I. INTRODUCTION

1.1. Background

The uniqueness of agroforestry system has been documented in many reports. Torquebiau (1984), Mary and Michon (1987) and Michon (1993) reveal that agroforestry is like a forest like land use system invented by local people over generations living at the margin of rainforest.

Natural rubber is an important export commodity for Indonesia with approximately 1.3 million farm households relying on rubber cultivation that accounts for 75% of national production (Director General of Estates, 2002). The predominant traditional rubber agroforestry system, has two characteristics of interest: firstly the crop is owned by smallholder farmers (with 2-5 ha plots on average) and secondly it is a result of local farmers adapting rubber as a cash crop into their crop fallow system rotation from the early 20th century (Van Noordwijk et al, 1995; Penot and Sunario, 1997; Joshi et al, 2002). In this system, a range of products additional to rubber can be harvested for self consumption or sale. The system provides regular income for farmers, mostly from the rubber, plus the temporary benefits of food and cash crops in the initial years and fruit, timber and other products in later years.

The yields of rubber-based agroforestry system can be classified into three product groups namely: (1) latex (2) rubber wood and (3) yields of the intercrops.

Smallholder natural rubber area in Indonesia covers 3 million ha (hectares) out of which 2 million ha are smallholder rubber agroforests (Director General of Estates,
The total area growth of rubber in Indonesia was 1.27 from 1970 to 2003 (Direktorat Jenderal Bina Produksi Perkebunan (2004)).

Table 1. Rubber Area and Growth in Indonesia from 1970 to 2003

<table>
<thead>
<tr>
<th>Description</th>
<th>1970</th>
<th>1980</th>
<th>1990</th>
<th>2003</th>
<th>Growth/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(000Ha)</td>
<td>(%)</td>
<td>(000Ha)</td>
<td>(%)</td>
<td>(000Ha)</td>
</tr>
<tr>
<td>Smallholder</td>
<td>1,813</td>
<td>78</td>
<td>1,947</td>
<td>82</td>
<td>2,639</td>
</tr>
<tr>
<td>Government Owned Estates</td>
<td>224</td>
<td>10</td>
<td>190</td>
<td>8</td>
<td>267</td>
</tr>
<tr>
<td>Private Owned Estates</td>
<td>281</td>
<td>12</td>
<td>246</td>
<td>10</td>
<td>234</td>
</tr>
<tr>
<td>Total</td>
<td>2,318</td>
<td>100</td>
<td>2,383</td>
<td>100</td>
<td>3,140</td>
</tr>
</tbody>
</table>


Smallholder’s rubber area had the highest growth of 1.64%, while the government owned and private owned estates area decreased to -0.04 and -0.10% growth respectively (Table 1). The highest production growth on smallholder’s rubber was 4.33% annually while the government owned and private estates were 1.77% and 3.88% growth annually as illustrated in Table 2.

From the natural conservation point of view, Muara Kuamang agroforestry affords environmental benefit. The forest like structure of agroforestry allows the conservation of large part of natural forest biodiversity (de Foresta and Michon, 1994). The mature agroforestry is made up of an intimate mixture of various tree crops managed by the smallholders. The trees shade out the crops, occupy different
strata and occupy high value products such as fruits and high grade timber. As far as wild animals are concerned, agroforests harbor too many wild species and most of them are protected by the Indonesian law. These animals include; monkeys, gibbons, siamang etc.

**Table 2. Natural Rubber Production and Growth in Indonesia from 1970 to 2003**

<table>
<thead>
<tr>
<th>Description</th>
<th>1970 Prod (Tons)</th>
<th>1970 (%)</th>
<th>1980 Prod (Tons)</th>
<th>1980 (%)</th>
<th>1990 Prod (Tons)</th>
<th>1990 (%)</th>
<th>2003 Prod (Tons)</th>
<th>2003 (%)</th>
<th>Growth/ Year (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallholder</td>
<td>571</td>
<td>73</td>
<td>715</td>
<td>78</td>
<td>913</td>
<td>72</td>
<td>1387</td>
<td>77</td>
<td>4.33</td>
</tr>
<tr>
<td>Government Owned</td>
<td>118</td>
<td>15</td>
<td>186</td>
<td>20</td>
<td>217</td>
<td>17</td>
<td>187</td>
<td>10</td>
<td>1.77</td>
</tr>
<tr>
<td>Private Owned Estates</td>
<td>96</td>
<td>12</td>
<td>12</td>
<td>1</td>
<td>145</td>
<td>11</td>
<td>219</td>
<td>12</td>
<td>3.88</td>
</tr>
<tr>
<td>Total</td>
<td>785</td>
<td>100</td>
<td>913</td>
<td>100</td>
<td>1275</td>
<td>100</td>
<td>1793</td>
<td>100</td>
<td>3.89</td>
</tr>
</tbody>
</table>


From the economic perspective, agroforestry land use system provides a wide range source of income to farmers, their neighborhood and actors along the trading chain (Levang, 1989; Dupain 1994; Bouamrane, 1996). Trees with about 65% of the tree community provide regular cash income from the harvesting and total sales. Fruit trees comprise almost a quarter of the tree community although not on a monthly basis, also provide additional cash income.

The interesting part of the story lies in the way farmers initiate and develop this land use. In the first year, after slash and burn, subsistence food crops (primarily
dry land paddy) are planted alongside rubber and fruit trees such as durian, duku, rambutan and other trees which have economic value for additional household income. Wherever possible, smallholder farmers plant any kind of vegetable for their own need.

Crop mixture has economic importance as it makes the basis of succession of harvestable commercial products before positive cash flow (i.e. 9\textsuperscript{th} year for agroforestry system). Food crops (dry land paddy and vegetables) are the first yields that are harvested mainly used for daily consumption before other commercial crops are harvested. Farmers have additional annual income from harvesting these fruit trees.

It is clear that rubber establishment creates sources of income for the operators as well as its neighborhood in harvesting the yields alongside before positive cash flow. It is also clear that there are conservation measures involved in the agroforestry system that provide income related incentives to farmers.

However, one of the major issues amongst smallholders under rubber agroforestry is how efficient and profitable their system is as compared to smallholder monoculture rubber production considering whether it is financially viable or not. Some of the evidences on this issue were considered, by analyzing the production structure and the arguments made for smallholders production efficiency and profitability. The expected outputs of the efficient production system are good price, improved product quality and enhancement of a better welfare of farmers and communities.
1.2. Statement of the Problem

Over years, developing countries have experienced a wide variety of agricultural policy regimes (Westlake, M. J. 1987). Promotion of one objective conflict with one or both; to a considerable extent, government policies often favor particular parties at the expense of the others in the use of agricultural resources, in addition to factor market imperfections. In this situation, policy makers need to trade-off the gains in one objective against the losses in the substantial use of land for smallholder rubber cultivation which might be not tolerated if the action could not bring about significant improvement. This makes it necessary to measure the effect of policies on the smallholder’s rubber agroforestry system while comparing it with the smallholder monoculture system.

Agricultural policies are influenced by government interventions mostly through price and trade policies. Looking at agriculture sector it cannot be treated in isolation, as it is substantially influenced by macro-economic factors. Some of the problems facing the sector could be attributed to market distortions. A distortion, in this case, is a degree of divergence between a situation with a particular intervention and a situation without the intervention.

Despite the current increase in price of rubber, previously Indonesian government was encouraging the replanting of rubber areas with oil palm in Jambi and other areas in Indonesia because of low price of rubber that existed at the world market (Peyman, 2003). Effectively it would take 10 to 15 years of consistent replanting and new planting to enable supply to catch up with demand. Hence, it is
predicted that rubber could see a decade of higher prices, which is estimated at least double of the present market price. Price fluctuations affect production of rubber under agroforestry system than monoculture system looking at the production base of this study in Jambi. Farmers are facing problems like low yields caused by lack of technology know how, lack of capital, lack of certified planting material, poor selection of clones, low productive SPH (stand per hectare), high tapping interference and lack of uniform productive stand amongst smallholders which have led to low rubber productivity and reduction in smallholders income and product profitability.

However, multipurpose uses are considered to attain highest productivity and land uses could be available for successions of more productive crop. It is very essential to establish other shade loving crops or creepers viz. Durian, Pertai, Duku and cassava, etc., in rubber plantation for economic and ecological benefit. Due to the existing problems scanned under rubber agroforestry system, it was compared with rubber monoculture system for better results.

In some recent literature, knowledge on quantitative effects of policy distortions on smallholder rubber agroforestry production in Jambi is still insufficient. Given this background, it is the objective of the study to analyze the direction and extent of distortions that will empirically fill the literature gap.

1. Is the production of rubber more efficient and profitable under smallholder rubber monoculture or smallholder rubber agroforestry system?

2. Do policy distortions affect rubber production efficiency under smallholder rubber monoculture system or smallholder rubber agroforestry system?
1.3. Objectives of the Study

1. To analyze production efficiency and profitability of smallholder rubber monoculture and smallholder rubber agroforestry systems in Jambi.

2. To find out the impacts of policy distortions towards rubber production efficiency under smallholder rubber monoculture and smallholder rubber agroforestry systems in Jambi.

1.4. Scope

This study attempted to analyze the production efficiency and the policy distortions affecting smallholders under rubber agroforestry while comparing them with smallholders under rubber monoculture in Muara Bungo - Jambi.

Production efficiency had to be obscured and to reveal the system’s commodities production practices, evaluation of potential gains in economic efficiency terms, policy distortions, and private profitability compared with potential social profitability. Policy analysis matrix (PAM) framework was used to analyze the impact of government’s agricultural policies and other factors that might have affected the systems performance. Since PAM is a static model, a sensitivity analysis was used to explore the effect of potential changes in various factors that influence profitability and efficiency of smallholders.

Although systems efficiency can be measured in terms of biological, environmental and ecological perspectives etc, this thesis did not look at any of them. It only concentrated on the economic perspective.