Economic Viability of Production of Tree Paricá 
(*Schizolobium amazonicum* Huber ex. Ducke) of 
Reforestation Project in the Municipality 
Paragominas-PA, Brazil

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Abstract: The objective of this study was to analyze the profitability of production Paricá reforestation in the municipality of Paragominas-PA. The study was conducted in the municipality of Paragominas Messoregião located in the northeast of Pará. The basic data used in the economic evaluation of production of planting paricá (costs and revenues) were derived from primary source through raising production cost of paricá with farmers from the municipality, analyzing the period of production horizon of seven years. The discount rate chosen for economic evaluation was 10% per year. NPV (net present value) calculation IRR (internal rate of return), BCR (benefit-cost ratio) and EP (break-even point). To check the economic feasibility of producing paricá the following criteria were used for economic analysis. The results for NPV, IRR and BC ratio were respectively of $495,970, 28.83% and 2.43. For EP (break-even point) the value of 41.08% was found, which demonstrates the minimum amount of production, so that revenue equals costs. Based on the results obtained, it was found that the reforestation model with paricá proposed in this paper presents economically viable for deployment.

Key words: Amazon, paricá, reforestation.

1. Introduction

In Brazil, over 75% of natural woods, for the production of furniture, houses, boats, veneer, plywood and various artifacts are from the Amazon forests. In the north, the timber companies represent 77.39% of the total number of companies and 74.37% of the number of jobs [1].

The Paragominas municipality, by the year 2008, was considered a synonym of deforestation in the Amazon, because the city had lost about 43% of its forest area due to local activities that caused deforestation. However with the implementation of the Project “Green City” of the Federal Government, reforestation program to plant about 10,000 trees per year, through sustainable production process, involving local communities, the situation changed and the municipality is currently considered example sustainability in practice in Brazil [2].

Currently the Amazon region, an example of native species planted for timber production on a commercial scale, which has been highlighted in recent years is the paricá (*Schizolobium amazonicum* Huber ex. Ducke), belonging to the family Leguminosae, primary forests and tree secondary [3].

Paricá is a kind of great importance for the region that can be used in homogeneous by timber
Economic Viability of Production of Tree Paricá (*Schizolobium amazonicum* Huber ex. Ducke) of Reforestation Project in the Municipality Paragominas-PA, Brazil

Planted industries, supplying the demand of raw material, and it is a plant of rapid growth, average 30-35 m³/ha/year, and high commercial value, which can be used in the recovery of areas degraded by human activities and thus reduce deforestation of native forests [4].

However, according to Sanguino [5], currently there are few existing studies on investments in forestry projects, which include information about the costs of deployment and maintenance, production and marketing of financial profitability.

Therefore, the generation of new knowledge, with species native to the Amazon, which involves economic information is a demand for research identified for the Amazon that can bring a number of environmental, social and economic benefits for our region.

In this sense the work aimed to analyze the profitability of production Paricá reforestation in the municipality of Paragominas-PA via the following economic indicators: NPV (net present value), IRR (internal rate of return), BCR (benefit-cost ratio) and EP (break-even point).

2. Materials and Methods

The study was conducted in the municipality of Paragominas Messoregião located in the northeast of Pará, Brazil, located in the following coordinates 2°59'45" S and 47°21'10" W. The selection of this council should be the location of the research center Paricá, with a planted area of 60,000 ha with approximately 37.5 million trees, and where are located several factories producing plywood.

The basic data used in the economic evaluation of production of planting paricá (costs and revenues) were derived from primary source through raising production cost of paricá with farmers in the municipality of Paragominas-PA, analyzing the period production horizon of 7 years (Table 1). The discount rate chosen for economic evaluation was 10% per year for being one of the most used by the Brazilian forestry sector, which traditionally works with rates between 6% and 12%.

To verify the economic viability of producing paricá the following criteria were used for economic analysis:

- **NPV**
  
  It is the most known and used in the investment analysis robust technique. The NPV of a project is defined as the algebraic sum of the discounted values of the flow of the associated box. It is measured by the difference between the discounted at a given discount rate, and the present value of cash inflows and cash outflows from present value also called the hurdle rate [6]. Calculate the present value of the remaining terms of cash flows to add them to the initial investment value of each alternative.

  The main problem associated with the use of this method is the determination of the interest rate appropriate to discount the cash flows. Of course, higher interest rates tend to reduce the NPV, whereas NPV lower rates increase, favoring the acceptance of the project [7, 12].

  \[
  NPV = \sum_{t=0}^{n} \left( \frac{R_t - C_t}{(1+i)^t} \right)
  \]

<table>
<thead>
<tr>
<th>Year</th>
<th>Period</th>
<th>Revenue ($)</th>
<th>Cost ($)</th>
<th>Cash flow ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>274,072</td>
<td>-274,072</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>40,179</td>
<td>-40,179</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
<td>17,017</td>
<td>-17,017</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>0</td>
<td>8,061</td>
<td>-8,061</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>0</td>
<td>8,061</td>
<td>-8,061</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>0</td>
<td>8,061</td>
<td>-8,061</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>1,491,267</td>
<td>8,061</td>
<td>1,483,206</td>
</tr>
</tbody>
</table>

Source: search results.
where:
\[ R_t = \text{fluxo de receita do projeto no ano } t; \]
\[ C_t = \text{fluxo de custo do projeto no ano } t; \]
\[ i = \text{taxa de juros de longoprazo, em } \%; \]
\[ n = \text{número de anos do projeto } (t = 1, 2, ..., n). \]

NPV > 0—development is economically feasible (revenue > cost);
NPV < 0—The Enterprise is infeasible (revenue < cost);
NPV = 0—No income, revenue is sufficient to cover expenses.

• RBC

The Benefit-Cost ratio is an indicator of economic and financial efficiency and refers to the return on investment from the comparison between revenues and costs. For purposes of analysis it is important that this ratio is greater than zero, since this indicates result in revenue as outweigh the costs, so a BC equal to 2.5 for example, link means for each dollar invested (cost), the gross return is 2.5 dollars in revenue. The index is calculated by the following formula [9]:

\[
R_{BC} = \frac{VB(i)}{VC(i)}
\]

where:
\[ i = \text{discount rate}; \]
\[ VB(i) = \text{present value of benefits flow to the discount rate } i; \]
\[ VC(i) = \text{present value of the costs to the discount rate } i. \]

• IRR

The internal rate of return is a measure popularized by John Maynard Keynes and receive great attention from economists. Until a few years ago, this criterion was considered as good as the criterion of net present value. Sets up internal rate of return as that interest rate that makes the sum of the discounted cash flows for the beginning of the period is zero [9]. The mathematical model to find the IRR is given by Santana [8]:

\[
\sum_{i=0}^{n} \frac{\text{Receita}_i \ast (1 + IRR)^{-i}}{\sum_{i=0}^{n} \text{Custo}_i \ast (1 + IRR)^{-i}} = \sum_{i=0}^{n} \text{Receita}_i \ast (1 + IRR)^{-i} = \sum_{i=0}^{n} \text{Custo}_i \ast (1 + IRR)^{-i}
\]

where:
\[ IRR = \text{Internal rate of return}; \]
\[ t = \text{number of years of the project } (t = 1, ...., n). \]

• EP

This is a short-term indicator that reveals the minimum required for product revenues are equal to the costs, i.e. this indicator shows that the minimum amount that the producer must produce to tie revenues to costs. The EP is important in that it establishes the minimum threshold to be produced to prevent damage to economic activity. Santana presents the following formula for calculating the EP [10]:

\[
EP = \frac{1}{RB / C}
\]

where:
\[ R B / C = \text{benefit-cost ratio}. \]

3. Results and Discussion

The data analysis of economic feasibility of production of planting paricá NPV, IRR, BC and EP, the rate of 10% per year are presented in Table 2. The NPV was of $495,470 showing good economic viability of planting paricá. The IRR amounted to 28.83% this planting. This value shows that it is more feasible to invest in planting paricá than the market rate of 10% pa used with reference, i.e. only the rates of these superior reference an exploration project of this culture, with technology similar to analyzed, would not be adopted by a credit institution. The results obtained in the BCR (benefit-cost ratio) confirm the good performance of this culture, where each $1.00 invested in deployment and production,
Table 3  Analysis of economic sensitivity to external shocks through increased costs of production, reduction in the sale price while reducing the price and production.

<table>
<thead>
<tr>
<th>Indicadores</th>
<th>Increased production costs</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV ($)</td>
<td></td>
<td>426,845</td>
<td>357,688</td>
<td>288,532</td>
</tr>
<tr>
<td>IRR (%)</td>
<td></td>
<td>24.76</td>
<td>21.42</td>
<td>18.58</td>
</tr>
<tr>
<td>BC</td>
<td></td>
<td>2.03</td>
<td>1.74</td>
<td>1.52</td>
</tr>
<tr>
<td>EP (%)</td>
<td></td>
<td>49.29</td>
<td>57.51</td>
<td>65.72</td>
</tr>
</tbody>
</table>

Reduction in the sale price

<table>
<thead>
<tr>
<th>Indicadores</th>
<th>Increased production costs</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV ($)</td>
<td></td>
<td>327,644</td>
<td>159,288</td>
<td>-9,068</td>
</tr>
<tr>
<td>IRR (%)</td>
<td></td>
<td>23.87</td>
<td>17.72</td>
<td>9.47</td>
</tr>
<tr>
<td>BC</td>
<td></td>
<td>1.95</td>
<td>1.46</td>
<td>0.97</td>
</tr>
<tr>
<td>EP (%)</td>
<td></td>
<td>51.35</td>
<td>68.46</td>
<td>102.69</td>
</tr>
</tbody>
</table>

Simultaneous reduction in the price and production

<table>
<thead>
<tr>
<th>Indicadores</th>
<th>Increased production costs</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV ($)</td>
<td></td>
<td>258,488</td>
<td>20,976</td>
<td>-216,537</td>
</tr>
<tr>
<td>IRR (%)</td>
<td></td>
<td>19.94</td>
<td>10.84</td>
<td>0.47</td>
</tr>
<tr>
<td>BC</td>
<td></td>
<td>1.62</td>
<td>1.04</td>
<td>0.61</td>
</tr>
<tr>
<td>EP (%)</td>
<td></td>
<td>61.62</td>
<td>95.85</td>
<td>164.31</td>
</tr>
</tbody>
</table>

To the point of balance was found the value of 41.08% that shows the minimum amount of production, so that revenue equals costs.

With the objective to verify the ability of reforestation with paricá withstand external shocks to production such as changes in sales prices, production costs and the production function phytopathological and/or entomological problems, simulated the following scenarios unfavorable planting, maintaining the same rate of interest of 10% PA:

1. increases in production costs in the order of 20%, 40% and 60%;
2. reduction in the selling price of the two species used in the order of 20%, 40% and 60%;
3. reduction in prices and simultaneous production of two species of approximately 20%, 40% and 60%.

They established that for any of the situations analyzed, with the exception of reducing the selling price while reducing the sales price and increased production costs in the order of 60%, there would be economic sustainability. The values can be seen in Table 3. Soares et al. [13] studying the economic evaluation of *Eucalyptus grandis* for the multiproduct, found that increases in discount rates and the cost of land significantly affect the NPV and project profitability [13].

4. Conclusions

Based on the results obtained, it was observed that the reforestation project with paricá proposed in this paper presents economically viable for deployment by small producers.

Data analysis indicates that cultivation is profitable with sales of timber to market. And even exposed to market shocks planting still has economic sustainability.

The proposed system was designed to one hectare and can therefore be deployed by small farmers with low cost.

The wood and furniture industry in the municipality
of Paragominas tends to grow, and the participation of smallholders in the supply of raw material to timber companies from reforestation emerges as a promising market niche.

References


