Economic analysis of agroforestry (Suyanto)

- Applications of the Policy Analysis Matrix tool for appraisal of agroforestry systems (Suseno Budidarsono)
- Who controls and benefits from tambaks in Aceh (Indra/Suseno)
- Rapid market opportunity appraisal (Joel Tukan/Jim Roshetko)

“For more than 10 years ICRAF has now used the Policy Analysis Matrix or PAM as a basis for assessing the profitability of agroforestry systems relative to other options, both at farmgate (private) and economic prices.”

“In the development of the ASB matrix for assessment of tradeoffs between profitability and environmental services, we started from a number of smallholders’ objectives.”
Policy makers’ objectives

- Growth
- Equity
- Stability

- Discounted returns to land at social prices (potential profitability)
- Employment generation
- Adoptability by smallholders
  - Local environmental impacts

Three categories of policies that affect agriculture and natural resources

- Agricultural and natural resource price policy: commodity-specific policy affecting one commodity at a time
- Macro-economic policies: nation-wide; affecting all commodities simultaneously
- Public investment policies: capital expenditures from public budget affecting various agricultural agencies, groups, producers, traders, and consumers

Three price policy instruments

- Taxes and subsidies: transfer between public budget and producers and consumers.
- International trade restrictions: taxes and quota limiting import and export
- Direct controls: regulation of marketing margin

“These may be compared to the policy makers’ objectives at more macro scale. A number of differences in objectives are apparent, although high returns to labour are desirable from both perspectives.”

“Government policies are usually a complex mixture of rules, incentives, taxes and disincentives; some of these policies affect specific commodities (and thus the relative attractiveness of different farm options), others all commodities simultaneously (but may favour or disfavour non-farm options).”

“Three major types of price instruments are normally used – their effects may be contradictory, compensatory or synergistic.”
“The PAM method was designed by Monke and Pearson to look at the net effect of all these policy measures on the profitability of farming options. It takes a ‘land use system’ as the unit of analysis, and starts by defining a relevant time frame for appraisal, relative to the life cycle of the production system.”

“By calculating revenues, costs for tradable inputs, costs for domestic factors (labour…) and profits at two types of prices, it allows for a number of ratios and contrasts to be calculated. Private prices reflect current reality for the farmers, social prices the reality of the overall economy.”

“The various contrasts (‘divergences’) refer to subsets of the overall policy impact on profitability.”

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“The various contrasts (‘divergences’) refer to subsets of the overall policy impact on profitability.”
"First of all, a comparison of the divergences in revenue and tradable inputs tells us whether the government is protecting the producers or (domestic) consumers. It is common for negative ‘revenue transfers’ (‘cheap food for the cities’) to be compensated by positive ‘input transfers’, e.g. fertilizer subsidies."

"The divergence on domestic factors shows us how much the allocation of land and labour follows the current opportunities in the economy as a whole."

"Finally, the divergence on net profits shows how the positive and negative effects of ‘policy’ work out on the profitability of farming."

---

### Effect of divergences: Output and Input Transfer

<table>
<thead>
<tr>
<th>Revenues</th>
<th>Costs</th>
<th>Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Prices: A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Social Prices: E</td>
<td>F</td>
<td>G</td>
</tr>
<tr>
<td>Effect of Divergence and Efficient policy: I</td>
<td>J</td>
<td>K</td>
</tr>
</tbody>
</table>

**Output transfer** ($I = A - E$) and **Input Transfer** ($J = B - F$) arise from two kinds of policies that cause divergence between observed and world product price: commodity-specific policies (wide range of taxes, subsidies and trade policies) and exchange rate policies.

### Effect of divergences: Factor Transfer

<table>
<thead>
<tr>
<th>Revenues</th>
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<td>K</td>
</tr>
</tbody>
</table>

Factor transfers, ($K = C - G$), defined as the difference between the costs of all factor of production (labor and capital) valued in actual market prices, and social costs of these factors. **The effects of divergence in the factors market are the result of both underlying market failures and distorting policies.** It indicates inefficiency-causing distorting policies affecting factor market, and market failures in factor market.

### Effect of divergences: Net Transfer

<table>
<thead>
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</tr>
</thead>
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<tr>
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</tr>
<tr>
<td>Effect of Divergence and Efficient policy: I</td>
<td>J</td>
<td>K</td>
</tr>
</tbody>
</table>

**Net Transfers**, $L = I - J - K$, shows the extent of inefficiency in an agricultural system. It is also the difference between private profit and social profit, hence $L = D - H$. 

---

"First of all, a comparison of the divergences in revenue and tradable inputs tells us whether the government is protecting the producers or (domestic) consumers. It is common for negative ‘revenue transfers’ (‘cheap food for the cities’) to be compensated by positive ‘input transfers’, e.g. fertilizer subsidies."

"The divergence on domestic factors shows us how much the allocation of land and labour follows the current opportunities in the economy as a whole."

"Finally, the divergence on net profits shows how the positive and negative effects of ‘policy’ work out on the profitability of farming."
“A number of ratios are also of interest: the private cost ratio and domestic cost ratio indicate the efficiency of using domestic resources.”

“The nominal protection coefficient allows comparison at commodity level. Application of this to the partial budgets for the ‘crop’ and ‘tree’ component of agroforestry systems in the SAFODS project showed crops to be protected and trees to be taxed.”

“Application of the PAM method to the various coffee production systems in Sumber Jaya focussed on a comparison of ‘shaded’ and ‘sun’ coffee, as practised on private or ‘forest’ lands.”

**Coffee farming in Sumber Jaya**

- The system has been improving from simple coffee farming system (under traditional shifting cultivation technique) to more intensive systems; mostly managed by smallholder of various ethnic groups (the pioneer Semendones, Sundanese, Javanese, very few Lampung natives, Batak and Balinese).
- Forest conversion for coffee farming (on the state forestland) had created serious problems
  - Conflict of interest regarding land status and land uses created problems to control the use of state forestland
  - The existence of administratively recognized villages within protection forest
Coffee farming in Sumber Jaya

- Forest conversion for coffee farming (on the state forestland) had created serious problems
  - Conflict of interest regarding land status and land uses created problems to control the use of state forestland
  - The existence of administratively recognized villages within protection forest
  - An assessment carried out by Tim Kopi (Ministry of Forestry) estimated that in July 1998 there are about 115,000 ha (out of 410 thousands ha) of state forestland in Lampung province have been cultivated for coffee farming (Gintings, 1999).

Coffee farming in Sumber Jaya

Typology

Low intensity
- Pioneer – insecure title
- Complex – insecure title

Medium intensity
- Simple – insecure title
- Complex – secure title

High intensity
- Simple-insecure title (rejuvenated from an old-abandon coffee farm)
- Simple – secure title without grafting
- Simple – secure title with grafting

“As part of a government policy task force ‘Tim Kopi’, an assessment was made of various proposed taxation regimes for coffee farms on forest lands.”

“The analysis started with development of a typology of coffee farming systems.”

Profitability

Returns to land
The present worth of benefit (revenues) less the present worth of the cost of tradable inputs and domestic factors of productions (NPV) - valued at private prices (private profitability), is an indicator for production incentive, and at social prices* is an indicator of potential profitability

Note
*) Social price is the economic prices that removes the impact of policy distortion: taxes, subsidy and other local levies and market imperfections.
Profitability

Returns to labor
- The wage rate that sets the NPV equal to zero
- Returns to labor that exceed the average daily wage rate, indicate that individuals with their own land will prefer this activity to off-farm activities.
- Returns to labor valued at private prices can thus be viewed as the primary indicator of profitability for smallholder’s production incentives.

Profitability
data requirements
- a detail-farm budget calculation
- proper prices for calculating the costs and returns
- the macroeconomic assumption used in this assessment.

Profitability
data requirements

Pricing the Costs and Returns
The assessment uses ten years annual average prices*) of all tradable farm inputs and farm commodities that are cast in the respective constant prices (constant price 1997):
- local market prices as the basis of calculation of farm budget valued at private-financial prices.
- export or import parity prices at farm gate as the basis for the comparable farm budget valued at social prices

Note:
In this regard, the period under study is 1991 to 2000.

“… and the returns to labour where the wage rate is adjusted until the net present value is zero.”

“…To calculate these ratios, we first of all need a good account of the input requirements and product flows per year over the life time of a production system.”

“In fact, prices for products and inputs vary between and within years – we use a long term average value as a simple indicator of what farmers may expect for the coming years. In fact, however, more flexible management decisions in response to prices can increase profitability.”
"For our study we used prices of the year 2000 – and thus results are different from current conditions."

"The study found that timber-based coffee systems with understorey would provide higher returns to labour than monoculture (‘sun coffee’), when assessed over the life time of the system and at moderate discount rates. Planting trees into coffee gardens makes sense for farmers, as long as they can expect to harvest them."

"These results were part of the considerations for provincial level policies on ‘retribution’ for coffee from state forest lands. As farmers don’t pay land tax for these farms, some form of retribution was deemed to be fair."
The proposed ‘retribution’ was high enough to make coffee monoculture on state forest lands unattractive – while it still allowed positive margins for the multistrata coffee, be it at lower ‘returns to labour’. Variable coffee process, however, influence these results.”

“The December 2004 Tsunami brought Aceh and its coastal zone to the forefront of public interest in discussions on environment and development. Conversion of mangrove forest to shrimp/fish ponds almost certainly increased the death toll from the tsunami…”

“Murals in Meulaboh along Aceh’s west coast try to capture the wall of water that took all people by surprise.”
“The devastation was unprecedented in recorded human history.”

“After the emergency relief phase, when clean water, food and shelter were available and the wounded had received care, the discussion started on sustainable livelihood options along the coast – but also on the ‘causes’ of the human damage and the role of the fish/shrimp ponds.”

“ICRAF and other CGIAR centres operating in the Tsunami-affected countries responded in a number of ways. A joint web-site was started to facilitate information flow. In Indonesia the Ford Foundation supports a study on ‘integrated natural resource management’ for Aceh.”
Background of the study

There is widespread pressure and interest from government and international donors to assist in the restoration of these aquaculture-based livelihoods, particularly along Aceh’s northeastern coast, after December 2004 tsunami.

Little is really known about the social, economic, and legal issues related to brackish water aquaculture in Aceh.

Objectives

To assess and get a clear understanding of the social, economic, and legal issues related to brackish water aquaculture in Aceh.

Provide information to international donors and government to design a more appropriate intervention for assisting households formerly dependent on brackish water aquaculture ponds for their livelihoods.

Methods

- Rapid assessment
  - field observation
  - secondary data
  - in-depth interviews
  - focus group discussions

- Farm budget

“The study reported here is part of that project. Its aim is to understand who controls and benefits from the tambaks (fish/shrimp ponds), especially along the N and E coast of Aceh. Little quantitative data existed before the Tsunami.”

“The objective of the study was to clarify the social, economic and legal issues that relate to the development of tambaks in the mangrove zone, as a contribution to the debate on rehabilitation strategies.”

“The study used rapid assessment methods to try and construct farm budgets for the operation of tambaks, focussing on ‘returns to land’ and ‘returns to labour’.”
“Our study involved all tsunami-affected parts of the north and east coast of Aceh – with a gradient in impact by the Tsunami from Banda Aceh eastwards. A number of villages was selected for detailed survey.”

“According to available statistics, the total area of tambaks was more than 30,000 ha, with an average annual productivity of shrimp or fish of 0.5 t/ha. The total number of households involved was nearly 15 thousand, with an average of more than 2 ha/household.”

“Mangrove conversion for tambak production occurred throughout the 1980’s, but in fact during the 1990’s the area of active tambaks declined. The main reason for this was a virus disease that affected the ‘tiger shrimp’ production, the most profitable enterprise.”
Despite this stagnation or decline in the tambak sector, it still formed 32% of the total fisheries value of Aceh province, prior to the Tsunami.

The question of who owns and benefits from the tambaks proved to be fairly complex, as a network of local investors (‘toke’ or middlemen), farm operator, owner/farmer or labourers was involved.

In the selected villages we found that 1,433 ha of tambak was owned by 834 people (nearly 2 ha each), involved 2,712 households (0.5 ha/household) and 12,285 persons. In fact the sector provided further employment in hatcheries, feed suppliers and along the market chain.
“In our study we observed a gradient where all tambak areas were destroyed by the Tsunami close to Banda Aceh while damage was about 50% in Aceh Utara and Loksheumawhe where our survey ended.”

“Overall we found that tambak owners represented only 6% of the people who directly relied on the tambaks as their source of income or employment.”

“Most of the tambaks were considered to be on ‘private lands’ by their owners, but only 9% was actually certified with a formal land title.”
“In 3/4 of the tambaks the household that owned the tambak also was the main operator, usually relying on credit from the middlemen for the necessary investment.”

“Among the 10 villages studied, only one had a clearly different pattern of ownership: in one of the villages in Bireuen district most of the operators were renting the tambak from a ‘land lord’.”

“Preliminary data on the farm budgets suggest that the tambaks provide employment for 633 person days per ha per year, at a return to labour that is certainly attractive: 47,000 Rp per day of work. This compares well with urban employment opportunities.”

“In conclusion, the
conversion of mangrove to tambaks along Aceh’s N and E coast was primarily driven by economic opportunity, with a combination of local land ‘ownership’ and capital obtained from local middlemen/investors. Rehabilitation of the labour-intensive tambaks will provide income and employment.”

“We found a lot of activity to restore the tambaks – but also considerable confusion over how and where the coastal protection functions of mangroves were to be restored. Interagency coordination needs to be improved and a clear policy on the ‘no-go’ part of the coast is needed, otherwise current efforts will lead to disappointment.”

“The previous results on the profitability of land uses that include agroforestry have been based on the average farmgate price that farmers receive. However, this price can change with changes in the market chain – and it is often assumed that farmers can improve their ‘marketing’ skills.”

Conclusion

- Tambak provide rural employment and generate income for rural economy
- Tambak owners does not always controlling tambak production
- Tambak rehabilitation would accelerate the economy of tsunami affected area

We found a lot of activity to restore the tambaks – but also considerable confusion over how and where the coastal protection functions of mangroves were to be restored. Interagency coordination needs to be improved and a clear policy on the ‘no-go’ part of the coast is needed, otherwise current efforts will lead to disappointment.”
The following test of this hypothesis was based on a case study of the farmers in Nanggung district, close to Bogor – operating in the Halimun ecosystem surrounded by the last substantive area of forest on Java.

The case study is based on an 18 months period of involvement with agroforestry innovations and livelihood enhancement in the area, supported by USAID and carried out by RMI (a local NGO), Winrock International and ICRAF staff.

The project tested a new approach to extension, based on the stimulation of farmer group formation, farmer-lead research and joint analysis of opportunities for improvement of the management of the mixed gardens.
“Most villagers still see themselves primarily as farmers, despite the proximity of urban centres and employment opportunities in the mining and service sector.”

“The mixed gardens contain a wide range of tree and other woody species – along with areas used for growing annual crops. Banana and bamboo emerged from the surveys as the number 1 and 2 opportunities to increase income from unsatisfied market demand.”

“A typology of the gardens showed a substantial variation in management intensity and focus on timber trees as ‘retirement plan’ or fruit trees for immediate income. Some of the gardens were considered ‘fallow’ – available for more intensive use in the future.”
"Four market channels were recognized, with a number of links in the chain between producer and consumer. Most of the bananas were sold to local collectors, who took care of the grading (sorting) and further marketing."

"Expressed per unit product, the profit margins increased along the market chain. Sorting of the farmer produce allowed the middlemen to target different markets with different qualities of products."

"A further analysis of the margins between consumer and producer showed that farmers only received 10-20% of the price consumers paid, except for 'channel 1', where farmers sell directly."

Table 2: Comparison of prices, costs and margins associated with different banana marketing channels.

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Channel 1</th>
<th>Channel 2</th>
<th>Channel 3</th>
<th>Channel 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Price/ton (Rp)</td>
<td>Percentage (%)</td>
<td>Price/ton (Rp)</td>
<td>Percentage (%)</td>
</tr>
<tr>
<td>1</td>
<td>Farmers</td>
<td>10,000</td>
<td>50.00</td>
<td>6,700</td>
<td>55.37</td>
</tr>
<tr>
<td>2</td>
<td>Collections</td>
<td>6,500</td>
<td>25.21</td>
<td>6,500</td>
<td>16.77</td>
</tr>
<tr>
<td></td>
<td>Buying Price</td>
<td>5,000</td>
<td>76.67</td>
<td>5,000</td>
<td>76.67</td>
</tr>
<tr>
<td></td>
<td>Selling Price</td>
<td>12,000</td>
<td>52.63</td>
<td>20,000</td>
<td>68.67</td>
</tr>
<tr>
<td></td>
<td>Marketing Margin</td>
<td>13,000</td>
<td>88.57</td>
<td>20,000</td>
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<tr>
<td></td>
<td>Marketing Cost</td>
<td>1,400</td>
<td>5.38</td>
<td>1,400</td>
<td>3.38</td>
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<tr>
<td></td>
<td>Profit Margin</td>
<td>11,600</td>
<td>57.20</td>
<td>18,600</td>
<td>79.30</td>
</tr>
</tbody>
</table>

(1) Farmers will become collectors at a price of Rp 5,000-Rp 7,000/bunch. Prices indicate in the table are average. (2) Collectors assume one bunch can produce 8 heads of bananas.
(3) Percentage indicates percentage of consumer buying price.
“Where up to 5 steps were involved between farmer and consumer, every step operated at a profit margin of 10-25%, after accounting for costs.”

“This analysis, logically, stimulated interest by the farmers in a more direct role in marketing. They clearly have comparative advantage on providing for demand on the local and Jakarta markets.”

“However – farmers maintain many varieties of banana and they are not equally appreciated in the market chain. Management intensity (and cost…) is low, while a lot of quality is lost between harvest and sale to collectors.”

### Highlights of ongoing research of the world agroforestry centre in Indonesia

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### Table 2

<table>
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<tr>
<th>No</th>
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<th>Channel 2</th>
<th>Channel 3</th>
<th>Channel 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price/ bunch (Rp)</td>
<td>Percentage (%)</td>
<td>Price/ bunch (Rp)</td>
<td>Percentage (%)</td>
</tr>
<tr>
<td>4</td>
<td>Regional Retailer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Buying Price</td>
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<td>66.67</td>
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</tr>
<tr>
<td></td>
<td>Selling Price</td>
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<td></td>
<td>Buying Price</td>
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<tr>
<td>6</td>
<td>Consumer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Buying Price</td>
<td>10,000</td>
<td>100.00</td>
<td>20,000</td>
</tr>
</tbody>
</table>

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### Discussion

**What is the high potential of tree gardens products in Nanggung**

- 45.3% of the trees in gardens are bananas
- 76.9% of tree gardens contain bananas
- Banana grows well in Nanggung area
- No significant diseases (bacterial, BDB, BBTV)
- Only 1.5 hours from Bogor and 2.5-3.0 hours from Jakarta
- Banana demand greater than supply (local to international)
- Farmers are interested in intensifying their farming system

### Current tree gardens management

**No Management**

1. Farmers do not focus on marketable varieties
2. Lacking access to quality germplasm - plant whatever is available
3. Agricultural inputs (fertilizers and pesticides) is infrequent
4. Fundamental banana cultivation is not practiced
5. Little to no weed control is conducted under and near bananas
6. Systematic or uniform spacing is not followed
7. Common to see 6-7 stems per plant
8. The removal of senescent leaves and male flowers is not conducted
9. Harvesting is not based on fruit maturity but rather on the arrival or anticipated arrival of local collectors, which is often unannounced.
10. Bunches are often stored on the floors of homes or farm sheds for 1-3 days before collectors’ arrival
11. Bananas are sold in bulk by bunch regardless of quality
12. Collectors do not pay a price differential based on variety.
“After this initial analysis, farmers became really excited… We helped by a series of consultations and visits.”

“Farmers learned that by targeting Grade A and Grade B bananas their farmgate price could be three times as high as they currently get…”

“The impacts that a change in marketing could have are thus substantial – and considerably larger than a change in physical productivity could expect to achieve.

However, the better price clearly set a process in motion to produce higher quality products.”
“Here we found a dilemma: a focus on less species and only those products for which there is current market demand seems logical – but what about risk? Is following the conventional pathway of ‘specialization’ really in their long-term interest?”

“All farmers found that simple recommendations on plant spacing and ‘quality germplasm’ were easy to follow; most also followed recommendations for reducing the number of shoots retained and better harvesting methods. Pest and disease management was less popular.”

“With simple measures and in a short term farmers experienced an increase in stem productivity and saw 85% of their production meet the specifications for Grade A or B. A shift to plastic crates reduces damage on the way to the market…”

**CONCLUSIONS**

*Experience indicates that farmers are best served by:*

1. Focusing on a limited number of species that are appropriate for local biophysical conditions and have a high market value/demand;
2. Utilizing high quality germplasm (provenance, varieties, etc) to increase productivity and profitability;
3. Managing tree gardens to yield tree products that meet market specifications;
4. Developing permanent market linkages.

<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>% of farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Using appropriate spacing</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Utilize recommended varieties (quality germplasm)</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Using Fertilizer</td>
<td>89</td>
</tr>
<tr>
<td>4</td>
<td>Circle Weeding</td>
<td>78</td>
</tr>
<tr>
<td>5</td>
<td>Number of stem retained</td>
<td>78</td>
</tr>
<tr>
<td>6</td>
<td>Good harvesting</td>
<td>78</td>
</tr>
<tr>
<td>7</td>
<td>Pest and Disease management</td>
<td>33</td>
</tr>
<tr>
<td>8</td>
<td>Leaf Pruning</td>
<td>22</td>
</tr>
<tr>
<td>9</td>
<td>Drainage</td>
<td>11</td>
</tr>
</tbody>
</table>

**Farmer Implementation**

**Recent impacts identified**

- 20-25% increase in stem productivity
- 85% of production meetings specification
- damage decrease from 10% to 3% using plastic crates
- 35% in transportation volume (plastic crates)
“Our case study is in line with the hypothesis that a more direct involvement of farmers in the market chain can pay off for farmers of mixed gardens within reach of large urban markets. This may be a ‘special case’ (?), but it was an opportunity that had remained underutilized.”