

Sustainable Manufacturing Practices in a Textile Company: A Case Study

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Abstract— The main purpose of the present study is to develop an in-depth understanding of sustainable manufacturing practices implemented by a textile company. A single case study has been employed in which a company located in Penang was chosen as a case to be studied. A face to face interview was conducted to get in-depth information from the respondent to fulfil the research objectives. The study found that the company being studied has implemented several sustainable manufacturing practices such as recycling materials, reducing hazardous input materials, emphasizing employees' well-being, managing waste in a sustainable way, and adopting solar energy in its operation. Furthermore, the findings of this study provide a great foundation for a better understanding of sustainable manufacturing practices and their contribution to sustainability performance, particularly in the context of the textile industry. The findings of this study also have a noticeable implication, especially for the textile company and other practitioners, to evaluate their current manufacturing practices and explore the strategy that could assist them to step forward to reduce the impact of their operation on the natural environment.

Keywords— *sustainable manufacturing practices, sustainability, case study, environment, textile*

1. Introduction

Manufacturing is a process of transformation of the raw materials into valuable and commercial product to satisfy the needs of the consumers. Meaning that, manufacturing is responsible for the converting the resources inputs into useful outputs. It also involves the process of assembling the components into semi-finished goods and finished goods by using materials-handling equipment and power-driven machines [1].

Manufacturing sector plays an important role nowadays towards the economic growth in various country including Malaysia. The Gross Domestic

Product (GDP) for Malaysia was 4.03 trillion which ranked 33 in total of 211 countries [2]. [3] stated that the GDP in Malaysia was increased in total of 4.7% in 2018. The manufacturing sector of Malaysia has increased the sales from RM62.3 billion in February 2018 to RM65.8 billion in February 2019, which has been grew for 5.5% between this years [4]. In the fourth quarter of 2018, the manufacturing sector in Malaysia had reached the highest records which is RM73,565 million and the lowest records was the first quarter of 2010 which only hits RM 45,868 million. The positive growth of manufacturing sector has also been demonstrated by many countries around the world.

However, unfortunately, the faster the growth of the manufacturing sector, the more environmental issues had been occurred [5]. The inefficiency in manufacturing sector causing the environmental issues such as global warming, deforestation, pollution and so on. In order to deal with the environmental issues in general, all United Nations Member States including Malaysia have adopted Sustainable Development Goals (SDGs) by year 2030 [6]. In addition, manufacturing sector were promoted by the government of Malaysia to implement the more sustainable consumption and production machine, including adopting of government green procurement to stimulate the growth of the green market. In order to achieve these green initiatives, new legislation, action plans and policies were introduced by the Malaysian government. Specifically, the government of Malaysia have released the 11th Malaysia Plan (11MP) on 21 May 2015 to make Malaysia to step forward to be developed country, through among others, manufacturing sector. On top of that, the introduction of Malaysia Carbon Reduction and Environmental Sustainability Tool as well as

National Policy on Biological Diversity have driven the manufacturing sector to be more alert to environmental issues that indirectly accelerate the green growth among the manufacturing companies.

Based on the previous studies which have been reviewed, this study focuses on analyzing the extent of sustainable manufacturing practices implemented by a textile company. Through this study, the researcher will be able to find out how the management of the selected textile company take the responsibility to preserve the environment by looking at their efforts in implementing sustainable manufacturing practices within their company.

2. Literature Review

2.1 Sustainable manufacturing practices

Sustainability means meeting the present needs of consumers without compromising the ability of future generations to meet their own needs [7]-[8]. Sustainable manufacturing practice, on the other hand, is an innovation of science and technology that minimize the environmental issues, conserve the natural resources and energy, maximize the profits of the organization and safety issues of the products produced and employees, consumers and communities while performing manufacturing activities [9]. Within the sustainability context, the environmental, economic and social aspect caused by manufacturing activities should be taken into accounts. Sustainable manufacturing could greatly affect the improvement of firms' sustainability performance.

Sustainable manufacturing is one of the methods in solving both exhaustion of the natural resources and environmental pollutions. Sustainable manufacturing can produce a product through the process with minimizing the negative impacts to the environment simultaneously conserving energy and non-renewable natural resources. In addition, it also could improve the safety issues of the community, products and employees [10]. In order to properly implementing sustainable manufacturing practice, manufacturing companies, mostly, have focused on product lifecycles, integrated environmental strategies and management systems.

Apart from environmental issues, sustainable manufacturing also takes consideration about the economics of the company [11]-[12]. Both sustainable and green manufacturing helps the manufacturing industry to be more effective and efficient, highly competitive and more profitable. While green manufacturing more frequently associated with a singular process or a product, sustainable manufacturing is more associated to the entire of the production process together with the logistics and supply and demand chain [13]. Although these both sustainable and green manufacturing often used interchangeably by manufacturer, they are just related with each other but not the same things. By using sustainable or green manufacturing, will not only solves the problems of the negative environmental issues but reduces the expenses and the cost of production process by improves the quality of the products.

In addition, sustainable manufacturing also put emphasis on the aspect of socials [12]-[14]. It pays more attention to the safety of the production process and the product itself including the safeness of employees and the local communities. Sustainable manufacturing gives a lot of positive impact to the social performance such as a sustainable business modelling, a convenience workplace and an enthusiasm employee [15]. Although most of the manufacturing industries nowadays are using automated manufacturing system but there is also needed for some employees such as engineers to control the system. Therefore, employees are part of successful sustainable manufacturing practices.

By looking specifically at one of manufacturing sub-sectors, namely textile industry, sustainable manufacturing practices enable textile and apparel companies to manufacture products with zero or at least minimal environmental and social impact. Appropriate sustainable strategies need to be formulated to underpin the development of sustainable products and processes.

3. Research Method

3.1 Research design

Case study is one of the methods used in the design of qualitative study. A case study is expected to capture the complexity of a single case, and the methodology which enables this has developed

within the social science which are psychology, anthropology and economics but also in practice-oriented fields such as environment studies, social work, education, and business studies [16]. A textile company located in Bayan Lepas, Penang, Malaysia was chosen for this study since it is an ISO 9001 and ISO 14001 certified company which has added value in the area of sustainable manufacturing practice.

3.2 Data collection method

Semi-structured interview was used for this study to obtain the primary data. Many researchers tend to use this method because the questions of semi-structured interview can be prepared ahead of time. This method also allows informants the freedom to express their views in their own terms [17]. [18] stated that the qualitative data collected need to be exchanged either using analytical or interpretation methods. This interview was conducted to obtain clearer information or description of the sustainable manufacturing practices implemented at the company. The respondent of this study is a Manager in the company being studied and a lot of valuable information have been obtained through the interview session. Secondary data has also been used to support the primary data. This type of data was obtained from the company's profile report, official website as well as from the reviewed of previous literatures.

The interview session was last about one hour and it is recorded. The interview record was then be transcribed for further process.

4. Case Study Results

4.1 Background of the Company

The textile company selected for the case study is located in Penang, Malaysia. The company has been established since April 1975. The textile company is a factory produced yarn. There are two types of yarn, cotton and polyester. Cotton yarn is a natural fiber which the company imported the cotton from United States, Brazil, Australia and Mali. Polyester yarn is a man-made fiber which it is extract from the petroleum and adding polyethylene terephthalate (PET) to the petroleum. There are total of 239 workers in the factory and it is ISO 9001, ISO 14001 and OEKOTEX certified

company. Table 1 shows the characteristics of the company being studied.

Table 1. Characteristics of the textile company

Characteristics	Information
Number of full-time employees	239 persons
Types of industrial	Blended yarn
Product manufactured	Yarn
Certification	ISO 9001, ISO 14001

4.2 The implementation of sustainable manufacturing practices

Based on the findings, the company has shown that it had, to some extent, implemented sustainable manufacturing practices in the manufacturing processes. Among others, the sustainable manufacturing practices that have been implemented by the company are e-waste management, material recycling, hazardous materials reduction, employees' well-being consideration, sustainable waste management and solar energy consumption.

Based on the interview, firstly, the respondent were asked about the existence of any sustainability program in the company. He has given a confident statement about his company's e-waste as well as material waste management by stating,

"We have labelled and throw the different category of waste into the containers which is SW410 and SW110 and we called it e-waste. SW 410 is a contaminated waste container. The waste we produced are when we are using glove or cloth to clean the machine which is hazardous waste and the machine oil, and we throw it into the container. The SW110 container is to throw the electrical and electronics waste that used to replace or changing the equipment."

He then added about the waste produced from fabric materials,

"For materials waste like cotton that are not fulfilling the target of the size, we will keep it in a

container and then sell to agent which they will find a buyer to buy the material waste.”

In addition, he also talked about solar panel installed on the factory roof,

“Our usage of electricity is high, but we got implement solar panel to cover the electricity. There is 25% of the electricity are using solar panel.”

At the same time, the factory roof has its own rain harvesting function. He then proudly stated that,

“When it’s raining, our roof there got special design that can harvest the all raining water to keep. The raining water that are dirty are used to wash toilets, and not critical items.”

On the other hand, the company has pursued some other efforts towards sustainability. Talking about materials, the respondent asserting,

“We got use a material which is polyester. But we try to replace it by using recycle polyester which is made by the recycle bottle. We also produce bio fiber which can decay itself after a long period.”

For long term planning, the company is targeting to produce green yarn with more environmental-friendly cotton, as he stated,

“For the cotton, we are using the cotton which has pesticide that to make it free from the insect. But for the future, we trying to buy the cotton that are free from the chemical, called BCI cotton (better cotton initiatives). Then mixed with the recycle polyester.”

In the meantime, he then claimed that his factory is trying to reduce the material consumption and they have to adhere to the restriction or consumption target, by stating,

“We have target of consumption for materials which is 102% including waste. For example, if we want to produce 100kg of cotton, but we can only have 2kg of extra cotton for spare.”

As the interview has slowly moved to the topic related to employee and their well-being and safety,

the respondent expressed his gratefulness on safety measures considered by the company and stated,

“Our company factory is very noisy, the measurement of the sound has very high db. So, we provide ear plug to the worker to reduce about 20% of the noisy. And cotton is a very dusty material, so we will prepare the mask for workers who work in the factory.”

This is parallel with the company’s quality management and continuous improvement effort, specifically, when it comes to risk management. Those efforts are translated into its employees’ well-being and safety.

Therefore, from the above findings, the company has shown that it had implemented sustainable manufacturing practices in the manufacturing processes. The company is also look forward to keep involving in any sustainable practices in its operation in future.

5. Discussion and Conclusion

5.1 Discussion

The finding of this study shows that the company has implemented sustainability efforts in the manufacturing process. In terms of material recycling, the company is planning to eliminate the usage of petroleum polyester and replace it with recycle bottle polyester. As recycle bottle were used as a raw materials in producing some products, the company would like to fully utilizing plastic bottles in producing recycle polyester in future. In addition, the company has purchased its raw materials which is cotton that are free from the chemical called Better Cotton Initiatives (BCI Cotton) to replace the pesticide cotton. In the study of [19], they stated that green manufacturing gives a lot of advantages to an organization. By using recycling waste, a company can improve production efficiency, lower the cost of raw materials, improved organization image and reduce the environmental and workers safety expenses. In short, the company could reduce the negative environmental impact due to using raw materials such as recycle bottle and cotton without pesticide.

The company has also reduced the usage of hazardous materials in its manufacturing processes. It can be seen in its continuous improvement effort.

For the company, the quality level of the products must achieve the specific level. It is parallel to the study conducted by [20] which stated that eliminating the production waste is necessary to improve the effectiveness and efficiency of the process and machines. An example from the company, if the fabrics that have been produced not fulfill the quality, they will need to be rewinded. Thus, it can reduce the consumption of the materials used. Apart from this, the company is also controlling the materials quantity that need to be used when it is in manufacturing process. [21] defined the sustainable manufacturing practices providing continuous improvement on the aspect of risk, cost, waste, materials and energy efficiency to provide environmentally friendly products and services.

In terms of social welfare of the employees, the findings have been supported by the past research conducted by [22] as they stated in their report that many companies providing occupational health and safety, equal opportunities, training, education and so on. The findings has shown that the company has implemented employees well-being practices. The textile company provided earplug and mask due to high decibel (db) of sound and dusty materials in the manufacturing processes.

One of the efforts in implementing sustainable manufacturing practices is waste management. This was supported by [23] in their research and stated that the e-waste issues has been exist for decades. These e-waste can cause adverse health effects to human and to the environment. In case of this textile company, it has implemented proper waste management such as label and throw different waste into different labelled container. One for contaminated waste and one for electronic waste.

Apart from this, the factory has also installed solar panel to reduce the electricity usage. According to the past research conducted by [24], solar energy technologies have become the world most popular and well established technologies. In addition, solar energy technologies is one of the most promising renewable energy resources to meet the global demand in the future. The company has implemented the solar panel on the roof top to reduce the electricity usage of the whole company. In addition, the company has also harvested raining water to be used for washing toilet and other non-critical items. These efforts can helps the company

to reduce the cost of electricity and water as well as reduce the negative impact to the environment.

5.2 Limitation and future research

Considering the limitation of this study which is only used qualitative approach, for future research, it is suggested to conduct a quantitative approach to support the result of this study. However, the study is limited to only one company which have a limited view and information. Thus, future researchers are expected to expand this study by interviewing multiple respondents from multiple companies in order to obtain richer information. Therefore, a comparative study might be possible to be done.

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