

APPLICATION OF LEAN MANUFACTURING TO REDUCE WASTE AT PROTRADE GARMENT JOINT STOCK COMPANY

Nguyen Vuong Bang Tam⁽¹⁾

(1) Thu Dau Mot University

Corresponding author: tamnvb@tdmu.edu.vn

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Abstract

The Covid pandemic and economic recession have seriously affected the production and business activities of businesses, including Protrade Garment Joint Stock Company. To increase competitiveness, the Company must improve its production activities. The article proposes the application of Lean Manufacturing to identify waste, calculate costs caused by waste and propose solutions to improve premises to minimize waste at Protrade Garment Joint Stock Company. In this study, Lean and JIT tools are used to identify waste in the production process and calculate the cost of losses caused by waste. Research results have helped Protrade Garment Joint Stock Company reduce waste costs due to transportation by 44%, helping production operations operate optimally.

Keywords: cost, JIT, lean, waste

1. Introduction

Today, the pressure of economic integration forces Protrade Garment Joint Stock Company to constantly improve productivity and quality to be able to compete with foreign businesses. One of the production models that the Company learns and applies is Lean Manufacturing. The Lean Manufacturing model helps companies reduce costs, increase productivity and establish a flexible production system that quickly responds to changing customer needs, thereby improving the organization's competitiveness. The theory of implementing Lean Manufacturing application into businesses has also been researched. And we have also learned many lessons about successfully applying the Lean Manufacturing model from companies around the world. The benefits of the Lean Manufacturing model are being convincingly demonstrated around the world through its application in multinational companies. Therefore, this study used tools in Lean and JIT to identify wasteful costs in the production process, helping Protrade Garment Joint Stock Company reduce waste, increase productivity and quality, contributing to increasing productivity. Profit creates its own competitive advantage.

2. Scientific research and research establishments

Lean Manufacturing is a methodology currently being applied more and more widely around the world, to eliminate waste and irrationalities in the production process, to have lower costs and more competitiveness for manufacturers (Phan, 2005).

From Toyota's perspective, waste is all activities that consume time, resources or space without adding value to products and services for customers.

There is a lot of waste that exists in the production process, usually we only consider 7 typical types of waste below:

- **Transportation:** Movement here refers to any movement of materials that does not create added value for the product such as the transportation of materials between production stages. The movement of materials between production stages should ideally aim for the output of one stage to be used immediately by the next stage. Moving between processing stages lengthens production cycle times, leads to inefficient use of labor and space, and can cause production delays.
- **Inventory:** Waste in inventory means over-stocking raw materials, semi-finished products and finished products. Extra inventory leads to higher financial costs of inventory, higher storage costs, and higher defect rates.
- **Movement:** Any unnecessary movement of limbs or walking of workers not associated with product processing. For example, walking around the factory looking for working tools or even unnecessary or inconvenient body movements due to poorly designed operating procedures slows down the worker's working speed.
- **Waiting:** Waiting is the time when workers or machines are idle due to congestion or ineffective production flow in the factory. The delay time between each product processing batch is also taken into account. Waiting adds significant costs due to increased labor and depreciation costs per unit of output.

Overproduction: Over-production is unnecessarily producing more or too early than what is required. This increases the risk of product obsolescence, increases the risk of producing the wrong type of product and makes it more likely that these products will have to be sold at a discount or thrown away as scrap. However, in some cases excess quantities of semi-finished or finished products are deliberately maintained, even in lean production processes.

- **Over-processing:** Over-processing means carrying out more processing work than the customer requires in terms of product quality or performance – for example, carefully polishing or smoothing parts. points on products that customers do not require and do not care about.
- **Defects:** Besides physical defects that directly increase the cost of goods sold, defects also include paperwork errors, providing false information about products, and late delivery, producing incorrectly, using too many raw materials or creating unnecessary scrap (Phan Chi Anh, 2005).

3. Research methods

To identify waste, the author used a number of methods such as: (1) desk research method to explore secondary data of the company to find waste, (2) method Field research to directly survey and measure waste, (3) quantitative statistical methods to calculate wasted money. To provide solutions, the author uses expert methods.

Identified wastes :

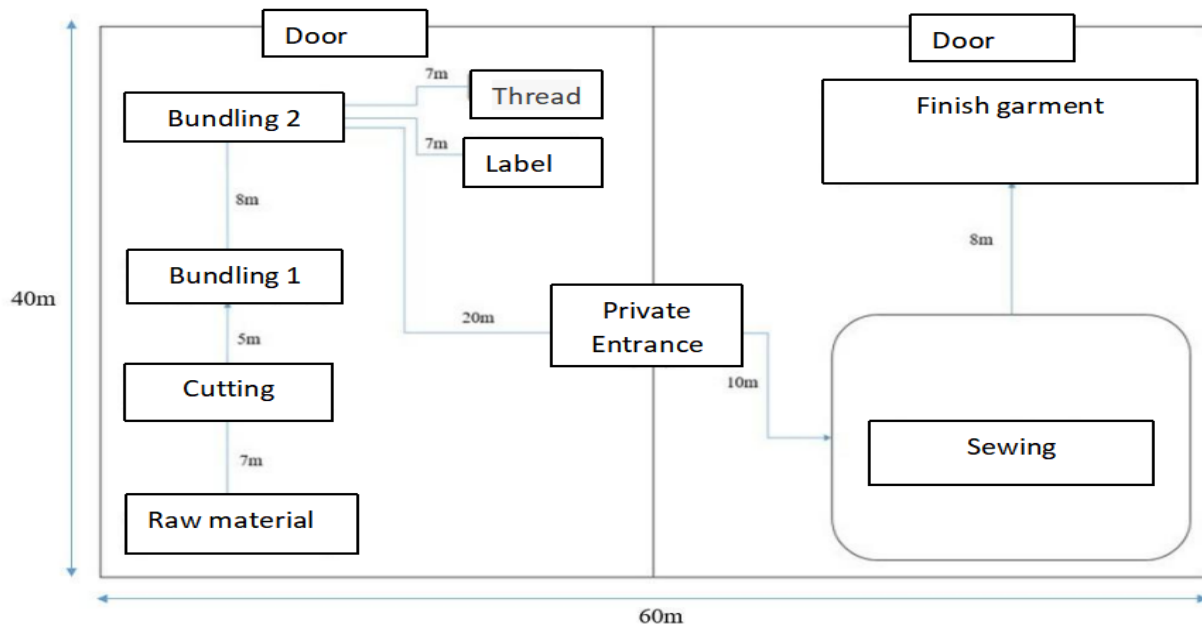
Protrade Garment Joint Stock Company has 4 garment factories. Garment Factory 1 is an enterprise with a small factory area, only about 2400 square meters. Here, there are high transportation costs in the factory due to the unreasonable arrangement of production and manufacturing departments. Therefore, rearranging production premises is an important tool to help save travel time and use production premises optimally.

Transportation waste often occurs from trolleys not placed in the layout but out of the way, causing obstructions in operations transport movement. In addition, carts loaded with too many materials can easily fall or fall to the floor, leading to damage and wasted time re-arranging. In addition, the Company's raw material storage area is not arranged properly and neatly, which is also one of the causes of waste in transportation. A messy and unscientific raw material area will cause difficulties for workers.

In finding the materials they need. In addition, arranging the raw material area far away from the import door makes it wasteful to move raw materials very far, thereby leading to waste of time for transportation and affect the production process.



Picture 1. Material flow diagram



Picture 2. Garment factory layout diagram (Before)

Through the floor layout diagram, it can be seen that the machinery and equipment in the production line are not reasonable. Travel distances between areas are very long. According to the layout, the distance between the raw material mixing area and the finished sewing area is 72m and it takes nearly 15 minutes to move semi-finished products.

In the production process, there are often interruptions because workers have to move to pick up semi-finished products from the material mixing area to continue sewing finished products. After observation, it can be concluded that on average, workers will move to pick up semi-finished products once every 4 hours. So in 8 hours of work, workers in the distribution area

Raw materials will move about 2 times, travel time from the raw material mixing area to the finished sewing area is about 15 minutes/trolley (about 100 products/trolley)

Consequences: Moving materials from the raw materials area to the packaging area causes time wasting and workers on the line are idle due to having to wait for materials. Meanwhile, during this idle time, no products are created but the company still has to pay workers. I estimate:

- + Travel distance: 72 meters, two return trips is 144 meters.
- + Travel time: 20 minutes.
- + Salary paid to workers/1 hour: 50,000 VND.

TABLE 1. Estimate the cost of transportation waste in an average month (Before)

Targets	Travel distance (meters)	Travel time (minutes)	Salary costs (VND)/worker
One shift (8 hours, 2 times)	288	40	33.333
One month (26 days)	7488	1040	866.667

Salary cost of transportation waste for 100 workers in a year:780.000.000 VND

Besides, for each import, the company must mobilize 20 workers. Because the vehicle was moving across the material distribution area and the sewing and label area, the vehicle had to move slowly to avoid accidents. Therefore, the time it takes to deliver goods to the correct location can take up to 10 minutes and each vehicle has to go an average of three times. On average, the company will import goods once a week.

+ Travel distance: 20 meters, two return trips is 40 meters.

+ Travel time: 10 minutes.

+ Salary paid to workers/1 hour: 50,000 VND.

TABLE 2. Estimate the cost of transportation waste for import in an average month (Before)

Targets	Travel distance (meters)	Travel time (minutes)	Salary costs (VND)/worker
One week	40	10	8.333
One month	160	40	33.333
One year	1920	480	400.000

Salary paid for 20 workers: 8.000.000 VND.

Total cost per year:788.000.000 VND

4. Results and discussions

Working stages have been rearranged according to a more scientific and convenient production process. Workers move faster because the distance has been shortened compared to the previous layout. The fabric storage area is located right at the entrance to make it easier for workers to import fabric materials. After improving the premises, the raw material warehouse was arranged right at the door, so the company no longer needed to mobilize 20 workers to transport raw materials.

In addition to rearranging the premises, the company also implemented 5S implementation in the work area including 5 steps:

S1: In this step, the Company has set the goal of "Right type, right quantity". First, people in the Company's 5S implementation committee will take photos of areas where 5S problems currently exist. The 5S implementation committee needs to make a list of available items and quantities, determine the level of necessity based on frequency of use and quantity available. Next, is "If in doubt, throw it out" - If you are in doubt or wondering whether to use it or not, remove unnecessary objects from the work area.

S2: With the Company's goal set as "Reduce space and search time, reduce risks and accidents; location regulations, problems are easy to detect. To do this, first, people in the implementation committee divide items into groups: by function; by type of goods or products. Next, proceed to specify the location and storage method. Use objects that are used a lot, keep them close, use them a little, keep them far away, and pay special attention to labor safety. At the same time, apply the principle "Easy to find, easy to see, easy to get, easy to check".

S3: In this step, the Company sets a cyclical cleaning goal to return equipment and machinery to their original state to detect and eliminate damage before it occurs. First, clean the machines and floors periodically. Cleaning is also about checking and paying attention to abnormalities, because small mistakes are signs for potential major problems. Next, is to suggest a solution or notify the relevant department. And here, cleanliness is not just about cleaning, cleanliness is about maintaining good condition, detecting damage early for timely repair.

S4: Also known as the "Standardization" step at the Company, with the goal set at the Company as "Maintaining the status quo, building habits, creating discipline and common sense". And first, the

Company's 5S implementation committee builds standards according to the 3-alike principle "Understanding alike - Doing alike - Results alike". Next, is the regulation of the inspector, the frequency of inspection, and the person responsible to maintain what S1, S2, and S3 have done before.

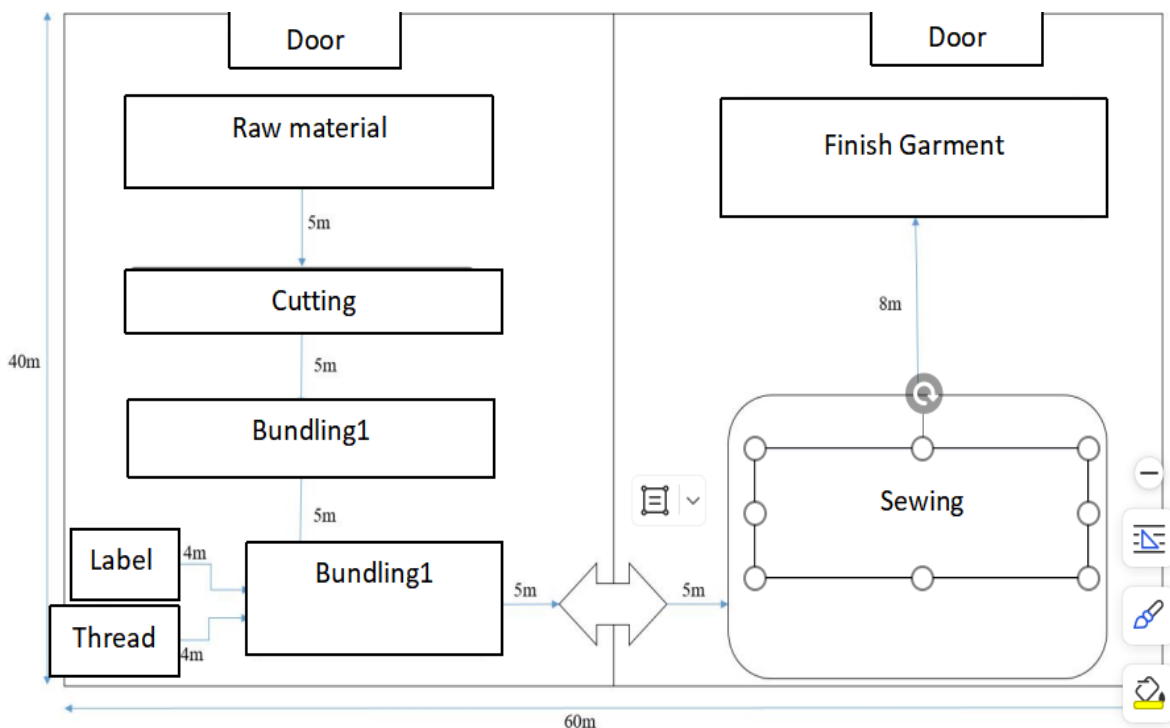
S5: In this step, the Company sets the goal of "Building 5S culture and thinking for the entire organization". First, managers and leaders regularly check and set an example. With the mindset: continuous improvement, continuous implementation from S1 - S4 to continuously update standards. Next, is to build a 5S promotion program to build a 5S culture that all individuals voluntarily implement, considering it an important part of their work.

The stages have been separated by painted lines, machinery and equipment are also cleaner and neater. The application of 5S has helped the work area to be rearranged, the travel time of workers is reduced. Besides, it helps Protrade Garment Joint Stock Company increase work productivity and reduce waste costs due to transportation. From the door to import goods to the fabric storage area: The distance is significantly shortened from 72m to only 41m. From there, the travel time is only nearly 8.5 minutes.

TABLE 3. Cost of implementing 5S and arranging premises

Cost	
1.Stationery	10.000.000 VND
2.Machinery relocation	10.000.000 VND
3.Paint the lines and create new paths	50.000.000 VND
4.Reward employees who perform 5S well	20.000.000 VND
Total	90.000.000 VND

To maintain and implement 5S effectively, after each periodic evaluation, the company always rewards employees and departments who perform well so that everyone understands and agrees to implement it.



Picture 3. Garment factory layout diagram (After)

After rearranged, costs have been greatly reduced, specifically as follows:

- + Travel distance: 41 meters, two return trips is 82 meters.
- + Travel time: 8.5 minutes.
- + Salary paid to workers/1 hour: 50,000 VND.

TABLE 4. Estimate the cost of transportation waste in an average month (After)

Targets	Travel distance (meters)	Travel time (minutes)	Salary costs (VND)/worker
One shift (8 hours, 2 times)	164	17	14.167
One month (26 days)	4264	442	368.333

Salary cost of transportation waste for 100 workers in a year: 442.000.000 VND.

Therefore, the cost from 788.000.000 VND reduced to 442.000.000 VND.

5. Conclusion and future research

Lean Manufacturing is a popular tool that most companies and businesses apply and achieve many positive results. Using Lean Manufacturing helps identify existing wastes that cause losses to the business. From the results of analysis and calculation, we see that the total cost due to conversion has decreased by 44% compared to the current status, while the cost for arranging premises only accounts for about 11%. From there, businesses proceed to eliminate this waste, improve a cleaner working environment, help employees feel more comfortable, and work more accurately. Applying Lean Manufacturing combined with 5S helps businesses reduce waiting time and moves that do not create quality value for the company, wasting time, money and human resources, increasing the competitiveness of the business.

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