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Value Stream Mapping As An Effective Lean Manufacturing Tool In A Carageenan Producing Company In The Philippines

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***Abstract*—Lean manufacturing strategy is one of the various techniques in eliminating wastes and implementing a flow to improve the processes in a manufacturing industry. In this study, Value Stream Mapping (VSM) was used as a lean manufacturing tool in a carrageenan producing company in the Philippines. Through preliminary observation in the production area, non-value-added activities were identified. Results of the study show that the most prevalent wastes in the production area are motion and transportation wastes due to poor implementation of method design and deficient equipment and tools. As a consequence of implementation of proposed state map in the production area, cycle time was reduced thus resulting to increase on net profit of the company.**

Keywords—Lean Manufacturing Tools, Value Stream Mapping

I. INTRODUCTION

In pursuit of competitiveness and profitability, higher numbers of companies were turning to lean manufacturing to reduce or totally eliminate wastes, as much as possible, in their production processes. As competition and customers' demands are changing from time to time, it is crucial for the manufacturer to change their business strategy and factory management in order for them to adapt and accommodate to these kinds of rapid changes. This is not easy to achieve for most of the manufacturers due to many internal and external factors that may lower the productivity and affect the competitiveness of the firm, thereafter deliver poor quality of products and delay the work processes in the factory. Therefore, it is important to reduce or minimize the operation cost by identifying and eradicate wastes in the firm to improve the quality in every area of the value streams. Value stream mapping is the visual representation of the material flow and information flow in the production line starting from the raw materials up to the final consumers. Value Stream Mapping provides both a picture of the current state of affairs as well as a vision of how we would like to see things work. Identifying the differences in the current and future state yields a roadmap for continuous improvement activities [1]. Furthermore, it also describes the effectiveness of the Value Stream Mapping (VSM) in moderating the impacts of the waste towards the process productivity [2]. Value stream mapping provided an optimum value to the customer through a complete value creation process with minimum waste in design (concept to customer), build (order to delivery) and sustain (in-use through life cycle to service).

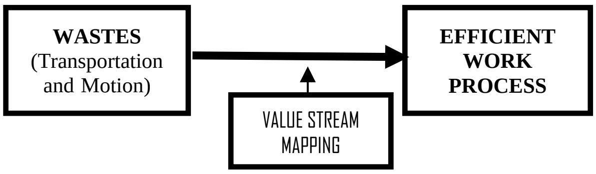

Figure 1. Operational framework of the study.

This study used value stream mapping as a tool in improving business performance of a certain company producing carrageenan through analysis of flow of information and flow of materials.

The study was conducted in the production area of a company that produces carrageenan powder in the Philippines. This company has been in existence since 1969 and had been exporting various sea products. In 1971, it added dried seaweeds to its range of exports. Due to its policy of strict quality control and good value, the company quickly established strong supply relationships with many carrageenan processors worldwide. Now, this company owns and operates two carrageenan production plants and one blending facility, all located in the Philippines.

The main purpose of this study is to increase its production efficiency through Lean Manufacturing tool with the use of Value Stream Mapping (VSM). Specifically, it aims to: (1) identify the two (2) most existing lean manufacturing wastes in the production area and its effect; and (2) redesign the current production area of the company; and (3) draw an effective future state map that will increase the company's productivity.

II. Materials and Methods

The researchers utilized the descriptive method of research with preliminary observation as the main source of data. Process Activity Mapping was used to determine the physical process in the production area, such as (1) Ishikawa Diagram to determine and establish the flow of factors between causes, main problem and the effects of the study, and track the existing manufacturing wastes present in making the product; and (2) Line Balancing to match the production rate after all wastes have been removed to the cycle time in each process of the value stream and as a guide in making improvements in the process.

III. Results and Discussion

Results of the study showed that the two most existing lean manufacturing wastes in the production area are motion and transportation. Using time study, the time required in different processes such as operation, transportation, inspection, storage and delay in the production area of Carrageen an powder were identified.

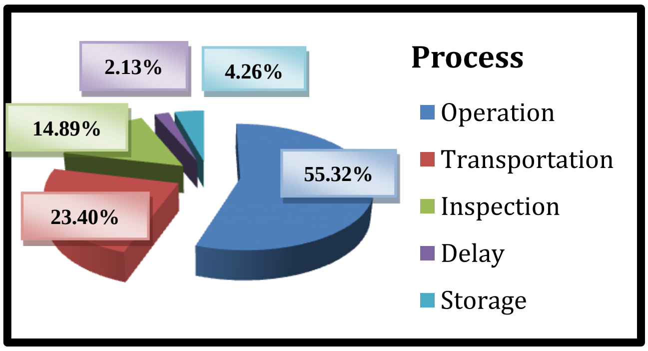

Figure 2. Percentage Distribution of different processes in the production line.

As illustrated in Figure 2, majority of the process in the production line was Operation numbering 26 out of 47 composing 55.32% of the total process. 11 out of 47 processes were transportation and are composed of 23.40% of the entire process. 14.89% was composed by inspection in the process, 4.26% came from delay and whereas 2.13% came from the storage process.

It was observed that during the process of seaweed profiling, after the seaweed had been loaded to tote bins it will be transferred to seaweed shaker for removal of impurities. The location is quite convenient for the transportation since the seaweed shaker is also located at the warehouse where the raw material (seaweed)will be stored. After inspection, it will be transferred to weighing machine located on the other building by means of conveyor. Then, it will be transferred to seaweed treatment area through rail. The seaweed undergoes pre-washing treatment prior to cooking tank, then at the bleaching area for an hour, and lastly to the washing area for final wash. From the treatment area, seaweed bin is being transferred to the drying area which is located quite near. After several hours on the drying process, bin will now go to the milling area with the use of hammer mill. After milling, it will go to the grinding area. From grinding machine, it will be transferred to the blending area which is the final process. Specific mixtures of chemicals are being blended with the seaweed powder. After the final process, carrageenan powder will be transferred to the staging area for storage.

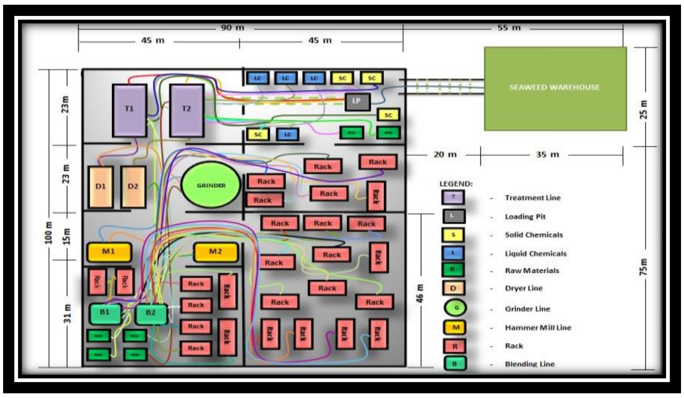

Figure 3. Spaghetti Diagram of the Current Production Layout of the Company

The above figure shows the spaghetti diagram from initial to final process on how the seaweeds were processed.

Time and motion study was conducted to determine the cycle time needed to finish the product. Total time is computed during the whole operation from seaweed profiling, transportation, inspection, storage and delay.

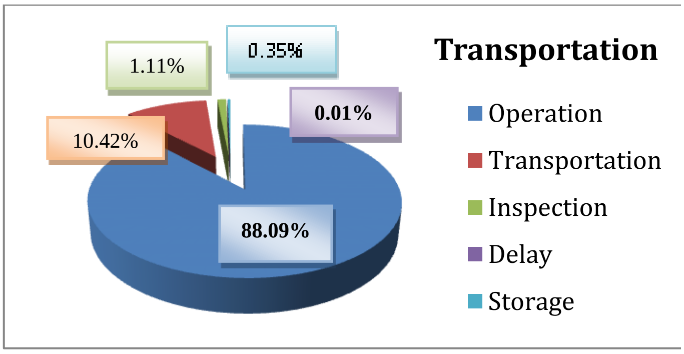

Figure 4. Time and Motion Study of the Current Process

As illustrated in Figure 4, the process consumed much time during operation which is 88.09% of the total time. Next to this is the transportation with 66.34 minutes out of 636.42 minutes or 10.42% of the total time. With this, it has been identified that transportation has the second leanest manufacturing wastes present in the production area. Inspection has 7.08 minutes out of 636.42 of the total time or 1.11%. Consequently, 0.35% came from delay and lastly, 0.01% of the total time was from storage.

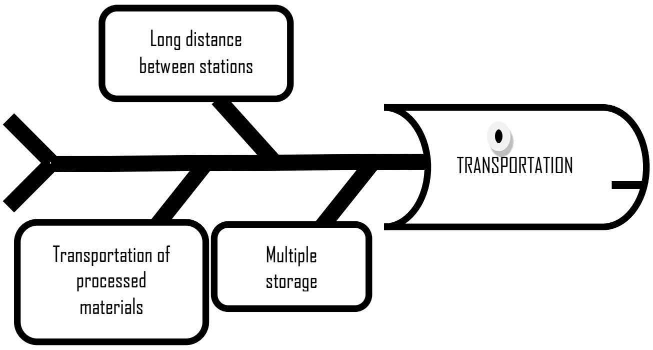

Figure 5. Transportation Ishikawa Diagram

Based on above figure, there was a long distance between operations that affected time and other non-value added activities. It was also observed that there was no linear arrangement of the process that causes multiple series of steps. Having multiple storage in the production area led backtracking of materials needed for every process in the production that grounds for motion waste which added no value.

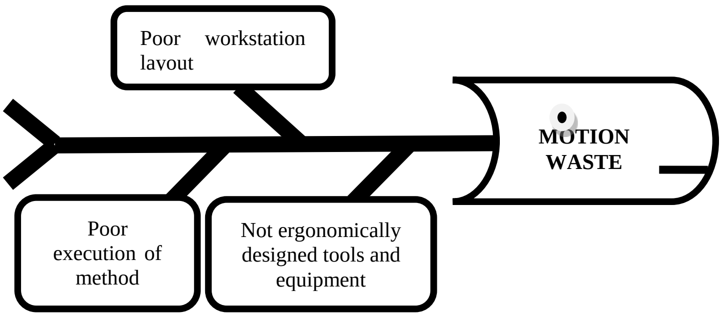

Figure 6. Motion Ishikawa Diagram

With regards to motion, it was evident that the company has poor workstation layout and poor execution of method design resulting to motion waste due to excessive walking of the operators. In addition, tools and equipment which are not ergonomically designed led to manual handling of materials by the operators. As identified, excessive motion was one of the lean manufacturing wastes that do not contribute to the value of the product which should be reduced if not eliminated.

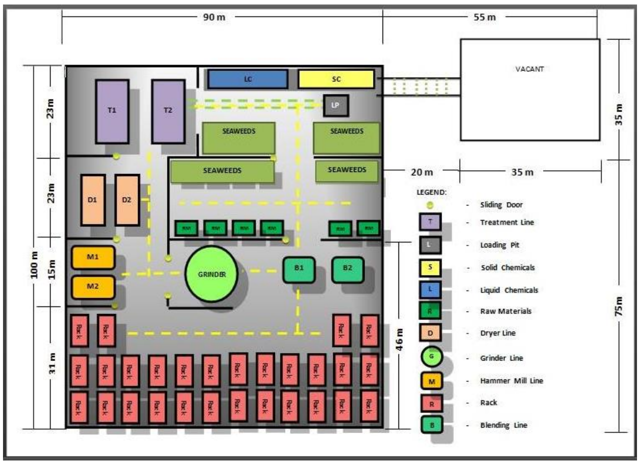

Figure 7. Proposed Production Layout of the Company

Upon redesigning the production layout, there will be a linear arrangement of process to eliminate the back tracking of materials between stations and lessen the transportation of these processed materials by 82.18 meters. Reduction in distance could result in reduction of cycle time. Subsequently, this will also eliminate or reduce the causes of motion waste. Desired future state map is documented as a future state of value stream map, and the improvements are implemented to drive toward the future state goal [4].

IV. Conclusion and Recommendations

Based on the findings of the study, the two (2) most existing lean manufacturing wastes present in the production area are the motion and transportation wastes. The implementation of proposed production layout resulted to reduction of cycle time.

For the improvement of the productivity of the workers, the researchers recommend the use of other gathering tools in identifying wastes such as Total Productive Maintenance (TPM) which is a holistic approach for equipment maintenance, as well.

IV. ACKNOWLEDGMENTS

Project was conducted in a carrageenan producing company and the team would like to complement the effort of management in practicing Lean Manufacturing and value their support towards continuous improvement.

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