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Feasibility Study of Cleaner Production Application Planning in CV Valasindo Sentra Usaha

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Abstract. CV Valasindo Sentra Usaha is a furniture industry located in Karanganyar Regency, Central Java. In the production process, it still produces a lot of waste in the form of 13,751 m^3 of sawdust, 17,158 m^3 of wood chips, 13,081 m^3 of Laminated RST, 20880 L of water waste, and waste from other packing materials. The waste has not been utilized by the company and is only sold or thrown away. This study aims to plan alternative improvements and analyze their feasibility at CV Valasindo Sentra Usaha with the concept of clean production. There were 6 alternative proposed improvements with the concept of clean production in the form of making baglogs, making briquettes, making FJL, making fertilizers, making washing basins and making SOPs for the use of packing materials. There are 2 alternatives that are economically feasible and can be implemented, namely making wash basins and making SOPs. From the making of the washing basin, it is expected to save water usage up to 96,224 m^3 and save Rp. 712.057,60 every year. Meanwhile, from making SOPs, it is expected to be able to reduce the amount of these wastes and save up to Rp. 7.502.400,00 every year.

Keywords: Cleaner Production, Furniture Industry, Feasibility study

1. Introduction

Furniture industry is one of the business sectors that play an important role in the Indonesian economy. In the global market, Indonesia is one of the largest furniture exporters in the world, along with China, Italy, Vietnam and Malaysia (Djunaidi et al., 2018). As Indonesia's main source of foreign exchange, the furniture industry has increased production every year. Exports of furniture products in 2020 increased by 7.6% (Kemenperin RI, 2021). The increasing demand certainly results in an increase in the use of natural resources, especially wood as the main raw material. In Indonesia, the production process for the furniture industry is still mostly inefficient because it still uses simple equipment and produces a lot of non-product output (NPO) (Sulistyono et al., 2017). If this condition continues, it can have a negative impact on the environment, namely an increase in waste and waste of resources.

At this time, consumer awareness and concern for product life cycles and certification of environmentally friendly products is getting higher (Handayani et al., 2018). Consumer awareness that continues to grow regarding environmental issues when viewed more deeply can also be a challenge and open up good opportunities for industries in Indonesia (Djunaidi et al., 2018). Industry players who are aware of this are starting to think about making environmentally friendly business strategies. One of the efforts that can be done by industry players is to implement clean production. Clean production is a preventive effort to reduce the adverse impact of products and production on the environment (Satish & Nagesha, 2018). Overall, clean

production is an effective tool not only in environmental protection, but also in enterprise management because it can increase profits, reduce resource consumption, reduce pollutant emissions and protect the safety of staff and workers (Hadibarata & Chia, 2021).

CV Valasindo Sentra Usaha is a wood or furniture processing company with an area of ±13,065 m^2. This industry, which started operating in 1999, uses a make to order system by making the export market its destination. In the production process, it still produces quite a lot of waste such as sawdust, wood chips and pieces, ash from oven combustion, and water waste. Currently, the waste is still not utilized by the company and is only sold or thrown away. Even though the waste produced is not classified as hazardous waste, if it is allowed to accumulate it can cause losses for the company, such as filling up space at the production station so that it interferes with mobility and requires workers to manage it. Based on this, it is necessary to plan a better production process so that it can minimize waste, maximize the utilization of waste into valuable by-products, and reduce the impact on the environment. The concept of production planning in accordance with these objectives, leads to the concept of clean production. This research focuses on economic feasibility studies and planning for the implementation of clean production at CV Valasindo Sentra Usaha.

2. Methodology

This research stage is used to collect data in analyzing the study of clean production opportunities in the furniture production process at CV Valasindo Sentra Usaha. The stages of this research are described in the flow chart of Figure 1 below:

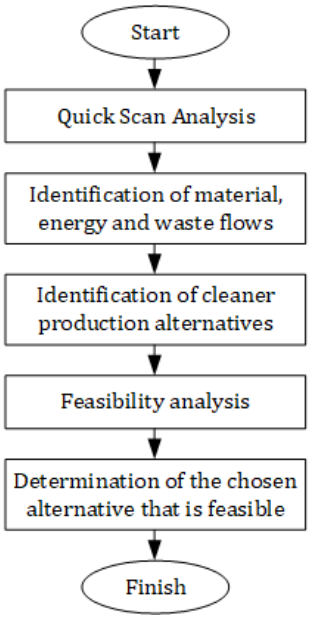

Figure 1. Research flowchart

1.1. Quick scan analysis

Quick scan is an initial study of the production process of a company followed by a brief analysis and becomes an indicator of the potential for implementing clean production. The quick scan method aims to analyze opportunities for implementing clean production in order to streamline the production process through analysis of material flows and energy flows (Indrasti & Fauzi, 2009). The quick scan method is carried out by means of source identification followed by cause evaluation, and the acquisition of options that may be applied (option generation). Quick scan can be done by interview, observation, and measurement. The data obtained based on quick scan analysis is calculated using a mass balance which is useful for knowing input and output.

1.2. Mass balance

The mass balance is an accurate calculation of all the materials that enter, accumulate and leave in a certain time. The general principle of the mass balance is to make a number of equations that are independent of

each other, where the equations are the same as the number of unknown mass compositions (Wuryanti, 2016) . Mass balance analysis is presented in Figure 2.

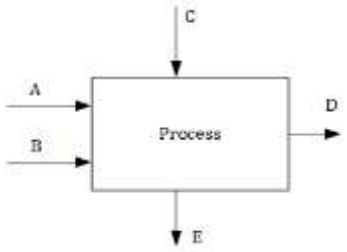

Figure 2. Mass balance chart

The general mass balance equation is:

$M_A + M_B + M_C = M_D + M_E$ (1)

1.3. Identification of cleaner production alternatives

The identification of alternatives for improving clean production is carried out by searching for alternative references for improvements from related previous studies. Based on the problems contained in CV Valasindo Sentra Usaha, alternative proposals are given to overcome them. These alternatives are provided with the aim of reducing the negative impact on the environment and increasing the company's profits.

1.4. Feasibility analysis

The application of clean production can be done with several efforts and techniques which in general are reducing pollutant sources and doing recycling (USAID, 1997). To find out whether a business or technique is feasible or not, a feasibility study is needed. The feasibility study for clean production includes environmental feasibility, technical feasibility, and economic feasibility (Indrasti & Fauzi, 2009). In this study, only an economic feasibility study was conducted to determine whether the clean production alternative could provide financial benefits or not if implemented. Usually used standard methods in financial calculations such as payback period and B/C ratio. The following are the formula for calculating the payback period dan B/C ratio:

$$\text{Payback period} = \frac{\text{Nilai Investasi Awal}}{\text{Kas Bersih}} \text{ x 1 tahun} \quad (2)$$

$$\text{B/C ratio} = \frac{\text{PW of benefit}}{\text{PW of cost}} \quad (3)$$

3. Result and Discussion

The results of data collection and processing that have been carried out include problem identification with a quick scan, mass balance diagram, alternative identification, feasibility analysis, and determination of feasible alternatives.

1.5. Problem identification

Based on the quick scan results, a summary of the identification of waste formation at CV Valasindo Sentra Usaha can be seen in Table 1.

Tabel 1. Identification of waste formation at CV Valasindo Sentra Usaha

No	Documentation of the problems	Waste Condition	Source Cause
1	 **Figure 3.** Sawdust	In the production process, a lot of sawdust is produced	There is a wood cutting process

2	 **Figure 4.** Pieces of wood	In the production process, many pieces of wood are produced	There is a wood cutting process
3	 **Figure 5.** RST Laminated	In the production process, many RST laminates are produced	The company only uses solid RST as raw material for production
4	 **Figure 6.** Ash	In the oven process there is ash left over from burning wood	The combustion process produces residue in the form of ash
5	 **Figure 7.** Defect componen	During the quality check process, defective materials were found	Wood quality that does not meet the established standards
6	 **Figure 8.** Waste water	In the process after assembling the used washing water is simply thrown away	The washing process uses a hose in the open without a water reservoir used for washing
7	 **Figure 9.** Packing material waste	In the packing process there is still a lot of wasted material	There are no rules on the use of materials so operators often overdo it than necessary

1.6. Mass balance chart

The mass balance diagram of the production activity of one of the products, namely Lounge Chair 1200x1200x660mm is presented in Figure 10.

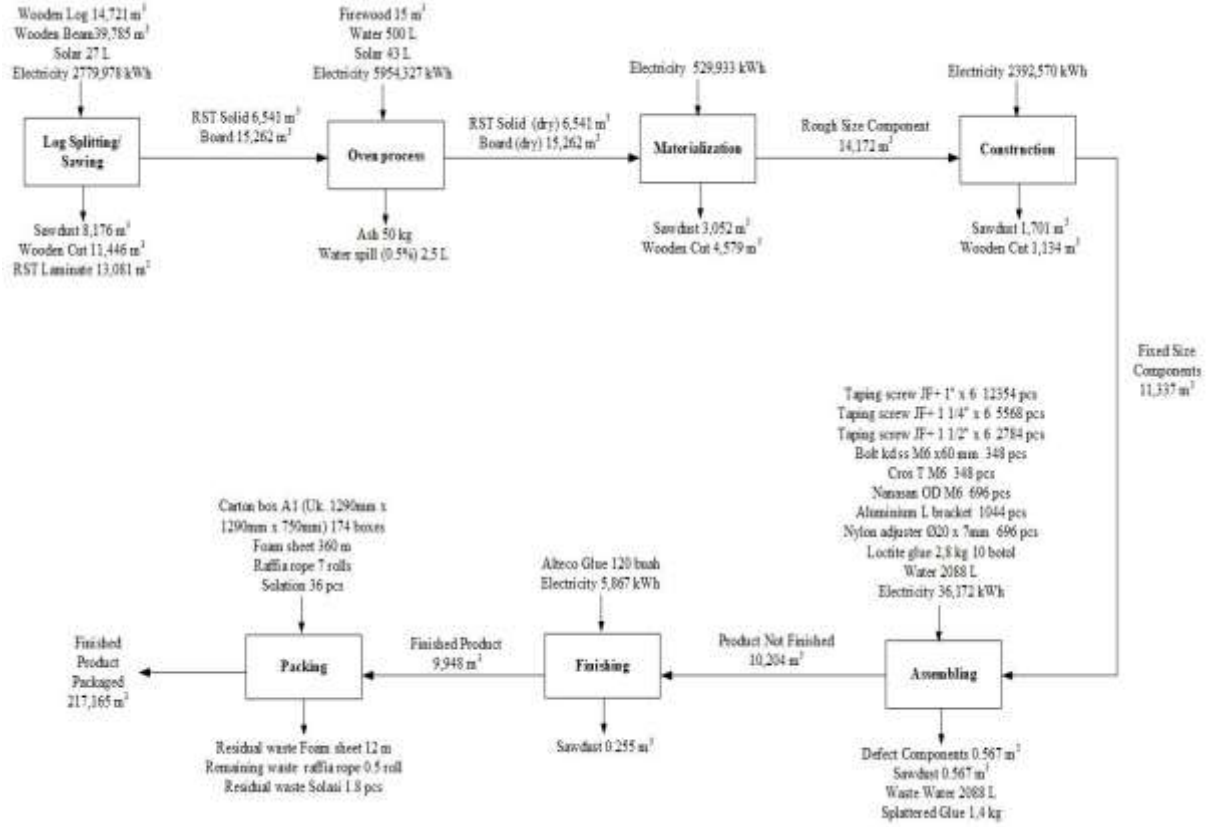

Figure 10. Mass balance diagram

1.7. Identification of cleaner production alternatives

The results of observations and calculations show that there are still many non-product outputs (NPOs) that have not been fully utilized. Based on the literature review and the search for alternative references for improvements from previous research, alternatives that can be done to overcome the problems at CV Valasindo Sentra Usaha are presented in Table 2.

Table 2. Alternatives based on previous research

No	Alternatives	Cleaner Production Concept		Problems
		(USAID, 1997)	(KLH, 2003)	
1	Raw material for making briquettes (Irwansyah & Ansyah, 2022)	Recycling (Recovery as a by-product)	Recycle	The sawdust that accumulates is used only for sale at a relatively cheap price
	Raw materials for making baglogs (Aji et al., 2019)	Recycling (Recovery as a by-product)	Recycle	
2	Indoor furniture raw materials (Wicaksana et al., 2022)	Recycling (Recovery as a by-product)	Recycle	Pieces of wood that are only used as fuel
	Raw materials for making FJL (Tanujaya, K.S.E., 2019)	Recycling (Recovery as a by-product)	Recycle	
3	Raw materials for making FJL (Tanujaya, K.S.E., 2019)	Recycling (Recovery as a by-product)	Recycle	RST Laminated stored stack
4	Raw materials for making fertilizers (Sujatmiko, C.I., dkk., 2021)	Recycling (Recovery as a by-product)	Recycle	Ash from burning wood in the oven
5	Making wash basin (Sirait et al., 2019)	Reduction of pollutant sources	Reduce, Reuse	Washing water waste is just wasted

		(Reuse)		
6	Raw materials for making FJL (Tanujaya, K.S.E., 2019)	Recycling (Recovery as a by-product)	Recycle	Defective components stored piled up
7	Making SOP (Armas, M., dkk., 2020)	Pollution source reduction (Source control with loss prevention)	Reduce	The remnants of packing materials are a lot and just wasted

1.8. Feasibility analysis

The calculation of economic feasibility is carried out in two ways, namely the calculation of the payback period and the B/C ratio. In this calculation, it is assumed that the economic life of the machine is 10 years and manual equipment is 5 years with no residual value at the end and in the calculation of the B/C ratio an interest rate is used which refers to the interest rate of BRI, BNI, and Mandiri as of March 2022 of 8%. (OJK, 2022). The recapitulation of feasibility calculation of alternative given for the problems at CV Valasindo Sentra Usaha is presented in Table 3.

Table 3. Recapitulation of feasibility calculation of the alternatives

Alternatives	Initial Investment	Cost of Raw Materials and Labor	Annual Average Profit	Pay back Period	B/C Ratio	Information
Making briquettes	Rp 202,000,000.00	Rp 22,729,305.60	Rp 7,648,332.80	7.254	0.93	Not feasible
Making baglog	Rp 62,978,000.00	Rp 18,120,426.00	-Rp 9,240,712.00	18.772	0.21	Not feasible
Making FJL	Rp 750,000,000.00	Rp 23,501,905.60	Rp 20,977,132.80	7.814	0.86	Not feasible
Making fertilizer	Rp 666,500.00	Rp 1,095,121.60	-Rp 74,759.20	11.385	0.35	Not feasible
Making wash basin	Rp 3,648,156.60	Rp -	Rp 347,241.94	5.123	1.31	Feasible
Making SOP	Rp -	Rp -	Rp 7,502,400.00	0.000	∞	Feasible

1.9. Determination of feasible alternatives

The results of data processing indicate that the economically feasible alternative is the making a washing basin dan making SOPs because they have a B/C Ratio > 1 and/or payback period < economic age.

1.9.1. Making a washing basin

In furniture production at CV Valasindo Sentra Usaha, the proposed improvement is in the process of washing the sub-assembly components of furniture products at the assembly work station. In the work process, waste water is generated as a result of the washing process to create motifs or wood fibers and clean the product from dirt. The alternative proposal given is in the form of making a washing basin. The tub is designed by considering the largest size of the sub-assembly component of the furniture product that is made, which is 2x2x0.6 m for the washing tub. Then for the sedimentation and filtration tanks have a size of 2x1x1.5 m. By making a washing basin, it is hoped that it will reduce the use of water and waste water produced. In addition, sedimentation and filtration tanks are also made so that the washing waste water can be reused. An alternative design for making a wash basin is presented in Figure 11.

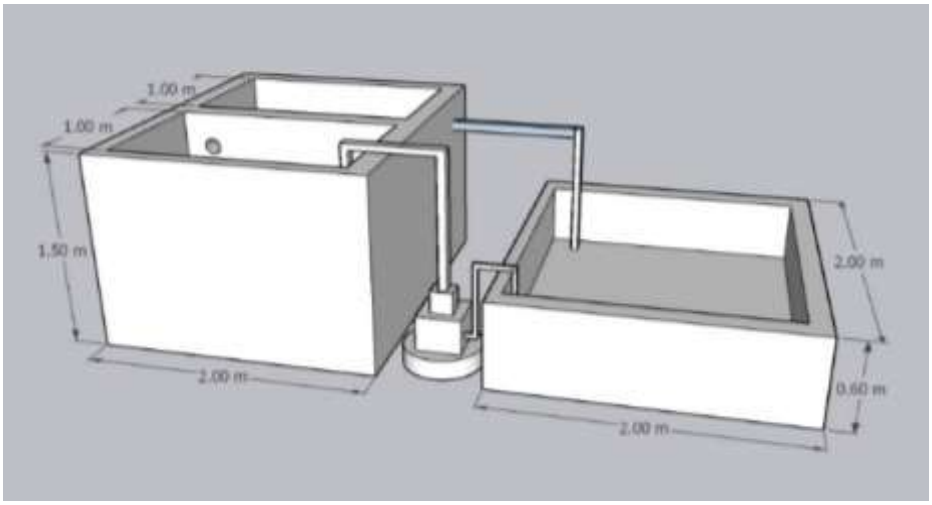

Figure 10. An alternative design for making a wash basin

With the washing basin, the dirty water from the washing process will be sucked in with a pump which is then flowed into the settling basin. After being deposited, the water will then be filtered in a filtration tank with 5 stages of filtration consisting of sand, gravel, charcoal, bricks, and fibers. The filtered water will flow back into the wash basin for reuse. From the construction of the tub, it is expected to save water usage up to 96,224 m3 and save Rp. 712,057.60 every year. In addition, it can have another positive impact, namely awareness and moral responsibility for the surrounding community to maximize water use because of the difficulty in getting water during the dry season.

1.9.2. Making SOPs

In furniture production at CV Valasindo Sentra Usaha, the proposed improvement is in the use of materials at the packing work station. In the work process, waste is generated from the remnants of packing materials due to the absence of rules regarding the use of packing materials so that operators often take materials from the auxiliary material warehouse by exceeding what is needed. The alternative proposals given are in the form of making SOPs. By making a washing basin, it is hoped that it will reduce the use of packing materials and the waste of the remaining packing materials produced.

Based on the results of data processing, for packing 174 products, more or less waste can be produced in the form of 12 m foamsheet, 0.5 rolls of raffia rope, 1.8 pcs of insulation. By making this SOP, it is expected to be able to reduce the amount of these wastes and save up to Rp. 7,502,400.00 in one year. This alternative does not require an initial investment so the company does not have to wait to be able to get a return on investment. In addition, the manufacture of SOPs can also be carried out by the head of production or the head of the packing section with flexible manufacturing times without disturbing production activities and can be evaluated on a regular basis. The company only needs to disseminate information to employees regarding the SOPs that are made. This makes the alternative of making SOPs worth considering to be implemented.

4. Conclusion

There were 6 alternative proposed improvements with the concept of clean production in the form of making baglogs, making briquettes, making FJL, making fertilizers, making washing basins and making SOPs for the use of packing materials. There are 2 alternatives that are economically feasible and can be implemented, namely making washing basins and making SOPs while the other 4 alternatives are not economically feasible, namely making briquettes, making baglogs, making FJL, and making fertilizers.

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