Economic Analysis of Improved Smallholder Rubber Agroforestry Systems in West Kalimantan, Indonesia - Implications for Rubber Development

Yuliana Cahya Wulan
Suseno Budidarsono
Laxman Joshi

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Presentation outline

- Natural rubber in Indonesia
- Improved rubber agroforestry systems
- Economic data assessment
- Scenario testing - examples
- Conclusions
Indonesia has 3.3 million ha rubber producing 1.8 million ton – 23% of world production

Land under rubber in Indonesia

- "Jungle rubber" (64%)
- Smallholder clone plantation (19%)
- Private (8%)
- PTPN (9%)
- Large-scale clone plantations (8%)

Smallholders produce 73% of Indonesia’s total production

Numerous projects, plans to convert jungle rubber to improved system – but most smallholder farmers have not adopted “improved” system
Natural Rubber production in Indonesia

Smallholder rubber:
- 83% of rubber area (3.3 mill ha)
- Adapted slash and burn system
- Annual crops in first 2-3 yrs
- Unselected rubber seedlings
- Extensive management; little/no input

**Consequences**
- Slow and heterogeneous rubber growth
- Competition: rubber and forest re-growths
- Mixed vegetation: complex jungle rubber
- Low latex productivity: $\frac{1}{2} - \frac{1}{3}$ of estate
Improved rubber-based agroforestry – alternatives to monoculture

• Based on traditional practices, but using clones
• Provide optimal return, diverse and adaptable by farmers
• On-farm trial-demo plots (managed by farmers, monitored by ICRAF)
• Data – bio-physical and socio-economics
**Rubber Agroforestry Systems (RAS)**

**RAS-1:** Natural vegetation re-growth outside weed-free strip

**RAS-2:** Fruit or timber trees between rubber rows; annual crops in inter-rows

**RAS-3:** Shrubs, cover crops or fast growing trees between rubber rows to shade out *Imperata*
Socio-economic data – analysis

1. characterize socio-economic background of RAS trial participants and compare with non-participants

2. To assess the economic performance of RAS technology and compare with alternatives

3. farm budget analysis - to assess impact of technology intervention and price and policy changes (aid decision making in selection of appropriate technology)
Data

1. Origin of different sources of income
2. Cost of production (farm inputs - fertilizer, agro-chemicals and labour)
3. Outputs and yields
4. Commodity price – time series

Sources:
✓ On-farm trial-cum-demo plots of RAS
✓ Farmer interviews – RAS (60) + non-RAS (20)
✓ Secondary sources and literature
Olympe

farming system modeling software developed by INRA/CIRAD/IAMM for constructing farm budget and economic analysis
OLYMPE farming systems modelling

1. Enables modeling of farming systems in order to characterize them and to identify typologies.
2. Provides features for prospective analysis according to price and yield evolution.
3. Permits the analysis at the level of farmer groups.
4. Helps build scenarios according to price, climatic events or various types of risks.
5. Assesses impact of technical choices at the farming systems level – both economical and environmental
**Results: Attributes of RAS Farmers**

1. Average land holding: 5.74 ha/household
2. Rubber area covers about 55% of total farm area
3. Average household size was 4.7 individuals
4. Average family labour used on the farm: 2.7 individuals (709 person-days/year).

<table>
<thead>
<tr>
<th>Land use</th>
<th>Max</th>
<th>Min</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigated field (sawah)</td>
<td>2.00</td>
<td>0.00</td>
<td>0.32</td>
</tr>
<tr>
<td>Upland field (ladang)</td>
<td>2.50</td>
<td>0.00</td>
<td>0.52</td>
</tr>
<tr>
<td>Rubber area non-RAS</td>
<td>16.50</td>
<td>0.00</td>
<td>2.34</td>
</tr>
<tr>
<td>RAS area</td>
<td>1.50</td>
<td>0.27</td>
<td>0.52</td>
</tr>
<tr>
<td>Oil palm</td>
<td>6.00</td>
<td>0.00</td>
<td>1.04</td>
</tr>
<tr>
<td>Tembawang/mixed fruit garden</td>
<td>3.00</td>
<td>0.00</td>
<td>0.16</td>
</tr>
</tbody>
</table>
1. Farmers normally tap 200-300 trees a day, 6 days a week.
2. Tapping intensity decreases when household labour is needed elsewhere (paddy harvest, off-farm work, social events).
3. Non-rubber products from RAS and traditional systems.
Margin: monoculture < RAS < traditional system.

RAS technologies require lower capital and inputs.

Margin Ha⁻¹ Year⁻¹

- Rubber Monoculture
- RAS Technologies
- Oil Palm
- Traditional Rubber

YEAR

- RAS 1 Med. Weed
- RAS 1 L. Weed
- RAS 1 H. Density
- RAS 2 Ass. Trees
- RAS 2 Food Crops
- RAS 3 Cover Crops
- RAS 3 FGT
- Jungle Rubber
- Oil Palm PT. SIA
- Rubber Monoculture
Net Present Value (NPV) and ‘discount factor’ in long-term investment. [1 US$=IDR 9000; daily wage rate=IDR 20,000]

<table>
<thead>
<tr>
<th>FARMING SYSTEMS</th>
<th>NPV (Rp'000/ha)</th>
<th>YPC (years)</th>
<th>EST. COST (Rp'000/ha)</th>
<th>Return to Labor (Rp/Ps-days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jungle Rubber</td>
<td>(1,073)</td>
<td>-</td>
<td>13,629</td>
<td>17,907</td>
</tr>
<tr>
<td>RAS 1 Low mgmt</td>
<td>10,087</td>
<td>13</td>
<td>10,874</td>
<td>40,838</td>
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<tr>
<td>RAS 1 Med mgmt</td>
<td>11,197</td>
<td>14</td>
<td>14,318</td>
<td>47,629</td>
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<tr>
<td>RAS 1 High density</td>
<td>13,496</td>
<td>12</td>
<td>12,657</td>
<td>47,629</td>
</tr>
<tr>
<td>RAS 1 High density</td>
<td>13,496</td>
<td>12</td>
<td>12,657</td>
<td>47,629</td>
</tr>
<tr>
<td>RAS 2 Food crops</td>
<td>4,116</td>
<td>18</td>
<td>21,834</td>
<td>25,113</td>
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<tr>
<td>RAS 2 Ass. trees</td>
<td>18,316</td>
<td>10</td>
<td>15,373</td>
<td>42,749</td>
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<tr>
<td>RAS 3 Cover crops</td>
<td>2,864</td>
<td>13</td>
<td>19,427</td>
<td>23,189</td>
</tr>
<tr>
<td>RAS 3 FGT</td>
<td>7,127</td>
<td>14</td>
<td>18,513</td>
<td>27,683</td>
</tr>
<tr>
<td>Rubber monoculture</td>
<td>18,567</td>
<td>10</td>
<td>19,035</td>
<td>35,683</td>
</tr>
<tr>
<td>Monoculture SRDP</td>
<td>8,045</td>
<td>14</td>
<td>20,192</td>
<td>29,477</td>
</tr>
</tbody>
</table>
Labor input in different rubber systems

- RAS 1 Medium Weeding
- RAS 1 Low Weeding
- RAS 1 High Density
- RAS 2 With Associated Trees
- RAS 2 With Food Crops
- RAS 3 With Cover Crops
- RAS 3 With FGT
- Local Jungle Rubber
- Oil Palm PT. SIA
- Ideal Monoculture
- Monoculture Private
- Monoculture SRDP
- Clonal Agroforest Private
- Clonal Agroforest Disbun

Monoculture rubber

RAS oil palm

Jungle rubber

ps-day per ha

0 50 100 150 200 250

1 2 3 4 5 6 7 8 9 10 year
Prospecting commodity price change

Scenario A: 50% reduction in rubber price between 2015 to 2019, other factors remain constant

Margin Ha-1 Year-1
Prospecting commodity price change

Scenario B: prices of rubber and oil palm drop by 50% and 40% respectively starting 2018
CONCLUSIONS

- Compared to traditional jungle rubber, RAS technology requires more capital input, but both returns to labour and return to land are higher.
- Intensive monoculture rubber offers better rubber productivity (yield and profitability), but requires much higher capital and input than alternatives.
- RAS technology, can provide smallholder farmers with diversified income and range of NTFPs.
- Simulating possible changes (e.g. commodity price) important aspect for informed decisions.
- Olympe software is informative and useful for farm budget analysis - customisable outputs.
- Olympe - potential decision support tool for choosing between land use alternatives and intensification
Thank you