resources		
	Output	Inputs	Labor	Capital	Profits
Private	15,912,160	298,428	7,341,319	1,527,949	6,744,464
Social	7,563,469	234,544	8,306,235	1,145,962	(2,123,273)
Divergences	8,348,691	63,883	(964,916)	381,987	8,867,737

Net Present Value Policy Analysis Matrix: NPV-PAM Long Fallow - Dry Paddy					
	Tradables		Domestic Resources		
	Output	Inputs	Labor	Capital	Profits
Private	21,486,788	298,428	8,236,602	1,707,006	11,244,752
Social	10,213,237	234,544	8,306,235	1,280,254	392,204
Divergences	11,273,551	63,883	(69,633)	426,751	10,852,549

NPV Ratios of Protection and Efficiency for Wet Paddy and Shifting Cultivation				
	NPC		EPC	DRC
	Outputs	Inputs		
Wet Paddy - AYV	1.29	0.77	1.31	1.00
Short Fallow - Dry Paddy	2.10	1.27	2.13	1.31
Medium Fallow - Dry Paddy	2.10	1.27	2.13	1.29
Long Fallow - Dry Paddy	2.10	1.27	2.12	0.96

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