



Afina Batik's Strategy in the Laweyan Batik Village Area in Realizing the Cleaner Production Concept

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Abstract - Cleaner production is an environmental management effort through preventive strategies to prevent pollution and waste of materials before the pollution occurs which is carried out in a sustainable manner in the hope of reducing the negative impact of the activities carried out. The view in cleaner production itself will provide a different perspective to achieve and sustainable consumption with the value of the resources that have been used. However, so far the batik production process is still considered inefficient and environmentally friendly. Thus, this study aims to determine the process of making batik and the behavior of efficiency in the batik production process in Afina Batik's MSME. This research was conducted by observation and interviews. Interviews were conducted using purposive sampling method. Then, given solutions related to the management of Afina Batik to go to cleaner production. The interviewees included the flow of the batik production process, the raw materials used, the use of energy in batik production, both water and electricity, the use of chemicals, the type of waste generated and the amount, and the waste treatment process. The results obtained are various wastes from the dyeing process to washing. In addition, several factors were found that hinder Afina Batik from moving towards a cleaner production process, such as the use of synthetic dyes, still using cordwood, and still wasteful use of air. There are several methods that can be used to implement cleaner production at Afina Batik' MSME, namely by maximizing the use of candles to efficient use of energy, air, and raw materials.

Keywords – cleaner production, strategy, afina batik, laweyan batik.

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1. Introduction

The times have encouraged various industrial fields to increasingly innovate in producing products that are suitable for the market. Industrial development has reached stage 4.0 which utilizes the latest technology and interconnection and data analysis that will increase the competitiveness of the global community for a product in an increasingly dynamic market [1] This industry also emphasizes special attention to the existing development in pursuing the production, distribution, and consumption processes in the industrial activities carried out. With great potential, today's industry should implement a green economy that minimizes the use of non-renewable natural resources and fossil fuels and their resulting impacts [2].

Complexity in the use of natural resources supports change and conflict which refers to community instability

and the impetus for problem solving to be carried out outside of its territorial boundaries [3]. Yasa [4] have stated Industrial activities that are included in the economy business can have a negative impact on global warming which is one of the environmental issues that is being discussed by experts around the world. So developing a green economy can be an option in the business sector, including industry, where this has received full support from the government in the idea of economic transformation so that the future of future generations can be guaranteed.

The development of economic transformation in industrial activities can be achieved by a concept called cleaner production. Cleaner production is an environmental management effort through preventive strategies to prevent pollution and waste of materials before the pollution occurs which is carried out in a sustainable manner in the hope of

reducing the negative impact of the activities being carried out [5]. Waste is emphasized mainly on businesses with multi-item output results that require more materials. The concept of cleaner production can be applied to reduce the impact on the environment, living things, or other life-supporting elements. The embodiment of cleaner production will be able to reach the level of economy that is targeted by an industrial activity but still in accordance with procedures that pay attention to the environment so that production activities can continue to be intensified by seeking raw materials that are processed to meet the needs of a large audience [6].

Cleaner production directs the movement to minimize residues such as waste, so that in it there will be efforts to reuse or reuse which is one of the principles in 3R environmental management. Management of industrial waste is one step to advance the quality of industry that can be started even from small industries [7] such as batik's MSME on a household scale. This is influenced by increasing competitiveness in the market so that an efficient approach is needed in optimizing production costs with the remaining output produced to improve product quality, increase precision, influence decision making, and increase MSME productivity. The view in clean production itself will provide a different perspective to achieve sustainable production and consumption by renewing the value of the resources that have been used [8].

Afina Batik's MSME, located in the Kampung Batik Laweyan area, applies waste management from batik residue and liquid waste that they produce during the process of business activities from production, packaging, to delivery to consumers at their destination. Afina Batik makes a breakthrough in creative innovation in the production scale of household or home made batik in a simple way in the production process which is still traditional. The innovation that can be seen clearly is in the disposal of liquid waste from washing batik cloth. These MSMEs have integrated the drain pipe in the wash basin with the communal WWTP for the realization of wastewater that is in accordance with quality standards so as to minimize impacts on workers such as skin irritation, shortness of breath, inhalation of toxic substances or direct impacts on the environment [9]. Proper treatment of waste avoids environmental degradation and dissolves chemical compounds such as lead or manganese in a simple way to save costs [10]. So the purpose of this study is to determine the process of making batik and the behavior of efficiency in the batik production process in Afina Batik's MSME.

2. Materials and Methods

Research on the strategy for implementing the concept of cleaner production was conducted in Afina Batik's MSME, Kampung Batik Laweyan, Surakarta. Afina Batik's MSME is located in the Kampung Batik Laweyan area where the location is a batik production center in Surakarta City as can be seen in Figure 1. This study uses a descriptive qualitative research type where observations are made on the clean

production process at Afina Batik's MSME Surakarta. This descriptive study explains and describes the purpose of the research by conducting several data collections, both observations, interviews and literature studies. The data needed in this study consisted of two types, namely primary data and secondary data. Primary data itself can be interpreted as data that can be obtained directly from the object under study [11].

The primary data in this study include the results of interviews with the owners and implementers of the production at Afina Batik's MSME. Interviews were conducted to determine the flow of the batik production process, the raw materials used, the use of energy in batik production both water and electricity, the use of chemicals, the type of waste generated and the amount, and the waste treatment process. Meanwhile, secondary data is data obtained not directly from the object under study but obtained from other sources as additional information such as journals, books, scientific works, and so on. The secondary data used in this study are in the form of energy efficiency and waste management processes produced by the batik industry. The data obtained is then processed and analyzed descriptively qualitatively where in the end will be obtained information related to the strategy of implementing the concept of cleaner production in Afina Batik's MSME Surakarta.

3. Result and Discussion

3.1 Process Flow of Batik Making

The flow of the process of making batik at Afina Batik's MSME Laweyan is a process that starts from preparing mori cloth to become batik cloth. The process of making batik in general is as follows:

a. Raw material preparation process

This process begins with the preparation of mori cloth that has been washed clean.



Figure 1. Mori cloth preparation process

The mori cloth provided is a cut model of mori cloth with each piece measuring 2.5 meters long. The use of mori cloth is intended to facilitate the process of batik. Another raw material that is prepared is candle raw material. Candle

raw materials are made from a variety of materials mixed with a dose according to the needs of the user. Batim candle serves to cover the surface of the batik cloth. Another ingredient that needs to be prepared is dye. The dyes used by Afina Batik's MSME Laweyan are artificial dyes. The use of artificial dyes is due to the practicality of its use. Artificial dyes make the batik production process easier and faster. However, artificial dyes have the disadvantage that they are not environmentally friendly [12]. The mori cloth is prepared by soaking the cloth overcandle in clean water and beating it the next day. The mori cloth is then rinsed until clean.

b. Batik Process

It is the process of sticking candle on a mori cloth that is ready to be used with a predetermined pattern. At Afina Batik's MSME, this process begins with the design that has been printed on the plan. The mori cloth is placed on a table whose base uses a soft material. The batik made is a type of batik kelengan. This batik has a simple coloring process because the color closure on the surface of the cloth with candle only has two colors with white being the basic color. The mori cloth is screened with candle with the aim that when it is colored, the part that has been candleed is not affected by the color. After that, the mori cloth is washed to prevent fading. The batik process is also carried out using a stamp as shown in Figure 2.



Figure 2. The coloring process using a batik stamp

c. Coloring Process

The process continues with the *soga*. *Soga* gives the mori cloth a brown color. Batik cloth is dipped in a solution that can bring out the color. The dyes that are often used are indigosol, reactive, naphol salt, and others. The dyes used in Afina Batik's MSME are artificial dyes. Generally, artificial dyes are easy to obtain and can produce bright colors [13]. But it has drawbacks because it can often be environmental. The colored cloth is then dried in the appropriate place. Batik that has been dried and then in water glass / fixation. Fixation is done to lock the resulting dye so it doesn't fade easily. This process uses water at a high temperature. Then it is done presenting a light brown color. The candle that

starts to come off will give an idea of the batik. Then the batik is dried again.

d. Pelorodan Process

This process is used to remove the batik candle that is still attached to the fabric. This process is carried out by boiling in water with a high temperature. The water has been starched or sodium cyclic to facilitate the overall candle removal process. This process is carried out according to the dye used and can be done repeatedly depending on the needs. Batik that has been dilorot then rinsed with plain water. When it is clean, the cloth is dried in a hot place to dry.

e. Completion Process

The final process of making this batik with *lasem*. *Lasem* to give a light yellow color. This process also aims to increase the color resistance of batik. Then the batik is dried in the sun to dry. Batik is ready to be packaged for distribution to consumers.

3.2. Source of Batik Production Waste

Afina Batik's MSME is one type of business that has the potential to produce hazardous waste. This waste can pollute the surrounding environment if it is not treated properly. The resulting waste is waste that comes from the batik production process. One of the wastes that can damage the environment is the remaining dye waste that falls and pollutes the water. This will cause the water to become polluted and can affect the deep water if it seeps into the ground. The following are the wastes generated from the batik-making process

a. Liquid waste

Liquid waste generated from the batik-making process comes from the dyeing process to washing. If this liquid waste is not treated before being disposed of, it can reduce water quality. This is because the content in the dye is harmful to the environment. An example is the heavy metals Cr and Pb. These heavy metals usually come from dyes. Cr and Pb also have toxic properties. This liquid waste also contains organic matter, suspended solids, and high oil content [14]. The dissolved oxygen content in the water will decrease and make the balance disturbed [15]. Anthropogenic activities are one of the factors that produce liquid waste [16].

b. Inorganic Waste

One of the inorganic wastes generated from batik production in Afina SMEs is patchwork. Patchwork comes from the remnants of cut cloth. This waste is a waste that is difficult to process because of its non-biodegradable nature. If the patchwork waste is processed by burning it will produce smoke that is harmful to the environment. At Afina Batik's MSME utilizes waste from patchwork used for rags.

c. Waste Gas

This waste comes from the combustion process that still uses firewood. This combustion is carried out to heat the water used in the process of pelorodan or candle removal process. The smoke from the combustion comes directly from the existing chimney. It can also increase the level of CO₂ emissions in the environment.

d. Solid waste

Solid waste generated from the batik production process at Afina Batik Laweyan is the rest of the candle. Good candle is made from a mixture of synthetic and non-synthetic organic materials. The rest of the candle from the staining process sticks to the surface of the floor. The residual of the candle comes from the process of pelorodan batik cloth.

3.3. Efforts and Benefits of Efficiency in Batik Making

There have been several efforts made to increase productivity with a better level of management efficiency to realize the principle of clean production [17]. The principle of cleaner production is closely related to efficiency. This efficiency is carried out to create a better environmental condition as a result of reducing sources that can produce waste. In the production of Afina Batik's MSME, there are several forms of efficiency, namely, as follows:

a. Technical Efficiency of Batik Making

Currently, the production process of making batik in MSME Afina has changed compared to the past. There are several technical changes that are influenced by technological developments. In the past, the manufacture of batik motifs used candle stamps, while nowadays, the making of batik motifs has been changed to a combination of screen printing and candle stamps.

b. Efficiency of Batik Making Raw Materials

The raw materials used today are very different from the past. There is a change in the use of raw materials, which used to use natural dyes and now turn into synthetic dyes. These changes occur because of the difficulty of making the dye. The manufacture of natural dyes and their use also requires a very large amount of energy so that it can waste more energy. Although currently using chemical dyes, Afina Batik's MSME has a strategy so that these chemical dyes do not become a burden to the environment. The strategy applied is to use the dye according to the amount made on that day so that no dye is wasted. If there is a residual dye, then the dye it will be stored to be mixed with the dye to be used the next day.

There is also the efficiency of the candle raw material because the process is not just candle stamping. Burning these candles produces pollutants that can endanger health for workers so that burning needs to be minimized [18]. The raw material for this candle can also be recycled so that in making batik motifs, you can use the recycled candle. In addition, the Batik Afina's MSME also streamlines all other raw materials with the aim of avoiding huge losses. Another example of efficiency is that the wrong or less-than-standard cloth will be processed again into white cloth so that it can be used again and processed again into a good batik cloth again.

c. Water Efficiency

In general, the process of making batik uses a relatively large amount of water so that the waste produced is proportional to the water used. There are efforts Afina Batik's MSME in reducing water use. In the past, the

manufacture of dyes required a lot of water. Not only has that, the coloring process using natural dyes also required a lot of water in soaking and washing. Currently, Afina Batik's MSME can reduce its water use to as much as 5 m³ per week because it no longer uses a lot of water to make dyes. Afina Batik's MSME also uses water if the fabric requires washing because not all fabric motifs require repeated washing. The water used in washing the cloth is also carried out simultaneously for all the colored cloth at the same time or in one batch so that the dirty water is not immediately replaced but can still be used.

d. Fuel Efficiency

After the making technique changes, there is an effect on the fuel. The combination of making motifs makes tasting less candle so that less candle is used. Thus, there is fuel efficiency because the amount of fuel used to melt the candle is also less. The combination of making motifs makes tasting less so that less candle is used.

In addition, there is a change in kerosene fuel into firewood. This change occurred due to economic reasons where the price of firewood is cheaper than kerosene. Although firewood produces more emissions, MSMEs provide waste management facilities to reduce pollution.

e. Electrical usage

The use of electricity in Afina Batik's MSME in a month is around 328 Kwh. The electricity used is included in the office space and in its production. Electricity is used for several purposes, namely lighting coloring machines, and other necessities in the office and employees. Working hours last from 07.00 to 16.00 and the source of lighting is alive at that hour in the office and also lives outside these hours to illuminate this place. To save electricity, the production room is made semi-open so that during the day it can take advantage of outside lighting. In addition, the use of the dye machine is used with a duration that is not too long so that the electricity is not wasted.

There are several advantages obtained by Afina Batik's MSME from this efficiency, namely a faster batik-making process so that production in one day reaches 216 batiks. In the economic field, there is a reduction in the price of raw materials, such as the manufacture of natural dyes and fuel. This makes the price of capital less and more economic profits. In addition, changes to the technical make the number of workers also reduced so that the cost to pay for labor is also reduced and provides economic benefits. However, this new batik-making process reduces the aesthetic value of batik because the screen printing process makes the pattern the same and looks monotonous. However, it still has different aesthetic values because there is still a tasting process that makes a little aesthetic value.

3.4 Efforts to Manage Waste generated in Batik Production

The waste generated by Afina Batik's MSME is very diverse, ranging from batik washing water waste, synthetic dye paint, mori cloth residue, chemical material, candle, and smoke from combustion. These wastes, if not treated

properly, will have a negative impact on the surrounding environment. Liquid waste generated by batik washing water, synthetic dye paint, and chemical material contains hazardous chemical compounds including chromium (Cr), Lead (Pb), Nickel (Ni), copper (Cu), and manganese (Mn) [19]. These heavy metal compounds can cause negative effects on living things and the environment because they can cause cancer and increase the levels of COD (Chemical Oxygen Demand) and BOD (Biological Oxygen Demand) of water so that it can disrupt aquatic ecosystems. The smoke from the combustion also has a negative impact on the environment if there is no waste management effort because the smoke from the combustion will cause carbon dioxide gas emissions which of course will affect the environment and living things in it. Therefore, it is necessary to have efforts in tackling waste in Afina Batik's MSME.

Afina Batik's MSME in this case carry out waste management efforts where there are things that can be done or have been done to reduce negative impacts on the environment, waste management is adjusted to the type of waste generated. In dealing with liquid waste such as Batik laundry waste, paint waste, and chemical waste of Afina Batik's MSME use WWTP (Waste Water Treatment Plant) which was granted by the Surakarta City Government in collaboration with the Environment Agency. WWTP (Waste Water Treatment Plant) is a means of treating liquid waste to neutralize toxic content in water [20]. WWTP at Afina Batik's MSME is a type of communal WWTP which is interconnected with other batik industries in the Kampung Batik Laweyan area. The liquid waste generated from the rest of the production process is then directed to the channel and accommodated into a temporary storage tank, in the temporary storage tank there is a filter to separate the liquid waste and solid waste that enters the channel. After that, the liquid waste that has been filtered by the temporary reservoir enters the channel that leads directly to the WWTP installation. The construction of a communal WWTP in the Afina Batik's MSME will have a positive effect, especially for the environment because the area is located between densely populated residential locations so that it will reduce the level of environmental pollution in that location. According to the results of an interview with the head of production for Afina Batik regarding communal WWTP, maintenance is carried out once a month by the Surakarta City Environment Agency to ensure that the WWTP are still functioning properly.

The rest of the mori cloth and the rest of the candles are examples of solid waste produced by Afina Batik's MSME Surakarta. For its own management, Afina Batik's MSME has made several efforts, such as the remaining mori cloth, if the remaining pieces of production are still long and wide, they will be recycled and reused as raw materials for making batik. However, if the rest of the mori cloth is in the form of small pieces, it will be sold or recycled into useful items such as decorations, bags, doormats, and various other craft items. Candle waste left over from batik cloth production is usually found on the floor around the production site, for its

own management the candle waste on the floor will be dredged clean using a shovel and collected into one sack. After that, the candle waste will be processed in such a way into a new candle so that it can be reused. To overcome the problem of air pollution caused by the combustion of batik production can be done by using a scrubber [21]. Scrubber is a tool used to overcome air pollution where the working principle is to separate air particles resulting from the combustion process [22]. Pollutants produced from the combustion process if there is no waste management treatment will have negative effects on the health of living things and the environment. Scrubber is considered effective in overcoming air pollution problems because scrubbers are proven to be able to separate pollutants such as CO₂, NO_x, SO₂, and other activated carbon gases. With some of the actions already mentioned related to the management of waste from the rest of batik production at the Afina Batik's MSME Surakarta, it can have a positive effect on the environment and for the living things in it. This can also be an embodiment of the concept of cleaner production.

3.5 Waste Management Inhibiting Factors

The inhibiting factors in the research regarding the efforts of Afina Batik's MSME in realizing the Cleaner Production Concept, namely:

- a. The use of chemical or synthetic dyes in the batik production process

Synthetic or chemical dyes used in the process of making Afina Batik are not yet environmentally friendly so they can cause environmental pollution. This is because some dyes can be degraded into carcinogenic and toxic compounds. Meanwhile, according to [23], of all synthetic dyes used, only about 5% are able to stick to the fabric and the rest is disposed of as waste. This means that as much as 95% of synthetic dyes that are often used, such as remazol black, red, and yellow gold, are discharged into nature with heavy metal content. [24] have stated that the disposal of batik waste with synthetic dyes into the waters can have an impact on the depletion of dissolved oxygen, decrease water quality and cause the death of living things that live in it due to lack of oxygen or contaminated with toxic compounds. Dye waste can increase water turbidity, smell, and prevent the penetration of sunlight.

- b. Use of cordwood

The making of Afina Batik when boiling still uses less environmentally friendly fuels such as cordwood in the process of candleing and candleing from mori cloth when boiled. The use of cordwood emits more carbon dioxide smoke compared to other fuels such as LPG, kerosene, wooden pallets and etc. The impact of using wood fuel can also pollute the environment and be harmful to human health [25]. Production processes that are not controlled properly can cause health problems for workers who are exposed to nitrogen dioxide gas every day.

- c. Lack of efficiency in energy use

The use of energy, especially water in Afina Batik is still not efficient. It is proven that in a week it requires 5000/ml

of water during production. The use of water should still be more efficient because it can still be saved again. In addition, when using cordwood during boiling, the rest of the cordwood burning in the lorod process is often left smoldering and not immediately extinguished, so that the use of fuel becomes inefficient. This energy wastage also occurs due to batik fabrics experiencing product defects, because it is necessary to carry out a process of refining or removing ink.

4. Conclusion

The process flow of batik making at Afina Batik's MSME includes the preparation of raw materials, the batik process, the coloring process, the *perlorodan* process, and the finishing process. Sources of waste found in Afina Batik SMEs include liquid waste originating from the dyeing process to washing batik cloth, inorganic waste originating from leftover patchwork, gaseous waste originating from the combustion process using cordwood, and solid waste originating from the rest of the candle. Batik cloth dyeing process. Efficiency efforts carried out at Afina Batik's MSME can be in the form of technical efficiency, raw material efficiency, water efficiency, fuel efficiency, and electricity use efficiency. With this efficiency, there are several advantages obtained by Afina Batik's MSME, namely a faster batik-making process so that the production in one day can reach 216 batiks, in the economic field there is a reduction in the price of raw materials and the number of workers which results in increased economic profits. Inhibiting factors in waste management consist of the use of chemical dyes in the batik production process, the use of cordwood during the boiling process, and the lack of efficiency in energy use.

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