

IMPLEMENTATION OF CLEANER PRODUCTION CONCEPT AS AN ADVANCED LEVEL OF ENTREPRENEURSHIP IN THE ERA OF INDUSTRY 4.0 (CASE STUDY OF PT. IKPP)

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Abstract. The world currently has entered the era of the Industrial Revolution 4.0 marked by increasing technological developments. The pulp and paper industry is one of Indonesia's leading agro-industrial commodities. The production capacity reaches 10 million tons and 17 million tons for pulp and paper production with raw material requirements reaching 45 million m³. The various environmental crises that hit our country today show that there are mistakes in the way of economic development that we are taking, especially in the industrial sector. Because of this, a better strategy change is needed after the end-of-pipe strategy, a strategy that has the potential to be cleaner production. This article is compiled to see the cost savings of the pulp and paper industry's production process that implements cleaner production and provides an overview for entrepreneurs to be able to calculate the profit and loss for the business being run related to the application of cleaner production. Based on a literature review on the application of clean production in PT. IKPP applied to white paper recovery, paper machine, and recycling at finishing proved to be able to get a profit of IDR 646,024,400.00 per day and can be used as a reference and inspiration for other entrepreneurs to be more sensitive and care for the environment.

Keywords: Cleaner Production, Entrepreneur, Industrial Revolution 4.0, Pulp and Paper Industry

I. INTRODUCTION

The world currently has entered the era of the Industrial Revolution 4.0 marked by increasing technological developments. The Industrial Revolution 4.0 produced many inventions, products, and sophisticated technology that can bring tremendous impact and rapid change so that it somehow can change human civilization [1]. In this era, the daily activities can be improved by altering the efficiency in time and process quality, as well as varying the types of available products. However, behind all the advantages, this revolution can also bring negativity to human life as well as to the environment. Wastes generation, greenhouse gases emissions, and non-degradable product wastes that will be accumulated in the earth can degrade the environmental quality. Those are a few examples of negative impact generated by activities in the Industrial Revolution 4.0 era [2], [3]. Beside, a mass unemployment will likely be occurred due to automation and digitalization processes of production activities [4].

The pulp and paper industry is one of Indonesia's leading agro-industrial commodities [5]. The production capacity reaches 10 million tons and 17 million tons for pulp and paper production with raw material requirements reaching 45 million m³ (Kemenperin, 2017). Liquid waste generated from the pulp and paper production process contains organic and inorganic compounds such as lignin which results in black waste and has a high COD (Chemical Oxygen Demand) value [6].

The various environmental crises that hit our country today show that there are mistakes in the way of economic development that we are taking, especially in the industrial sector. The government, the business community, and the public are aware that the end-of-pipe approach is being introduced as a strategy to protect the environment is not a cost-effective way. In fact, cost savings are one of the important factors in competitiveness, as a result, many business circles are less enthusiastic about managing the environment [7].

Because of this, a better strategy change is needed after the end-of-pipe strategy, a strategy that has the potential to be cleaner production [8]. Cleaner production has the concept of minimizing waste from sources in various ways such as reduce, reuse, and recycle, this can increase the profits of companies that implement [9].

This article is compiled to see the cost savings of the pulp and paper industry's production process that implements cleaner production and provides an overview for entrepreneurs to be able to calculate the profit and loss for the business being run related to the application of cleaner production.

II. BASIC THEORY

A. Pulp and Paper Industry

The pulp and paper industry is an industry that processes wood as a base material for producing pulp, paper, board, and other cellulose-based products. Cellulose is an organic compound that is abundant in nature which is generally found in wood. Pulp (which is made from raw materials with cellulose fibers) approximately 60% in developing countries uses the main components of pulp / paper made of wood-based cellulose fibers, such as straw, bamboo, hemp, reeds, and bagasse. The paper-making procedures include preparing materials for processing, paper-making mechanisms, paper washing and filtering, mechanical processing with chemicals, bleaching, paper preparation, and paper making [10].

B. Cleaner Production

The Cleaner Production concept was coined by the United Nation Environmental Program (UNEP) in May 1989. UNEP states that Cleaner Production is an environmental management strategy that is preventive, integrated and applied continuously to production processes, products and services to improve eco-efficiency so as to reduce risks to human health and the environment [7].

The International Labor Organization states that Cleaner Production (CP) is a strategy to reduce environmental pollution and simultaneously reduce resource consumption. The main focus is on process and loss reduction, in accordance with the objective of minimizing input (resources such as labor, materials, capital, and energy) while maximizing output (the final product to be sold to increase company income). Cleaner Production does not only focus on technical improvements, but includes an unified view that is not limited or concentrates on one aspect of the problem. Cleaner Production emphasizes efforts to prevent waste and unnecessary use of resources, making comprehensive pollution control and countermeasures only as a last resort. Cleaner Production can be described in three main parts:

- Prevention and minimization - avoiding waste production and ensuring efficient use of resources
- Reuse and recycling - recovery of materials and waste for productive use
- Clean and efficient energy - maximizes the productivity of energy inputs and minimizes pollution. [4]

C. The practice of implementing clean production

There are practices that can support the implementation of clean production such as:

1. Good Housekeeping

Includes procedural, administrative and institutional measures that can be used to reduce the generation of waste and emissions. This concept has been widely applied by industry in order to increase efficiency by means of good operating practices which include developing cleaner production, developing human resources, handling and investing in materials, preventing material / material loss, separating waste by type, calculating costs, and scheduling. [11]

2. Input Substitution

Aims to reduce or eliminate hazardous and toxic materials that enter or are used in the production process, so as to avoid the formation of B3 waste in the production process. Input material changes include material refining and material substitution. [11]

3. Better Process Control

Better process control includes operational procedures, equipment instructions and process logging with the aim of running processes more efficiently and at lower levels of waste and emissions. [12]

4. Equipment Modification

Equipment modification is modifying existing production equipment and utilities to run processes with higher efficiency and lower levels of waste and emissions. [12]

5. Technology Modification

Includes process and equipment modifications made to reduce waste and emissions, technology changes can range from simple in a short time and low cost to changes that require high investment, such as changes in equipment, plant layout, use of automated equipment and changes in process conditions. [11]

6. On-site Reuse

on-site reuse is an attempt to reuse the materials contained in the waste, either for reuse in the initial process or as input material in another process. [11]

7. Product Modification

Includes product substitution, product conservation, and changes in product composition. [11]

8. Using Energy Efficiently

The aim of this practice is to reduce the environmental impact of energy use by increasing energy efficiency and using energy from renewable sources. [12]

III. METHOD

This article is written using the literature review method and examines articles that discuss cleaner production and research on the application of cleaner production in the Paper and Pulp Industry. The discussion was carried out by analyzing data from the Paper and Pulp Industry in implementing cleaner production.

PT Indah Kiat Pulp and Paper is the company selected in this study as the object of data collection in the application of cleaner production. The data collected comes from the company PT Indah Kiat Pulp and Paper, especially data regarding the production process.

IV. DISCUSSION

Based on the literature on the implementation of clean production at PT. Indah Kiat Pulp and Paper (PT. IKPP) is carried out in 3 ways, namely White water recovery in stock preparation 3/6, implementation of clean production in paper machines, and recovery in finishing.

White water recovery is an activity carried out to treat residual water or backwater by adding chemicals to separate paper fibers from water. The fibers that have been separated will be pressed to reduce the moisture content which will then be returned to the raw material storage area for processing in the pulper. Meanwhile, the water will be stored in the water tank to be reused as a medium for burying raw materials in the production process. Water recovery by treating water from the remaining production is a very good step, because it can reduce the liquid waste that will be formed besides that the treated water can be used as a burial medium and the separated fibers can be used as raw material [13]. This is certainly very beneficial for the company because it can save on waste processing costs and reduce the use of resources (raw materials). Based on the literature, the profit that can be taken from this activity is IDR 126,024,400.00 / day.

Implementation of clean production is also carried out in the paper machine section by applying the principles of reduce, goodhouse keeping, and reuse. The principle of goodhouse keeping is implemented by PT. Indah Kiat Pulp through activities to reduce fiber loss by optimizing the performance of production machines in the paper machine, intensively controlling machines, and paying attention to the raw material formula. In addition, controlling the quality of the slurry in stock preparation is also carried out to ensure that the slurry is free from dirt that will hinder the formation process, adjusts the turbulence to the head box and roll pressure during pressing so that it does not break, besides that the work environment is made comfortable for the

workers. workers because the work environment is not hot, this can be achieved because PT Indah Kiat Pulp & Paper conducts efficient use of steam which is reducing hot steam that is distributed to an environment that has a lower temperature than reduced steam.

In addition, the principle of input substitution, reduce and reuse is also applied through the reduction of the dose of chemicals in the production process [14]. This principle still does not reduce the quality, selecting raw materials that do not consume too many chemicals by using raw materials from waste paper that are still eligible for raw materials, and reusing discarded sheets when passing through wire parts that occur in paper machines (broke) by sending the broke back to the paper machine to be processed again through the initial stages. These activities have brought profit to the company, in September 2005 the amount of production in the paper machine was 35,000 tons, so the number of broke was 3,500 tons. With a fiber price of Rp.3,600,000.00 per tonne, the company can pocket profits of IDR 12,600,000,000.00 per month or IDR 420,000,000.00 per day.

Recycling is also carried out during the finishing process where defective or non-quality products are sent to the warehouse and then reprocessed in the production process from the beginning as raw materials. This practice can guarantee the quality of products that will be marketed and can reduce the cost of raw materials because raw materials can be added from the reject products, based on the literature the number of rejects is 20 tons per day and the price per ton is IDR 5,000,000, so this activity has profit of IDR 100,000,000.00 per day.

Summed up the benefits of white water recovery and reuse of broke will get a profit of Rp646.024.400,00 per day

V. CONCLUSIONS

Based on the above description, clean production can be an alternative that can be done as an environmental treatment strategy that is preventive and implemented in an integrated manner. Application of cleaner production in PT. IKPP applied to white paper recovery, paper machine, and recycling at finishing proved to be able to get a profit of Rp. 646,024,400.00 per day, the application of goodhouse keeping performed can also speed up the production process and ensure the health and comfort of workers.

The concept of implementing clean production PT. IKPP can be used as a reference and inspiration for other entrepreneurs to be more sensitive and care for the environment but without eliminating the financial and non-financial benefits of the company.

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