ANALYSIS OF ECONOMY ON BLACK BAMBOO CULTIVATION (GIGANTOCHLOA ATROVIOLACEA WIDJAJA) FOR FEEDSTOCKS AND ENVIRONMENTAL SUSTAINABILITY

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Profile of *Gigantochloa atroviolacea* Widjaja

- also known as Java Black Bamboo or Tropical Black Bamboo
- is a dense tropical clumping bamboo native to Java, Indonesia
- This bamboo species prefers to grow in dry areas
- where the purplish black color of its culms becomes more prominent.
Profile of *Gigantochloa atroviolacea* Widjaja

- Many clustered branches at the nodes with 1 larger dominant branch
- Culms are dark green when young and turn purplish-black when mature with whitish nodes
- Gigantochloa *atroviolacea* prefers to grow in dry areas on limestone rich soil.
- Medium size tufted woody bamboo with 8-12 m tall culms and an average diameter of 6-8 cm at the base
- The culm internodes are fairly thick-walled (5-8 mm) and on average 30-50 cm long
- Leaves are lance-shaped and are on average 20-30 cm long and 2-5 cm broad
- This species can be propagated vegetatively by rhizome or culm cuttings

Origin of *Gigantochloa atroviolacea* Widjaja

- *Gigantochloa atroviolacea* grows widely in West Java, especially in the Banten and Sukabumi District as well as Central Java.

Source: Heyne, 1951
**Uses of Gigantochloa atroviolacea Widjaja**

- The *poles* are used for any sort of construction and excellent for decorative purposes and furniture making.
- It is a very desirable bamboo for making traditional musical instruments, handicrafts and fencing panels → high economic value on the market

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**The Current State of Bamboo System**

- **Community land**
- **Forest surrounding**
- **Limited production in quantity (scarcity)**
- **Not maintained well**

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**Upstream**

- Small scale industry
- Labor intensive
- Furniture, handicrafts, music instruments, etc
- Difficult to develop business due to the scarcity of feedstocks

**Processing Industry**

- High prices due to scarcity
- Faked black bamboo
- Local Market, with Prospected export market

**Downstream**

**Keys to develop the Bamboo Industry System:**

- Availability of Bamboo (Feedstock/Raw Material)
- Skilled worker Availability
- New Technology Options
- Market Opportunity
Why we should to start planting black bamboo?

- Add bamboo clumps population
- Meet the increasing market demand
- Produce quality bamboo stems to meet market specifications
- Economic impact for the community surrounding plantation
- Preserve nature sustainability
- Support the development of the national bamboo industry competitively and sustainable

Availability, Quality & Continuity of Feedstocks

But, does the Black bamboo cultivation has economically advantageous to do?

Study Purposes

- The objective of this paper is to assess and analyze the economic feasibility of black bamboo plantation based on investment criteria: NPV, Net B/C, IRR and payback period.

Methodology

- The data used is secondary data from Sutiyono (2014). The data used is the result of research on a company PT. XYZ (as the request of the company name disguised) which has cultivated bamboos in Terbanggi Besar Village, Sub-District of Sumberjaya, District of Lampung Tengah, Province of Lampung, Indonesia

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Formula</th>
<th>Indicator of Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value (NPV)</td>
<td>[ NPV = \sum_{t=0}^{n} \frac{C_t}{(1 + i)^t} ]</td>
<td>NPV &gt; 0</td>
</tr>
<tr>
<td>Internal Rate Return (IRR)</td>
<td>[ IRR = 1 + \frac{NPV_1 - NPV_2}{NPV_1} \times (1 - i) ]</td>
<td>IRR &gt; DR</td>
</tr>
<tr>
<td>Net B/C</td>
<td>[ \frac{\text{Net Benefit}}{\text{Cost}} ]</td>
<td>Net B/C &gt; 1</td>
</tr>
<tr>
<td>Payback Period</td>
<td>[ \text{Discounted payback period} = \frac{i}{\text{Ab}} \times 1 \text{ tahun} ]</td>
<td>Less than economic period</td>
</tr>
</tbody>
</table>
### Sustainable Bamboo

- 3-7 years to harvest
- No need to replant
- Fastest growing plant
- Release 35% more oxygen
- Sequester up to 12 tons of carbon dioxide
- Has numerous uses
- High-yield renewable resource

### Silviculture Techniques

(Sutiyono, 1990, 1992, 2014)

#### Planting preparation
- Land clearing
- Plant spacing of 8x6 m or 210 clumps/ha
- Recommended to use organic fertilizers such as manure, green manure, or compost.

#### Propagation
- Stem cuttings and Rhizom
- Bamboo seedling in nursery about 4-5 months

#### Planting
- Planting should be done in the rainy season, such as in December, January, or February at the latest

#### Maintenance
- Maintenance consists of patching, weeding, slashing shrubs, pruning, fertilization, thinning, composing the structure and the composition of stems in the clump, and managing the drainage
Cultivation Techniques

Logging and Production

- Black Bamboo is grown in the wet climate of type A and B must be set in a grove of four generations of age, namely 1, 2, 3, and 4 years old.
- To get sustainable production of stem should be made composition of 25% for each age generation stems.
- Logging the stems of Black Bamboo is done during the dry season in order to obtain a good quality of stems with low water content.

<table>
<thead>
<tr>
<th>Age of clump</th>
<th>Stem/clump</th>
<th>Stem/ha</th>
<th>Kg/stem</th>
<th>Ton/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2nd year</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3rd year</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4th year</td>
<td>2</td>
<td>420</td>
<td>5</td>
<td>2,1</td>
</tr>
<tr>
<td>5th year</td>
<td>4</td>
<td>840</td>
<td>10</td>
<td>8,4</td>
</tr>
<tr>
<td>6th year</td>
<td>7</td>
<td>1470</td>
<td>15</td>
<td>22,1</td>
</tr>
<tr>
<td>7th year</td>
<td>12</td>
<td>2520</td>
<td>20</td>
<td>46,2</td>
</tr>
<tr>
<td>8th year onwards</td>
<td>12</td>
<td>2520</td>
<td>25</td>
<td>57,8</td>
</tr>
</tbody>
</table>

Production cost of plantation

1. Labor

- Labor needs of Black Bamboo plantation in the first year is quite large because there are planting preparatory activities, bamboo seedling preparation, planting, and maintenance. Whereas in 2nd, 3rd, and 4th year only need for maintenance labor.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Labor use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1st year</td>
<td>93.77 HOK</td>
</tr>
<tr>
<td>2</td>
<td>2nd year</td>
<td>29.41 HOK</td>
</tr>
<tr>
<td>3</td>
<td>3rd year</td>
<td>31.37 HOK</td>
</tr>
<tr>
<td>4</td>
<td>4th year</td>
<td>31.58 HOK</td>
</tr>
<tr>
<td>5</td>
<td>5th year</td>
<td>71.37 HOK</td>
</tr>
<tr>
<td>6</td>
<td>6th year</td>
<td>81.37 HOK</td>
</tr>
<tr>
<td>7</td>
<td>7th year onwards</td>
<td>81.37 HOK</td>
</tr>
</tbody>
</table>
2. Production Cost

- The production cost of Black Bamboo cultivation consist of the cost of purchase of bamboo seedling, fertilizer and labor.
- In the first year, the production cost to be incurred relatively quite large for planting preparation.
- The production costs are vary in 2nd, 3rd, 4th, 5th year subsequently and the fixed production cost in the 6th and 7th year.
- After the 7th year onwards the production cost are the same which consists the purchase cost of fertilizer and harvesting cost.
- To note, in the 7th year and so, there is no maintenance cost due to in the bamboo cultivation when do logging continuously every year is equal to perform maintenance the clumps. If do not logging the stems continuously, the clumps will be damaged and less productive.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Production Cost (Rp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1st year</td>
<td>6.591.950</td>
</tr>
<tr>
<td>2</td>
<td>2nd year</td>
<td>1.263.350</td>
</tr>
<tr>
<td>3</td>
<td>3rd year</td>
<td>1.497.750</td>
</tr>
<tr>
<td>4</td>
<td>4th year</td>
<td>1.897.950</td>
</tr>
<tr>
<td>5</td>
<td>5th year</td>
<td>3.497.950</td>
</tr>
<tr>
<td>6</td>
<td>6th year</td>
<td>4.047.950</td>
</tr>
<tr>
<td>7</td>
<td>7th year onwards</td>
<td>4.247.950</td>
</tr>
</tbody>
</table>

Economy analysis

- Economics analysis in this study uses the profitability/project investment analysis.
- This study is performed to determined whether the cultivation of bamboo is profitable or not.
- The study uses the assumption that: (1) the project life of 15 years (pesimist cond), (2) discount rate of 6%, (3) production of bamboo stems to follow the prediction of bamboo production, and (4) production, input prices, and output stable after the 7th year.
## Result of Project Investment Criteria on Black Bamboo Plantation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
<th>Feasibility Indicator</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV</td>
<td>29,148,617.89</td>
<td>NPV &gt; 0</td>
<td>Feasible</td>
</tr>
<tr>
<td>Net B/C</td>
<td>-2.95</td>
<td>Net B/C &gt; 1</td>
<td>Feasible</td>
</tr>
<tr>
<td>IRR</td>
<td>13%</td>
<td>IRR &gt; DR</td>
<td>Feasible</td>
</tr>
<tr>
<td>PP</td>
<td>9 year</td>
<td></td>
<td>Feasible</td>
</tr>
</tbody>
</table>

The results of a financial analysis/investment criteria shows **that the cultivation of Black Bamboo worth the effort.** This revealed that black bamboo cultivation is profitable, projected to have a healthy cash flow, and feasible in the long run.

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## Conclusions

- All the financial aspects show that the cultivation of black bamboo is feasible. Result revealed that NPV about IDR 29,148,617.89 > 0, Net B/C at |-2.95| > 1, and IRR at 13% > DR 6%.
- These results indicate that black bamboo cultivation economically promising profits, and return on capital can be achieved in the 9th year of Black Bamboo plantation.
- Cultivation/plantation of bamboo ensuring the supply of bamboo for bamboo processing industry and bamboo market, improving the quality of bamboo, supporting bamboo processing industry by providing the availability and continuity of feedstocks and keeping the natural sustainability.
- Future researchs needed are to valueing the bamboo plantation to complete this research namely economy analysis using social, bioeconomy and environmental values.
REFERENCES


