Analysis of the impact of convection industrial waste

Nilda¹, Mulyadi¹, and Andi Nurwahidah²

¹Industrial Engineering, Hasanuddin University
²Industrial Engineering, Polytechnic ATI Makassar

Email: Nilda.syamsul@yahoo.com

Abstract. Waste from the production of an industry is one of the problems that often arise. The statement about whether the waste will be thrown away or will be produced again to obtain products with added value to increase the economic value of residual waste production and reduce environmental impacts. This study will identify the impacts and causes of residual production waste in the convection industry and develop products from residual production waste so that we can reduce the environmental impact in the form of waste and also increase the economic value of products and of course become income for the industry. Initial identification is done by identifying waste from the production process in the convection industry. The list of wastes will be analyzed for their impacts and causes using the cause consequence analysis method. The initial method used was the fault tree analysis method to identify the cause of the waste that occurred and it was found that the average waste that occurred was caused by human error and the standard of clothing that was not good so it could not be continued to be produced. The next method is an event tree analysis that is used to identify the consequences if the waste is not handled properly. Solid waste from production if not managed properly will accumulate and can cause negative effects such as flooding. Processing waste into finished products must be supported for the sustainability of this earth, by providing financial assistance to small industries or households to develop products.

1. Introduction
The development of the manufacturing industry in Indonesia is one of the major contributors to the development of the Indonesian economy [1,2]. This can be seen from the increasing number of manufacturing industries in Indonesia, both large and medium industries. Some of the products from Indonesian industries have also gained control of the world market share. Based on data released by the United Nations Statistics Division in 2016, Indonesia ranks fourth in the world from 15 countries where the manufacturing industry contributed 22 percent to Gross Domestic Product. The development of the manufacturing industry at this time is certainly proof that Indonesian products have been accepted by many groups, but with such intense competition now, it is not impossible if one day the Indonesian industry will be unable to compete with industries from other countries. It is this highly competitive competition that demands the industry to increase the competitive advantage to win the competition.

The residual production waste from industry is one of the problems that often arise. A statement about whether the waste will be thrown away or will be produced again to get products with added value thereby increasing the economic value of residual waste and reducing the environmental impact. This research will identify the impacts and causes of residual waste produced in the convection industry and develop products from residual waste products so that we can reduce the environmental
impact of waste and also add to the economic value of the product and of course, be an income for the industry. Previous research on convection industry wastes was conducted by Idaman (2001) concerning the treatment of textile industry small-scale wastewater by the biofilter process [3]. Other research by Komarawidjaja (2016) concerning the distribution of textile industry liquid waste and its impact in several sub-district villages in Bandung [4]. A study by Mastur (2012), on the impact of the operation of the textile industry in the downstream watershed on the quality of well water and water supply in the city of Semarang [5]. Previous studies discuss more the impact of convection industry wastewater, Mazedul et al. (2014) raised research on the Environmental Sustainability Evaluation of Apparel Product: A Case Study on Knitted T-Shirts and concluded The unsustainable practices trends of poorly designed, raw materials selection, processing, manufacturing, and disposing of apparel products major contributing factor this problem [6]. The purpose of this study was to evaluate the environmental sustainability of various branded T-shirts and find out various sustainable issues for greener apparel products. While this study will discuss the causes and impacts of convection industry solid waste. This study uses the cause consequence diagram method to identify the impacts and causes of solid waste and provide an overview of the treatment of solid waste

2. **Research Methods**
This research focuses on identifying the impacts and effects of convection industry waste. The research method used is caused consequence diagram method. This method is a combination of two methods, namely the method of fault tree analysis and event tree analysis. This event tree analysis method identifies the effects of existing waste while the fault tree analysis method identifies the cause of the waste

3. **Result and Discussion**
The initial stage of this research is to identify the types of solid waste from the production of the convection industry. At this initial stage, it was identified that there were 6 types of solids, most of which were fabric waste from the material cutting process. The following are the types of solid waste produced:

1. fabric leftover from the fabric cutting process
2. defective clothes due to the wrong sewing process
3. defective clothes due to the wrong cutting process
4. Deformed clothes because of poor fabric quality
5. liquid waste from the screen printing process
6. bottles of screen printing paint

From the results of identification in each production process in the convection industry, it was found that the most waste occurred was the remnants of discarded cloth and clothing that was defective and could not be sold.

![Figure 1. Types of convection industrial waste](image-url)
The 6 types of waste that have been identified are then identified using the fault tree analysis method to determine the potential causes of the waste. Below is the identification of the causes and impacts of one of the convection industry wastes.

**Figure 2.** Fault Tree Analysis for remaining fabric from the process of cutting clothes pattern

| EVENT | very large size of fabric raw material | incorrect pattern cuts | The consequences |
|-------|----------------------------------------|------------------------|------------------|
| Remaining Fabrics from Pattern cutting | YES                     | YES                    | Remaining fabric from cutting patterns multiply |
|       |                                       | NO                     | Cloth residue from cutting patterns can be reduced |
|       |                                       |                         | Remaining Fabric from cutting patterns will be reduced |

**Figure 3.** Event Tree Analysis for Remaining fabrics from pattern cutting
The results of the identification of several types of waste were obtained. The identified waste is a type of waste originating from the main raw materials from the convection industry, namely fabrics such as the results of pieces of cloth that are not used/wasted, clothes that are sewing incorrectly and cannot be sold anymore, clothes that are damaged due to wrong pieces, fabrics that are not used because incorrectly cut patterns and fabrics that cannot be used because of fabric defects that are congenital. The results of identification using the FTA method show that the waste from the fabric resulting from pattern cutting is a type of waste that cannot be avoided because at the time of cutting the fabric that follows the pattern will leave a cloth that will definitely be discarded. The second type of waste is the wrong sewing clothes, this type of defect, if it cannot be repaired, will become waste, this type of waste is caused by human error because workers are not trained so many clothes are sewing incorrectly and do not fit the desired specifications. Other types of waste are clothes that are defective and cannot continue to be produced due to poor quality raw materials such as tearing and others. The identification results of the event tree analysis method are known that all types of defects that result from the production process in the convection industry if not managed properly will cause major environmental problems whether it's in the form of solid waste from the production process or liquid waste from the clothes printing process. Solid waste in the convection industry, if not managed, will cause flooding because it is disposed of and makes garbage accumulate, which we know our country is still very poor in its solid waste management. For liquid waste, itself must also have good treatment from the beginning because it will endanger the environment with chemicals contained therein.

4. Conclusion

The initial identification process to determine the type of waste from the production process of the convection industry is found there are 4 types of waste namely cloth leftover from cutting fabric, clothes that are defective due to wrong sewing, clothes that are damaged because of scissors process, clothes that are defective because of poor fabric quality. After identification with cause consequence diagram methods (fault tree analysis and event tree analysis), it is known that the impact of convection industry waste, in addition to being able to pile up into the waste, can also cause material losses to the company. The results of the identification of the causes of waste are largely due to human error, and workers are less professional, and also the type of raw material is not good. In the development of waste management of the convection industry at this time still, by selling the waste to collectors, the convection industry is advised to manage its own waste to become a product so can have added value to the company and not contribute to the environment.

Reference

[1] Sugiharti L, Purwono R, Primanthi M and esquivias miguel angel 2019 Indonesia Industrial Productivity Growth: Evidence of Re-industrialization or De-industrialization? Period. Polytech, 27 108–18
[2] Tadjoeddin M Z, Auwalin I and Chowdhury A 2017 Revitalising Indonesia’s Manufacturing Eur. J. East Asian Stud. 16 124–53
[3] Said N I 2001 Pengolahan Air Limbah Industri Kecil Tekstil Dengan Proses Biofilter Anaerob-Aerob Tercelup Menggunakan Media Plastik Sarang Tawon J. Teknol. Lingkung. 2
[4] Komarawidjaja W 2016 Sebaran limbah cair industri tekstil dan dampaknya di beberapa Desa Kecamatan Rancakek Kabupaten Bandung J. Teknol. Lingkung. 17 118–25
[5] Mastur Z and Rokhman F 2012 Dampak Pengoperasian Industri Tekstil di Das Garang Hilir Terhadap Kualitas Air Sumur dan Air Pasokan PDAM Kota Semarang Sainteknol J. Sains dan Teknol. 10
[6] Islam M, Khan M and Rahman M 2014 Environmental sustainability evaluation of apparel product: a case study on knitted T-shirt J. Text. 2014