Journal of Engineering Science and Technology
Special Issue on ISCoE2024 Vol. 20 No. 4 (2025) 62 - 69

PINEAPPLE LEAF COMPOSITE AS AN ALTERNATIVE MATERIAL FOR MAKING COMMUNICATION BOARDS AS A THERAPY TOOL FOR SPEECH DELAYED CHILDREN

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Abstract

Deforestation has led to a decline in forest production, creating a shortage of wood and necessitating sustainable alternatives. Agricultural waste, such as pineapple leaves, presents an untapped resource for addressing this challenge. This study explores the economic feasibility of producing communication boards from pineapple leaves. These boards serve as speech aids for late-talking children while contributing to environmental sustainability by utilizing organic waste. By repurposing agricultural by-products, this initiative not only meets specific societal needs but also helps mitigate global warming through effective waste management. The findings provided insights into the viability of this innovative approach, balancing economic success with environmental responsibility.

Keywords: Business economics, Children, Communication board, Education, Pineapple leaf composite.

1. Introduction

Waste in environment is increasing due to the use of synthetic materials that do not decompose which easily harm the environment [1]. The agricultural sector produces various types of organic waste, which are often not utilized properly [2]. Pineapple leaves are one such waste, but in large quantities, it just becomes waste without any value [2]. Pineapple leaves are strong and can be processed into high quality mixtures [3]. These natural fibres not only reduce agricultural waste, but they are also more sustainable than synthetic materials [4]. Pineapple leaf fibre can be used for various new purposes, one of which is environmentally friendly communication boards [5]. Communication boards are often used for various purposes, including as a therapeutic tool for children with special needs. A good board should be light and safe for children to use [6].

The novelty of this research is that communication boards made from pineapple leaf composite can meet these requirements and support sustainable practices in accordance with the regulations in sustainable development goals (SDGs) [7]. Pineapple leaf waste, how pineapple leaf fibre is processed into composites, and the advantages of using this environmentally friendly material to make communication boards [1].

This method is expected to produce new products that are not only practical but also have added value for society and the environment. Communication aids are very important in child therapy because they help children with various special needs interact and express themselves [8]. During the civic -19 pandemic, the rate of speech delay reached 20% in Indonesia. The total number included 2-20 children who had difficulty memorizing vocabulary, therefore there were many methods of assistive devices for space delay children [9].

Figure 1 shows the stages of waste pineapple leaf fibre into boards. Based on these steps, the flow diagram for the results of chemical properties is carried out in 5 stages:

(i) The first stage is preparing the raw material by removing the skin of the pineapple leaves until white fibres are visible, then taking the fibres slowly, making a solution. NaOH according to the specified concentration.

(ii) The second stage is the delignification stage of pineapple leaf fibres which are soaked in NaOH solution with and without stirring using a magnetic stirrer [10].

(iii) The third stage is cleaning the pineapple leaf fibres. This is done by using distilled water to remove impurities and residual solvent from the fibres.

(iv) The fourth stage is to boil pineapple leaf fibre for 8 hours at 100 °C to produce hundreds of boards. To obtain ideal pineapple leaf fibre, this experiment used a variable NaOH concentration of 4% [11, 12], soaking temperature of 80 degrees Celsius, stirring speed of 300 rpm, lignin content of 0.3%, pore size of 18.30 μm, and tensile strength of 10.83 g. /Tex.

(v) In the fifth stage, the preservation stage begins by drying the pineapple leaf fibres until the weight is constant, sorting the pulp, cleaning it, and soaking it in salt water. The drying process involves drying the fibre in the sun for 1 day.

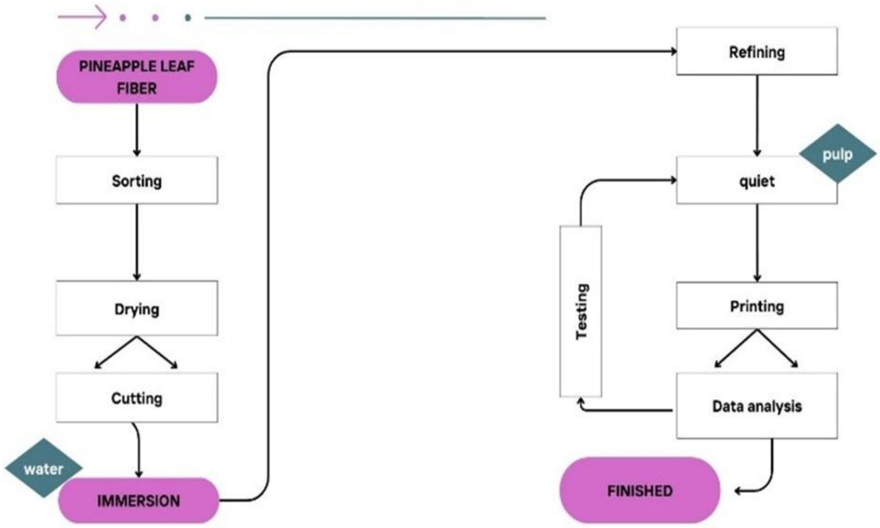

Fig. 1. Stages of pineapple leaf fibre waste into boards.

2. Method

This study was carried out in several steps, namely basic design of the tool, assembly or manufacture of the tool, testing the design results, observation and data analysis. This research focuses on analysing the prices of commercially available materials, equipment and equipment specifications using online shopping platforms.

To calculate all the data, the Microsoft Excel application performs simple mathematical calculations [13, 14]. The economic evaluation parameters used indicate that the economic evaluation of this project is valid [15]. The research uses various economic evaluation parameters.

3. Results and Discussion

The stages for turning pineapple leaf fibre into planks are based on five preparation stages. First, remove the skin from the pineapple leaves until you see white fibres. Then, slowly take the fibre and make a NaOH solution with a predetermined concentration. Delignification of pineapple leaf fibres was carried out in the second stage by soaking them in NaOH solution with and without stirring using a magnetic driver [16, 17].

Table 1 shows pineapple leaf fibres must be cleaned. To do this, distilled water is used to remove impurities and residual solvent from the fibres. The subsequent neutralization process involves boiling the pineapple leaf fibre for eight hours at 100 degrees Celsius, which produces hundreds of planks.

Delignification of pineapple leaf fibres was carried out in the second stage by soaking them in NaOH solution with and without stirring using a magnetic driver [11]. Fixed Capital investment (FCI) provided by the Company IDR 451,335,152 during a year.

Figure 2 shows the graphic relationship between NPV/TIC on the x-axis which is lifetime (year). The income in the 1st year is still at a loss until the 2nd year due to initial capital costs such as the tools required. In the 3rd year the graph shows an increase in income experienced an increase in production.

Figure 2 also shows the increase in payback period (PBP). profits can cover the initial capital spent and profits continue to increase thereafter until the 20th year. Thus, the production of pineapple leaves shows the return model for the project plan which is said to be profitable.

Table 1. Determination of total fixed capital investment.

Component		Cost (IDR)
Direct Cost	Equipment price	83,164,760.00
	Transportation costs	8,316,476.00
	Insurance transportation	582,153.32
	Transportation to location	4,158,238.00
	Equipment installation costs	45,740,618.00
	Instrumentation	24,949,428.00
	Piping	41,582,380.00
	Electrical	41,582,380.00
	Utility	33,265,904.00
	Building Costs	58,215,332.00
	Insulation	4,989,885.60
	Painting, fireproofing, safety	4,158,238.00
	Yard Improvement	6,653,180.80
	Environmental	58,215,332.00
	Land	6,653,180.80
	Direct Cost	422,227,486.52
Indirect Cost	Technician and supervision	8,316,476.00
	Contractors fee	12,474,714.00
	Contingency	8,316,476.00
	Indirect Cost	29,107,666.00
Starting Up Fee	Off-site facilities	16,632,952.00
	Plant start-up	5,821,533.20
	Working capital	16,632,952.00
	Starting Up Fee	39,087,437.20
Total Investment	Fixed Capital Investment (FCI)	451,335,152.52
	Working Capital Investment (WCI)	79,647,379.86
	Total Capital Investment (TCI)	530,982,532.38

Table 2 shows summary parameter Labor costs vary in profit percentage of 0.91% apart from economic analysis. The attractiveness of this project is an unattractive perspective for investors.

This perspective of Indonesia's standard capital in the case of this CMV project in 20 years drains from the PI analysis relatively low. PBP analysis shows competitive conditions. This is seen based on capital. This typical long-term investment is not attractive to investors; this research is knowledge about services for the production of pineapple leaf pulp. Costs incurred Rp 6,300,000,000 with profit of sales 170% with 30000 units.

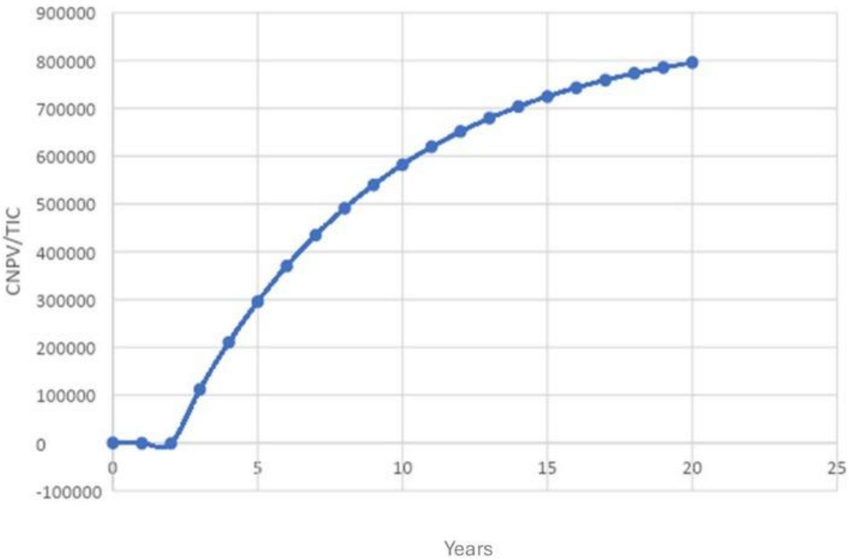

Fig. 2. Ideal conditions for CNPV/TIC relative to lifetime (years).

The break-even point (BEP) analysis shows that sales need to exceed 211.49% to recover production costs, indicating significant financial pressure. Despite a seemingly competitive profit margin, the project's long-term viability is constrained by Indonesia's investment standards and the extended timeline required for favourable returns. With an operational cost of IDR 6,300,000,000, the project demonstrates high percentage profit on sales, but the underlying financial structure, including capital investment requirements and payback challenges, makes it less attractive to investors. This research highlights the financial dynamics of pineapple leaf pulp production, providing valuable insights into its economic feasibility and challenges. Data explains the estimated employee salary of IDR 1,800,000.00 per month, so the total per month for 10 employees is IDR 18,000,000.00, so that the employee salary expenditure for one year is IDR 216,000,000.00.

Table 2 also provides a comprehensive summary of the parameters involved in the economic analysis of the pineapple leaf pulp production project. The analysis reveals that labour costs contribute only 0.91% to the overall profit percentage, which underscores their limited impact on profitability. While the project generates a profit-to-sales ratio of 170% from the production and sale of 30,000 units, with total sales amounting to IDR 90,000,000,000, the financial attractiveness of the project remains questionable. Fixed costs, including depreciation, amount to IDR 583,771,803.12, and variable costs are IDR 7,191,993,000.00. Although the return on investment (ROI) is 182.27%, the payback period (PBP) is considered relatively long, diminishing its appeal to potential investors. The break-even point (BEP) analysis shows that sales must exceed 211.49% to cover production costs, indicating significant financial stress.

Although profit margins appear competitive, the long-term viability of the project is limited by investment standards in Indonesia and the long time required to obtain profitable returns. With operational costs of IDR 6,300,000,000, the project shows a high profit-to-sales percentage. Still, the underlying financial structure, including the need for capital investment and challenges in capital returns, makes it less attractive to investors. This research highlights the financial dynamics of pineapple leaf pulp production, providing valuable insight into the economic viability and challenges faced. Detail information for calculating techno-economic analysis is explained elsewhere [18]. This study adds new information about techno-economic analysis, as reported elsewhere [19-23].

Table 2. Summary parameter.

	Parameter	Cost (IDR)
Fixed Cost	Loan Interest	
	Capital Related Cost	538,638,287.87
	Fixed cost Depreciation	
	Depreciation	45,133,515.25
	Fixed Cost less depreciation	
	Total Fixed Cost	583,771,803.12
Variable Cost	Raw material	509,523,000.00
	Utilities	21,750,000.00
	Operating Labor (OL)	216,000,000.00
	Labor Related Cost	144,720,000.00
	Sales Related Cost	6,300,000,000.00
	Total Variable Cost	7,191,993,000.00
% Profit Estimated	Sales	90,000,000,000.00
	Manufacturing Cost	7,730,631,287.87
	Investment	483,769,408.92
	Profit	0.91
	Profit to Sales	170.06
BEP	Unit	30000
	Fixed Cost	583,771,803.12
	Variable cost	7,191,993,000.00
	Variable cost	0.00
	sales	90,000,000,000.00
	sales	0.00
	BEP	211.4910711
	Percent Profit on Sales	0.914104097
	Return on Investment	182.2799936
	Pay Out Time	0.005483058

4. Conclusions

Based on the analysis of the pineapple leaf dregs production project using the sol gel combustion method which provides an economic evaluation point of view. PBP analysis shows that investment calculation after more than 2 years. This project can compete in the capital market within 2 years and gain profits. Project it can compete with PBP capital market standards due to investment returns in a short time. Several things that influence this benefit include using the method *sol-gel combustion*, because this method is very easy and cheap. From this economic evaluation analysis, we can conclude that this project is feasible to carry out.

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