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TECHNO-ECONOMIC ANALYSIS OF WOOD PULP ECO-FRIENDLY LEARNING MEDIA: SOCIAL MEDIA EMPATHY BOARD

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Abstract

The objective of the research is to analyse the eligibility for the technical and economic development of a learning media-friendly environment made from powder wood, which is board empathy social media. Powder wood processes become a product worth as much as it can be used as a learning medium, like at school inclusive, which requires a school-friendly environment. The method study uses analysis of techno economy, which covers the analysis of raw materials and components price, capacity production, selection tool technology, structure power required work, and analysis eligibility finance others, such as NPV, BEP, and IRR. Analysis results show that processing powder wood becomes board empathy social media worthy in a technical way with quality and durability, adequate product, low production cost, and very supportive market potential. Therefore, processing powder wood becomes board empathy. This social media offers solutions for managing wood industry waste with innovation as a learning medium so that you can have a high economy.

Keywords: Learning media, Powder wood, School inclusive, Social media, Techno economy.

1. Introduction

In this digital era, taking advantage of technology to improve effective learning has become common, like in learning media. However, developing a friendly learning media environment still becomes difficult separately for educator circles, especially in an environment that is school-inclusive. This is an important notice at school that prioritizes a friendly learning environment, including the use of learning media [1, 2]. One of the possible innovations made solutions, namely learning media made from base powder processed wood, become a learning medium friendly environment, like board empathy social media.

Powder wood is an industrial waste that can be efficiently processed into valuable products [3]. One such application is the board empathy social media, a learning tool for schools, including students with special needs [4, 5]. Made from processed powder wood, this board combines visual and textual elements to enhance students' understanding and empathy toward social media issues while guiding their online interactions [6, 7]. Proper innovation in powder wood processing enables a techno-economic analysis of its feasibility in developing educational media, assessing both technical and economic viability. Research on techno-economics and utilization of wood waste has been widely used, as in Table 1.

Table 1. Research summary: Techno-economic analysis and wood waste.

No.	Topic-Analysis	Ref.
1	Techno-economic analysis reveals the untapped potential of wood biochar	[8]
2	Biofuel production from construction and demolition wood waste	[9]
3	Techno-economic analysis and life cycle assessment of cellulose nanocrystal production from wood pulp	[10]
4	Techno-economic analysis of integrated torrefaction and palletisation systems to produce torrefied wood pellets	[11]
5	A review of converting woody biomass waste into useful and eco-friendly road materials	[12]
6	A comprehensive techno-economic comparison of bamboo fibre production through mechanical and chemical processes	[13]
7	Eco-friendly high-strength composites based on hot-pressed lignocellulose microfibrils or fibres	[14]
8	wood chips-based organosolv biorefinery concept for the production of lignin monomers and oligomers by base-catalysed depolymerization	[15]
9	Advanced eco-friendly wood-based composites	[16]

The objective of this research is to analyse techno learning media economics friendly environment made from powder wood form board social media empathy. In addition, this research is designed to see feasibility and potential development of learning media friendly environments made from powder wood, esp. in the form board social media empathy become a product that have impact economic potential for management waste industry wood. That matter became a novelty in this research.

2. Literature Review

These methods usually cover testing of characteristic physical, mechanical, and thermal composites that can be customized as needed. Figure 1 shows the process of making a wood powder social media empathy board.

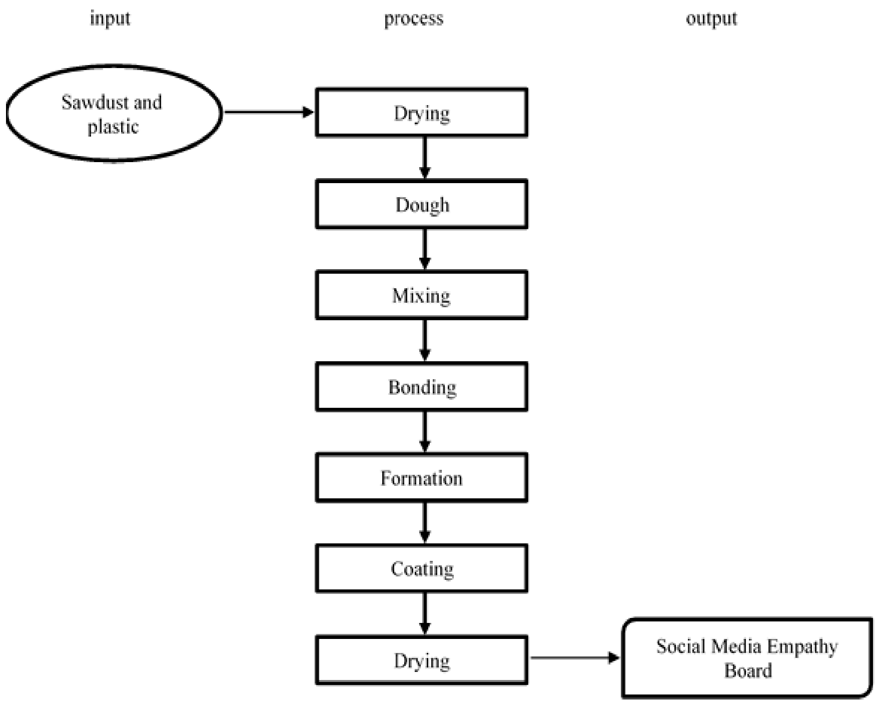

Fig. 1. Flowchart of the manufacturing process board empathy social media material powder wood.

Making process board empathy social media material standard powder wood through a number of stages, including (i) preparing ingredients standard with composition in accordance with the formula/ recipe that will be made. All this material is a must-own of good quality, has not expired, and has not been damaged. Try powder. The wood used has a uniform size. Accuracy in volume and weight measurements Ingredients also have an influence on the quality of end board resulting particles; (ii) all materials that have been prepared and dried, and moreover formerly. Among them were powder saw and plastic. This stage can be done through the drying process in a way experienced with light solar or artificial using an industrial oven; (iii) materials that have been dry furthermore will enter stage kneading. The method is to insert all materials in a standard inward tank, then stir using an industrial mixer with slow rotation. The goal is to obtain results of homogeneous mixing throughout the point. If needed, you can add a little water to facilitate the mixing process; (iv) check moreover formally whether all the ingredients have been mixed evenly or not. When it's done, you can add synthetic adhesive in the form of resin/UF inside the stir. Stir very Again so the ingredients that have been mixed with each other adhere and do not erode again; (v) it is time to carry out the formation process sheets using a press machine. So that the results are maximum, this process is carried out for 2.5-3 minutes with a pressure of 100 kg/cm^2 at a temperature of 170-190 degrees Celsius.

The formed sheet is then cooled in a room at a normal temperature; (vi) before it is ready to be marketed, board particle results in production must be tested formally. Objective testing ensures that the product board and the resulting particles are in sufficient condition.

3. Method

This research uses analysis of techno-necessary economics about eligibility for a business in a production board-friendly environment made from base powder wood. Analysis eligibility in a way techno economy covers analysis material raw materials and components price, capacity production, selection tool technology, structure power required work, and analysis eligibility finance others, such as NPV, BEP, and IRR [17]. To count eligibility in a way, techno economy used Microsoft Excel with simple calculations using the formula that was entered.

4. Results and Discussion

The process of converting powder wood into boards involves four main steps: collecting powder wood, mixing with natural adhesive, pressing under high pressure, and drying. Test results show that the process produces durable boards, making it a valuable economic innovation [18-26]. Material costs for production are IDR 119,000 daily or IDR 35,700,000 annually, which is relatively low. The materials required include sawdust (7 kg/hour), plastic (10 packs/hour), and resin (3 kg/hour). These materials cost a total of IDR 119,000 per day, making production affordable for both small and large-scale operations. The required equipment totals IDR 10,416,000, including items such as scales, presses, ovens, and mixers. These are one-time purchases for long-term production. Daily utility costs are IDR 20,000, amounting to IDR 6,000,000 annually. The technician's monthly wage is IDR 200,000 (approx. $12.12), and the annual salary is IDR 2,400,000 (approx. $145.45), reflecting a low wage cost in this small-scale operation. The analysis of fixed and variable costs, profit, and break-even point (BEP) as in Table 2.

Table 2 presents an analysis of fixed and variable costs, profit, and break-even point (BEP). The total fixed costs, including capital costs, raw materials, equipment, and employee salaries, amount to IDR 112,119,143.68, with depreciation at IDR 8,908,963.20. Variable costs are estimated at IDR 62,508,000.00, and sales are projected at IDR 240,000,000.00, yielding a profit of 0.78%. The break-even point (BEP) is reached at 1,200 units. The return on investment (ROI) is 0.83, and the investment payback period is approximately 1.07 years. This indicates the project's potential for profit.

Figure 2 illustrates the trend of apparent change over two decades. Initially, during the first two to three years of production, losses are expected due to significant investment in equipment acquisition. However, after this period, the financial performance gradually improves, as indicated by a steady and rising curve. This trend suggests that the studied calculations confirm the viability of production. Additionally, it highlights the role of factors such as the eligibility of the production board, social media influence, and the material base (e.g., powder wood) in ensuring stable long-term profits.

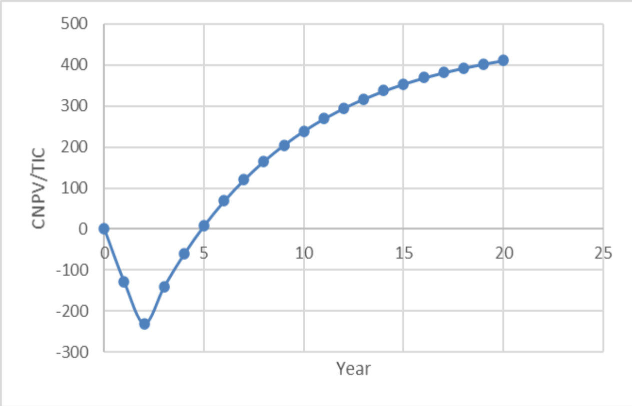

Fig. 2. Graph calculation studies eligibility economy production board empathy social media material base powder wood.

Table 2. Summary analysis of fixed and variable costs, profit, and break-even point (BEP).

Component	Parameter	Cost (IDR)
Fixed Costs	Loan Interest	
	Capital Related Costs	103,290,180.48
	Fixed cost+Depreciation	
	Depreciation	8,908,963.20
	Fixed Cost less depreciation	
	Total Fixed Costs	112,199,143.68
Variable Costs	Raw materials	35,700,000.00
	Utilities	6,000,000.00
	Operating Labor (OL)	2,400,000.00
	Labor Related Costs	1,608,000.00
	Sales Related Costs	16,800,000.00
	Total Variable Cost	62,508,000.00
% Profit Estimated	Sales	240,000,000.00
	Manufacturing Costs	165,798,180.48
	Investment	95,491,872.00
	Profit	0.31
	Profit to Sales	0.78
BEP	Units	1200
	Fixed Costs	112,199,143.68
	Variable costs	62,508,000.00
	sales	240,000,000.00
	BEP	758.5636108
	Percent Profit on Sales	0.309174248
	Return on Investment	0.832889505
	Pay Out Time	1.07193831

5. Conclusions

Based on the analysis of the results, the techno economy related to learning a friendly environment made from powder wood that is board empathy social media shows that the processing process of powder wood becoming board empathy social media is proven worthy in a way technical. Powder wood as a material standard has the potential to process and become a product worth plus high and reduce unused wood industry waste. Relatively low production and large market potential make this innovation feasible to develop more continuously, not only in the facet economy but also in the facet educational and environmental sectors.

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