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The Implementation of Green Manufacturing at IKM. Tani Lestari

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Abstract:- IKM Tani Lestari, a wood processing small and medium-sized enterprise (SME), generates approximately 400 kg of sawdust waste daily. This accumulation, if left unmanaged, can lead to significant environmental pollution. To address this issue, the Green Manufacturing method was applied to analyze and reduce waste, thereby increasing the added value of the products. The research involved direct observation and interviews, revealing that the implementation of Green Manufacturing effectively reduced waste and enhanced the value of the processed products by 50%.

The study employed Value Stream Mapping (VSM) to identify and improve waste management processes. Initially, sawdust waste was sold directly every 15 days, generating a maximum income of Rp. 1,200,000. Through the application of Green Manufacturing principles, the waste processing time was reduced to 3 days before being sold, thereby increasing the product's market value and reducing environmental impact. This method not only streamlined waste management but also resulted in a significant reduction in non-value-added (NVA) activities from 15 days to 5 minutes.

The improved process highlighted by Future Stream Mapping (FSM) demonstrated a 50% increase in value-added (VA) activities, from 6 minutes to 9 minutes. This enhancement in operational efficiency directly contributed to the welfare of the employees, as the increased profits from the sale of processed waste could be reinvested into improving their working conditions and overall well-being. The findings underscore the potential of Green Manufacturing to transform waste management practices in the wood processing industry, leading to both economic and environmental benefits.

Keywords:- *Waste, Green Manufacturin, Value Stream Mapping, Future Stream Mapping, Value Added).*

I. INTRODUCTION

IKM Tani Lestari is a wood processing SME that manufactures various processed wood products such as boards, usukki, glugu, beams, and others. Its products are primarily intended for housing projects. Intense competition in the wood industry necessitates IKM Tani Lestari to enhance its operations and optimize all available resources. Ideally, the wood industry should minimize wood waste. IKM Tani Lestari generates significant waste such as scrap metal, debris, defective products, and sawdust. The company needs to dispose of its waste effectively to ensure that it holds greater economic value. In this context, IKM Tani Lestari faces the issue of accumulating waste, particularly sawdust, which amounts to about 400 kg per day. If left unchecked, this waste accumulates and pollutes the company and its surroundings. The company lacks effective waste management, some of which is simply sold as is, and selling sawdust remains challenging, often taking 15 days to a month to complete a sale because buyers typically purchase waste once a month. The literature review used in this research focuses on the utilization of sawdust waste in Denpasar city, where sawdust is used in brick production [1]. This paper analyzes the economic benefits of sawdust waste, highlighting its value-added benefits

The economic aspect is discussed first [2], followed by a journal on sawdust waste being transformed into acoustic bricks and methods for processing or disposing of sawdust waste into value-added acoustic bricks for sale [3]. Additionally, there is a Lean Implementation Journal that discusses the application of lean manufacturing in a particular setting. Furthermore, an article on factory simulation in manufacturing [5] and an article on sustainable manufacturing [4] are also relevant to this study.

[7] An article on Industry 4.0 manufacturing [8] and an article on machine materials [9] are also pertinent. [10] An article on environmentally friendly manufacturing practices discusses the implementation of eco-friendly manufacturing [11] articles, including models of environmentally friendly production systems. [12] A magazine on waste management [13] highlights the utilization of waste as a raw material for glass production. [14] The magazine discusses the utilization of waste as a raw material

In Indonesia, there are three dominant wood industries that consume wood in relatively large quantities: veneer/plywood manufacturers and pulp/paper producers. The issue arises from the waste produced by these manufacturers, which, in practice, is still being piled up and partially disposed of in river streams (causing water pollution) or directly burned (contributing to increased carbon emissions in the atmosphere).

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A. Wood Waste Processing

In Indonesia, three primary wood-processing industries dominate in terms of wood consumption: veneer/plywood manufacturers, and pulp/paper producers. These industries generate significant quantities of wood waste, which presents substantial environmental challenges. Field observations reveal that some of this waste is still irresponsibly handled; it is either piled up unsystematically, discarded into rivers (causing water pollution), or directly burned (contributing to atmospheric carbon emissions).

Wood waste management in these industries is critical due to its potential environmental impacts. The improper disposal of wood waste into water bodies leads to significant water quality degradation, affecting aquatic ecosystems and potentially harming human health. Furthermore, the direct burning of wood waste releases carbon dioxide and other greenhouse gases into the atmosphere, exacerbating climate change.

Additionally, regulatory frameworks and policies must be strengthened to enforce proper waste management practices. This includes stricter monitoring and enforcement of waste disposal regulations, providing incentives for industries to adopt environmentally friendly practices, and promoting awareness and education on the importance of sustainable waste management.

➢ *Research Methodology*

The research method referred to is the mixed methods approach. This approach is conducted to seek structured, systematic solutions and facilitate drawing conclusions from the research findings. The process begins with data collection, encompassing both primary and secondary data.

➢ *Data Collection*

- *Primary Data*

Primary data are information obtained directly from the research subjects. In this context, information is gathered directly from Small and Medium Enterprises (SMEs) or through field observations. The primary data collection technique used is interviews, where information is obtained from responsible parties, such as business owners or production managers. These interviews are conducted in-depth to gather comprehensive and detailed data.

- *Secondary Data*

Secondary data are information that is already available and accessible to the researcher. Sources of secondary data include various documents such as annual reports of SMEs, statistical data, publications, books, scientific articles, and other relevant sources. Secondary data help to enrich and complement the primary data collected.

➢ *Data Collection Techniques*

- *Field Observation*

This technique involves direct observation at the research site. Field observation allows researchers to see and record the conditions and processes taking place in the SMEs in real-time. This technique is useful for collecting data that cannot be obtained through interviews or written documents.

- *Interviews*

Interviews are a method of data collection conducted face-to-face with respondents. In this research context, interviews are conducted with business owners, managers, and employees to obtain in-depth information about the business operations and strategies being implemented.

- *Literature Review*

Literature review is conducted by examining various sources such as books, magazines, scientific articles, research reports, and other documents relevant to the research topic. This technique helps in understanding the theoretical context underlying the research and comparing the research findings with previous studies.

➢ *Data Analysis*

The data collected, both from primary and secondary sources, are then analyzed qualitatively and quantitatively. Qualitative analysis is performed to understand the patterns, themes, and meanings contained in the data. Quantitative analysis, on the other hand, is used to test hypotheses, calculate frequencies, and make generalizations from the sample to the population. The analytical techniques used include descriptive analysis, inferential analysis, and content analysis.

➢ *Recommendations*

After the data are analyzed, the research findings are discussed to draw conclusions that can provide solutions to the problems being studied. The recommendations derived are expected to offer practical contributions to the development and enhancement of SME performance. This research also provides suggestions for further studies to deepen or expand on the topics that have been investigated.

This mixed methods approach allows researchers to combine the strengths of qualitative and quantitative methods, thereby producing a more comprehensive and in-depth understanding of the phenomena being studied. With this approach, the research is expected to make significant contributions to the development of knowledge and practices in the relevant field.Discussion and Findings

➢ *In the Data Collection Required for this Research:*

Table 1 Waste Collection Data

Type of Waste	Quantity Per Day	Accumulation Period	Total Amount
wood sawdust	400 kg	15 days	6,000 kg

The accumulation of sawdust at IKM. Tani Lestari is 400 kg per day, with the waste being stored at the company for 15 days. Therefore, the total accumulation of sawdust waste at UD. Tani Lestari every 15 days amounts to 6,000 kg. The company typically sells the sawdust waste every 15 days with the following sales estimates:

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Table 2 Selling Price of Wood Sawdust at IKM. Tani Lestari

Total waste generated	Selling price / kg	Total sales
6.000 Kg	Rp. 200	Rp. 1.200.000

The price of sawdust at the company is Rp. 200 per kilogram. Therefore, if the company sells the sawdust waste without any processing, the maximum revenue obtained every 15 days from the waste sales is Rp. 1,200,000.*Metode Value Stream Mapping*

The methods used for data processing are Green Manufacturing and sustainable manufacturing methods, with Value Stream Mapping (VSM) created first to observe the material flow from the wood sawing production process.

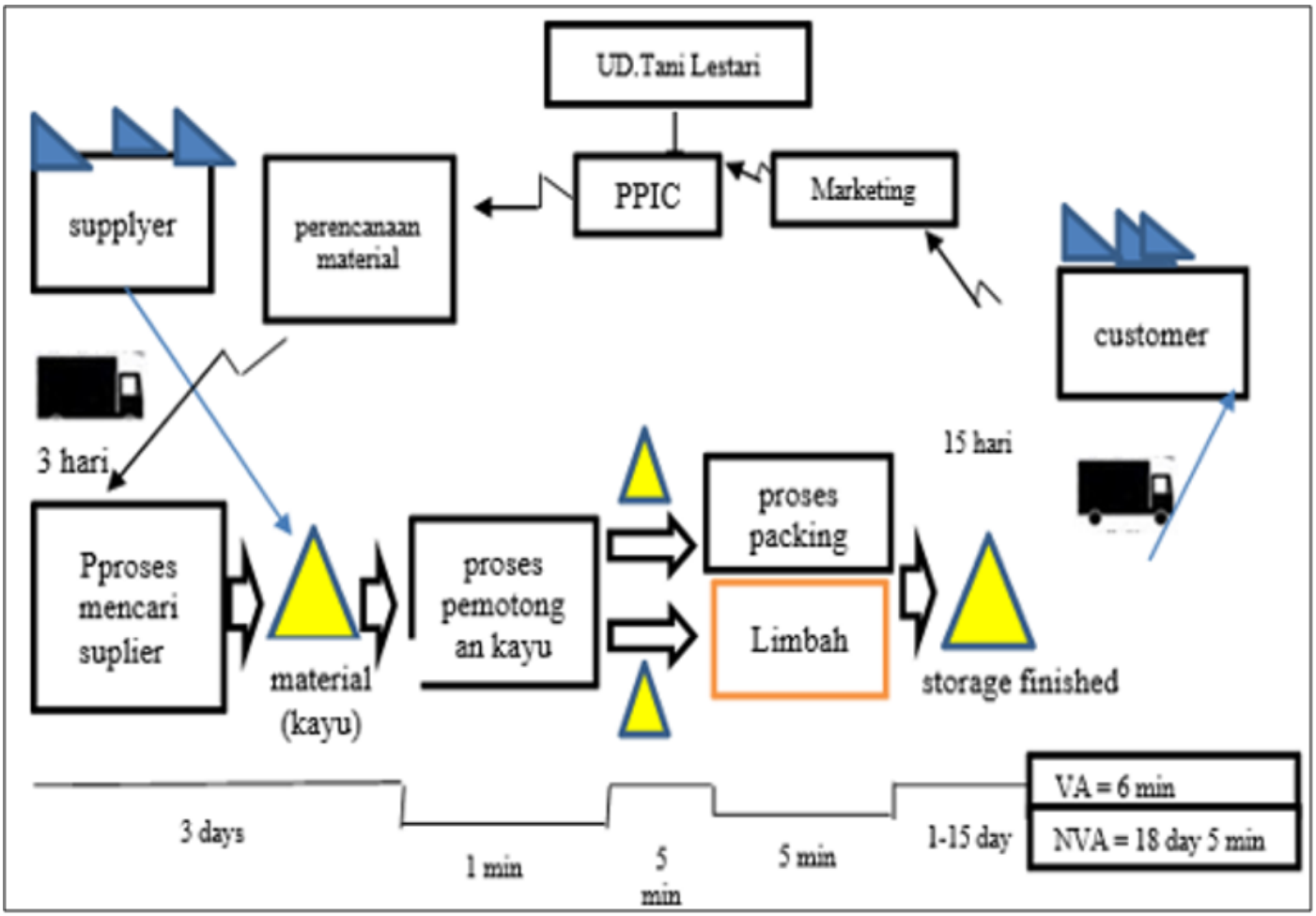

Fig 1 Value Stream Mapping

From the stream mapping image above, it is evident that improvements were made in waste management. Previously, the waste was sold directly, taking approximately 15 days. Improvements were made to process the waste first for 3 days before selling it.

Table 3 Calculation of value Stream Mapping

No	Activity	Time	Activity				VA / NVA/NNVA
		(Days/ hours)	O	T	S	D	
1	Purchasing raw materials	3 Days		V			VA
2	Raw material storage	3 Days			V		NNVA
3	Wood cutting	1 Day	V				VA
4	Packing process	5 Days	V				VA
5	Waste generation	5 Days				V	NVA
6	Waste processing	3 Days	V				VA
7	Finished goods storage	1 Days			V		NNVA

Explanation - O = operation, T = transportation, S = storage, D = delay.

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II. RESULTS AND DISCUSSION

➢ *The Final Research Results are Compared in the Table 4 below.*

Table 4 The Final Research Results

	Initial Value Stream Mapping	Future Stream Mapping
VA	6 minutes	9 minutes
NVA	15 days 5 minutes	5 minutes
NNVA	7 days	7 days

Based on the comparison of VSM and FSM values, it appears that FSM has an increased VA value from 6 minutes to 9 minutes, representing a 50% increase. Meanwhile, the NVA value has significantly decreased from 15 days and 5 minutes to 5 minutes. The NNVA value remains constant at 7 days.

III. CONCLUSION

The research on IKM Tani Lestari's implementation of Green Manufacturing principles and Value Stream Mapping (VSM) has yielded significant improvements in waste management and operational efficiency. By focusing on the reduction of sawdust waste, which amounted to approximately 400 kg daily, the company was able to address major environmental and economic concerns. Initially, sawdust waste was sold every 15 days, generating a maximum income of Rp. 1,200,000. However, through the application of Green Manufacturing, the waste processing time was reduced to 3 days, thereby not only enhancing the market value of the processed waste but also minimizing the environmental impact. This strategic shift underscores the potential of sustainable practices in transforming waste into valuable resources.

The study highlighted that the adoption of Green Manufacturing and VSM significantly reduced non-value-added (NVA) activities from 15 days and 5 minutes to just 5 minutes. This drastic reduction in NVA activities was complemented by a 50% increase in value-added (VA) activities, from 6 minutes to 9 minutes, as demonstrated by Future Stream Mapping (FSM). These improvements directly contributed to increased operational efficiency and productivity at IKM Tani Lestari. Furthermore, the streamlined processes and reduced waste management time allowed the company to reinvest increased profits into enhancing employee welfare and working conditions, showcasing a holistic approach to sustainable business practices.

Overall, the findings of this study emphasize the transformative impact of Green Manufacturing on waste management in the wood processing industry. By integrating sustainable practices and efficient waste management strategies, IKM Tani Lestari not only achieved economic benefits but also contributed positively to environmental conservation. The success of this implementation serves as a valuable case study for other SMEs in the industry, encouraging the adoption of similar sustainable methods to enhance productivity, profitability, and environmental responsibility. Future research could expand on these findings by exploring the application of Green Manufacturing principles in different contexts and industries, further validating the broad applicability and benefits of sustainable manufacturing practices.

IV. SOLUTIONS

➢ *Implementation of Green Manufacturing*

Implement the Green Manufacturing method comprehensively throughout the production process to reduce waste and increase efficiency.Focus on processing wood sawdust waste into products with added value, such as acoustic bricks or other products that can be sold at higher prices.

➢ *Value Stream Mapping (VSM):*

Use Value Stream Mapping to map material flow and identify non-value-added (NVA) activities as well as value-added (VA) activities.Improve the waste handling process to reduce the time and costs involved in processing waste.

➢ *Waste Processing*

Invest in technology and equipment that can help process wood sawdust waste into higher-value products.Develop partnerships with third parties that can assist in processing waste into products with high market value.

➢ *Sales and Marketing*

Enhance sales and marketing strategies for processed waste products to ensure quick sales at higher prices.Identify potential markets for processed wood sawdust products, both domestically and internationally.

➢ *Employee Welfare Improvement*

Use a portion of the profits from selling processed waste products to enhance employee welfare, such as providing bonuses or improving workplace facilities.

Involve employees in the waste processing activities and provide training to improve their skills in producing value-added products.

By implementing these solutions, IKM Tani Lestari can manage waste more effectively and environmentally friendly, while also increasing company profits and employee welfare.

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REFERENCES

[1]. W. Sutarman, "Pemanfaatan Limbah Industri Pengolahan Kayu Di Kota Denpasar (Studi Kasus Pada Cv Aditya)," J. PASTI, vol. 10, no. 1, pp. 15–22, 2016.

[2]. "13 Green Manufacturing.pdf.".

[3]. A. M. Deif, "A system model for green manufacturing," J. Clean. Prod., vol. 19, no. 14,pp. 1553–1559, 2011, doi: 10.1016/j.jclepro.2011.05.022.

[4]. Bahri S., "Pemanfaatan Limbah Industri Pengolahan kayu untuk pembuatan briket arangdalam mengurangi pencemaran lingkungan di Nangroe Aceh Darussalam," J. Mek., vol. vol.4 no.2, pp. 410–415, 2007.

[5]. C. B. Joung, J. Carrell, P. Sarkar, and S. C. Feng, "Categorization of indicators for sustainable manufacturing," Ecol. Indic., vol. 24, pp. 148–157, 2013, doi: 10.1016/j.ecolind.2012.05.030.

[6]. I. Artikel, "Jurnal SENOPATI," pp. 50–61, 2019

[7]. I. N. Tika, I. G. Ayu, T. Agustiana, D. Agus, and W. Erawan, "Pengolahan Limbah Serbuk Gergaji Kayu Menjadi Bata Akustik," pp. 585–593, 2017.

[8]. P. O. Box and S. Lind, "Proceedings of the 2008 Winter Simulation Conference S. J. Mason, R. R. Hill, L. Mönch, O. Rose, T. Jefferson, J. W. Fowler eds.," pp. 1922– 1930, 2008.

[9]. Procedia CIRP, vol. 40, no. Icc, pp. 536–541, 2016, doi: 10.1016/j.procir.2016.01.129.

[10]. I. S. Editor, Front Matter. 2014.

[11]. T. Stock and G. Seliger, "Opportunities of Sustainable Manufacturing in Industry 4.0,"

[12]. U. Malik, "Jurusan Fisika Fakultas Matematika dan Imu Pengetahuan Alam Universitas Riau," vol. I, no. 2, pp. 21–26, 1994.

[13]. W. Widada, "Reduce The Risk of Atherosclerosis through the wet Cupping Therapy," J. Med. Sci. Clin. Res., vol. 6, no. 11, pp. 581–586, 2018, doi: 10.18535/jmscr/v6i11.102.