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Implementation of Standardization Work to Improve Productivity in Indonesian Furniture Industry

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Abstract: Lean manufacturing is now one of the most powerful manufacturing control systems in the current trend. In present competitive and challenging market, industries need to improve their productivity. This research discusses about the implementation of lean manufacturing in the furniture industry to reduce waste that exists on the production floor. The company is having a high delivery delay caused by the component process production delay. The production process delay is caused due to waste by means of non-value added activity about 34%. This research will use standardization work which is one of the tools in lean manufacturing. The application of standardization work has improved the company productivity by reducing production time from 39.83-23.05 min./pair products. Standardization work has proven effective to balance the operator workload so the production process flows continuously.

Key words: Lean manufacturing, non value added activity, standards work combination table, workload, flows

INTRODUCTION

High competition in Indonesia's furniture industry prompted every furniture company to improve their productivity by create production process that is effective and efficient. The goal is to be able to deliver their products to customers in time and good quality. Nowadays, lean manufacturing has accepted and adopted best manufacturing practice across countries and industries. The main goal of lean manufacturing is to create a smooth, high quality organisations that is able to produce finished goods at the rate of customer demands with minimal or no waste (Nordin *et al*., 2012). There are several types of waste in production: overproduction, unnecessary stock, inefficient transportation, unnecessary motion, waiting, defect and inapropriate process (Liker and Meier, 2006).

Company X is one of furniture companies in Indonesia which has the main products,headboard and footboard. The most critical issue faced by the firm is a frequent delays in delivering the products to customers, with 92% of delivery is a delay in anually. Based on field observations, the delays in product delivery is caused by the delays of several work stations while producing the product's components. The delays in production process is affected by the presence of waste in the form of a non-value added activity by 34%. Non-value added activity can occur due to the absence of production process standard. The method that can be used to reduced waste is lean manufacturing (Rohani and Zahraee, 2015). There are several tools in lean manufacturing which can be used to reduce waste such as 5S and yamazumi chart (Rahani and Ashraf, 2012) Value Stream Mapping (VSM) (Tyagi *et al*., 2015). Single Minute Exchange of Die (SMED) (Suhardi, 2008) and standardization research (Johansson *et al*., 2013; Nurcahyo and dan Hartono, 2012). According to Halim *et al*. (2015) the tools that can be used to minimize process variaton among the operators and to eliminate unnecessary motion or NVA tasks is standardization work. Standardization work is a most efficient method to produce goods by ordering the work without creating a waste. Standardization work combines jobs in focus to their human movement (Liker and Meier, 2006). In a company, standard work is usually communicated in write through a standard work combination table. The objective of creating a standard work combination table is to eliminate non-value added activity from the production process so the productivity can increase and the company able to complete the customer orders in time. In addition, the standard work combination table also can distribute the workload of each operator equally. Another

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tools that can be used is work charts and operation analysis (Suhardi, 2008; Wignjosoebroto, 2003) but both of them, don't show takt time, layout, quality control and safety aspect. So that in relation to the problems faced by Company X, the tools that can be used to reduce the waste is the standardization research.

MATERIALS AND METHODS

Experimental design: This study focused on production of the headboard and footboard. There are three elements that must be considered in performing the standarization work: takt time, work sequences and standard stocks in the process. Takt time shows the cycle time of sales to customers. In production line, takt time is considered as the time needed to produce one unit of product. Standard stock in process is the minimum amount of stock of parts required to carry out a work process.

Determine the working elements and calculate the cycle time: The initial step in standardizing work is to describe the flow of the production process into the process flow map and process flow diagram. After the production process know by those diagram, the next step is to determine the working elements of each operator. The company has 16 operators to do the production proses. The working element must occur repeatedly so that it can be used to measure cycle time. The method used to measure the cycle time is stopwatch time study. The cycle times taken 30 time for every working element. To measure data sufficiency and uniformity, the adequacy and uniformity test are carried out.

Calculate working ratio and workload before standardization work: In production floor, working element is classified into 3 categories: Value Added Activity (VAA), Necessary Non-value Added Activity (NNVAA) and Non-value Added Activity (NVAA). The working elements which are included in VAA and NNVAA are categorized as primary works while the working elements which are included in NVAA are categorized as waste. Working ratio calculation is used to determine the percentage of those production activities' value categorized in VAA, NNVAA and VAA. While the workload calculation is used to determine the workload level of each operator. By taking both consideration into account, standard work combination table is set to be made.

Implementation of standardization work: Standardization work can be used to eliminate waste such us NNVA. Standardization work also can be used to optimize the operator workload by change the operator's job description. There are some operators which encounter a job modification in the new work standards. The modification is done to distribute the workload of each operator equally and is to eliminate the waste. Standardization work is documented in standard work combination table.

Calculate of working ratio and workload after standardization work: The calculation of working ratio and workload level in new standards required for comparing the condition in production floor, before and after implementing standardization work.

Compare production time before and after standardization work: After implementing standardization work, waste such a NVA has been removed which impacted on production time changes. By comparing production time before and after standardization, it can be seen whether the timing of production become more efficient or not.

RESULTS AND DISCUSSION

Production flow: The firm has 16 operators in production line. Work station which present in production line were 7 work station that consisted of 24 work process. Headboard and footboard manufacturing process started from wood board drying and ended by finishing products.

Takt time calculation: The firm should finished 250 pairs of headboard and footboard within 18 day or 7020 min. So, the production takt time is:

- Taktime = Available process time demand
- Taktime = 7020 min. 250 pair
- Taktime = 28.08 min. pair

Working ratio and workload calculations before standardization: The largest waste was found on operator 14 with the value of non-value added activity by 81%. That's because there is ineffective work processes between the operator 14 and 15. The calculation ofthe working ratio is shown in Fig. 1 and 2. Ineffective work process also led to a high workload for the operator 15. The workload calculation can be seen in Fig. 3.

Operator 12 also has a high workload level at 1.43 point. The high value was due to lack number of operators in sanding process. Thus, there are two factors that are considered in making standardization work which is waste

such non value added activity and operator workload so that the workload of all operators can be balanced.

Standards work combination table: There are some operators which encounter a job modification in the new work standards. The Modification is done to eliminate waste and distribute the workload of every operator evenly. The job modification can be seen in Table 1. The

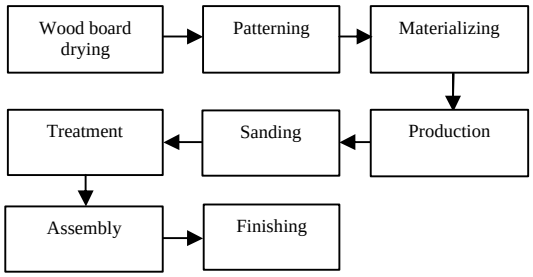

Fig. 1: Production flow

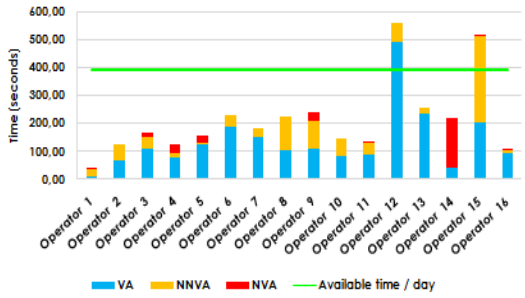

Fig. 2: Working ratio before standardization work

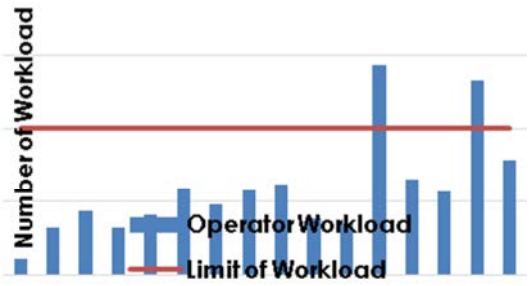

Fig. 3: Workload before standardization work

standard work combination table is assigned after the job modification step. The example of the new standard work combination table of the operator 14 shown in Fig. 4.

Working ratio and workload calculations after standardization: After the standard work combination table is implemented, the non-value added activity has been reduced. This is because any activity that doesn't have a value-added has now been eliminated. The workload of operator 12 also decrease due to the sanding process after standardization is now assisted by the operator 1 and operator 5. The workload of operator 1 and 5 become more optimal than before. Workload of operator 15 is also decrease, because the headboard and footboard assembly process is now assisted by operator 14. Following is the calculation of the working ratio and workload after the standardization of work.

Comparison of production time after standardization: Before the standardization, the cycle time of making a set of headboard and footboard was 39.83 min (above takt time). After standardization, the cycle time is only 23.05 min. (under takt time). The cycle time reduction makes the firm able to achieve the production target by produce 16 pair products/day. Before implementing the standardization work, the firm can't achieve the production target, only produce 9 pair products/day.

Before implementing the standardization work, the firm needs overtime to achieve production targets, thus causing increase in manufacturing costs. After implementing standardization work, the firm doesn't require overtime, thereby saving production costs of USD 456.

Similar results were obtained from previous studies to improve work efficiency in automotive industry in Sweden by implementing standardization work at the company (Johansson *et al*., 2013). In addition research conducted by Nurcahyo and Hartono (2012) obtain the result of increased work efficiency from 28-85% by optimizing operator workload and implementing standardization work.

Table 1: Job description change

Operator	Initial job description	New job description
Operator 1 (patterning)	Transportation of wooden board patterning	Transportation of wooden board patterning sanding components
Operator 2 (radial cutting 1)	Radia cutting (1) arranging components	Radia cutting (1) arranging components assembly top with palang atas
Operator 5 (jointer)	Jointer	Sanding components profil top
Operator 14 (assembly without slat component	Assembly headboard and footboard without slat components	Assembly headboard
Operator 15 (disassembly and assembly all comonents)	Disassembly and assembly all components of headboard and footoard	Assembly footboard

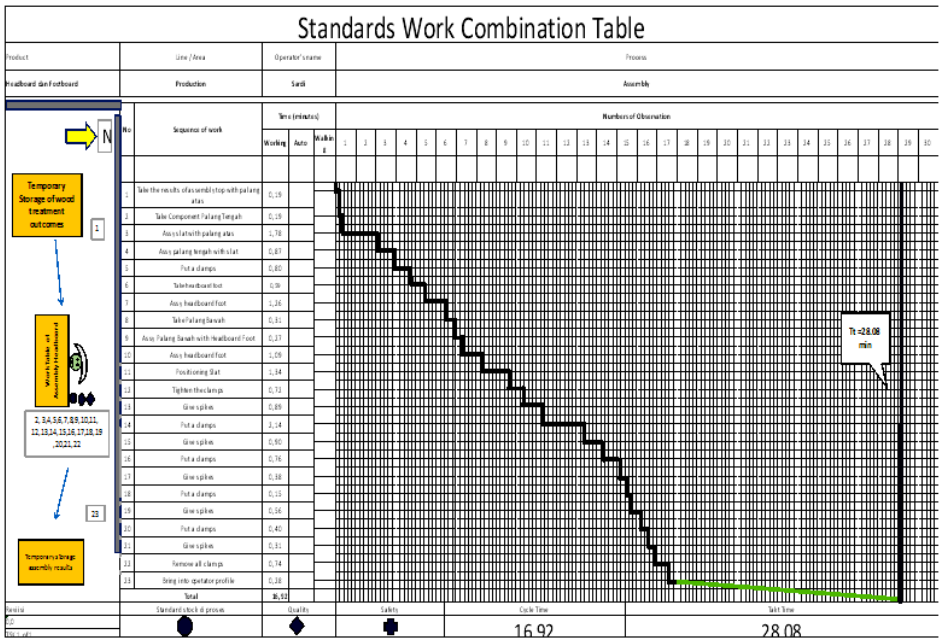

Fig. 4: Standard work combination table

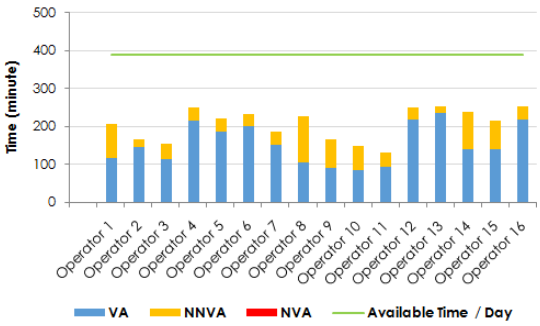

Fig. 5: Working ratio after standardization work

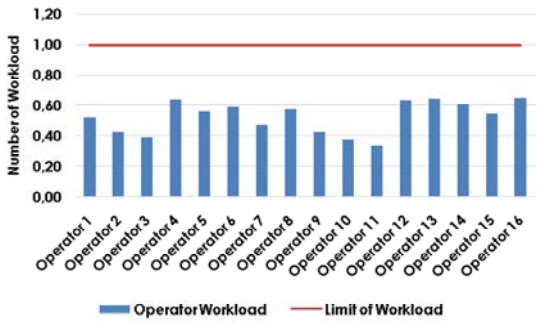

Fig. 5: Workload before standardization work

CONCLUSION

The goal of this research was to improving efficiency work in production line by implementing standardization work and optimizing operator workload. The final result showed that by implementing standardization work, the production time can be reduced from 39.83-23.0 5 min. pair products, so it can achieve the production targetday. In the other side the workload of the operator can be distributed evenly with the modification of job between the operator who has a high workload and the operators who has a low workload. However, the overall workload of operators is considerably become less optimal because it doesn't deduct the number of workers to optimize the workloads instead it only making the workload distributed evenly to all existing workers (Fig. 5 and 6).

Fig. 6: Comparison of production time after standardization

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