

Work environment standardization for the t-shirt production process at CV Nanda Konveksi using lean principles

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ABSTRACT

The purpose of this study is to standardize the workplace to meet CV ND Konveksi's goals for working hours. The variety of t-shirt production process timings at CV ND Konveksi. The unknown production process time for each type of t-shirt and the nonconformity of Standard Operational Procedures (SOP) with actual work techniques are all impacted by current work environment issues. Using process activity mapping, observations were conducted of every step in the t-shirt production process to gather data for the study. By classifying the value of operations into three categories value added, no value added, and no value added but necessary. The outcomes of data processing are assessed. Root Cause Analysis (RCA) is used to perform a root cause analysis based on the activity categories whose values have been determined. The identification of the root cause of the issue was based on the source of the problem that was experienced. This root cause was the absence of standardization in the work environment, which led to the formation of wasteful practices such as searching. The 5S principle (seiri, seiton, seiso, seiketsu, and shitsuke) is applied in the work environment standardization strategy. When CV ND Konveksi Lampung adopted the 5S program, performance productivity increased by 10%, the value ratio decreased by reducing NNVA activities by 22 and NVA by 13, and the processing time efficiency increased by 30%, from 19.7 minutes to 13.9 minutes for the production of a single t-shirt. Another result was activity efficiency, which came in at 22%. Of the activities, 15 could be deleted because they contributed no value.

Keywords: Lean; standardization; value; waste.

1. INTRODUCTION

The campaign season for the 2024 election has begun, and orders for party logos and campaign items like flags and t-shirts have grown in popularity. CV ND Konveksi was interested in learning about its production capacity since it expected demand for t-shirts as a campaign prop to rise. Using preset work procedures, production capacity is calculated based on the average working time per piece of t-shirt.

Data from the CV ND Konveksi t-shirt production process show that there is a variance in processing time, which causes demand to not be satisfied in the appropriate amount and at the appropriate time. The real circumstances in the t-shirt production process were determined based on these issues. The process of identifying the actual conditions begins with the preparation of the goods, followed by the cutting of the t-shirt body material, the sleeve joints, the sleeves and neck, the t-shirt sewing and overlocking, the over deck, and the packing.

Finding real conditions led to the discovery of several non-value-added tasks in each step, including searching for supplies (fabric, thread, labels, and ribs), patterns (fabric size and type), and tools (scissors, needles, needles, pins). This activity takes place because the work environment for producing t-shirts lacks a standard location for the placement of equipment supporting the production process. As a result,



the placement of the supporting equipment frequently changes, which causes a search process to occur by sorting the available fabrics, patterns, and threads one at a time.

Lean concepts are applied to overcome these issues. Lean is the endeavor to minimize waste in a manufacturing system, encompassing human, machine, equipment, material, and work environment waste [1][2]. Lean is a well-liked and useful technique for handling waste and non-value-adding tasks [3]. To cut production costs, any action that does not improve the finished product should be scaled back or, if feasible, eliminated. PAM, a Lean approach, is utilized to identify problems [4]. Root Cause Analysis (RCA) is then used to examine the problem's root cause. Based on the design stage, the chosen root causes are then improved and implemented utilizing the 5S principle.

One of the Lean techniques, PAM maps the production process and analyzes waste (waste) [5]. PAM is a useful method for thoroughly mapping processes since it can pinpoint material, physical, and lead times in the value chain [6]. PAM is developed using the steps and duration that a product goes through from raw materials to completed items and the warehousing of those things [7]. PAM includes operational procedures such as operations, inspection, transportation, waiting, and storage in a production process [8]. In addition, PAM is incorporated into several movement components such as task duration, working distance, and labor strength for every job [9].

Root cause analysis is used to determine the activities involved in the production process [10]. Five Whys, or Root Cause Analysis (RCA), is a method that involves asking why five times [11]. 5 What makes a process for decomposing and evaluating gathered data. 5 reasons is an instrument that can be used to identify the underlying causes of issues that develop. A straightforward question-and-answer method for determining cause and effect is called the "5 Why" method.

The 5S principle will be implemented to enhance and optimize the problem analysis outcomes during the design phase [12]. The Five Sigma methodology serves as a basis that employees can use to guide their ideas when implementing continuous improvement and raising quality awareness [13]. The 5S method of organizing a workspace focuses on getting rid of and cutting down on waste to create a comfortable, productive, and efficient work environment.

This background informs the research's objectives, which include analyzing issues in the CV ND Konveksi Lampung t-shirt production area, designing a 5S program at CV ND Konveksi Lampung to increase performance productivity, and ensuring the program's sustainability through Standard Operating Procedures (SOP).

2. METHOD

This study starts with system identification and continues through CV ND Konveksi's t-shirt production process, as shown in Figure 1. To map the business process of making t-shirts, data was gathered through stakeholder interviews and direct observation. To systematically understand the actual conditions in the production process, business processes are built using the SIPOC approach (Supplier, Input, Process, Output, and Customers), taking into account the conditions of acceptable process, unacceptable process, control process, uncontrol process, risk process, opportunity process, threat process, and constraint process [14].

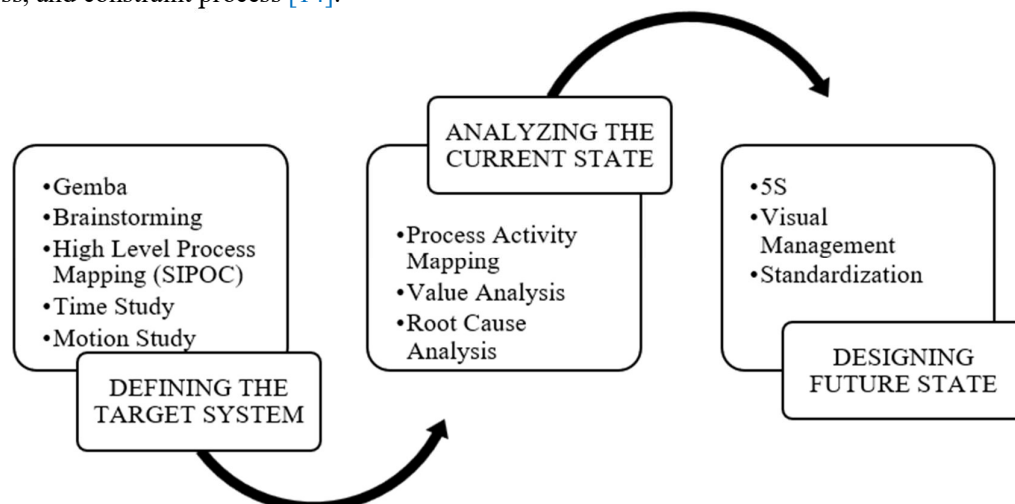


Figure 1. Research methodology diagram.

The actual conditions are analyzed using the PAM approach, taking into account movement and time studies for each activity, based on the identification of the actual conditions that have been established. Operational processes (O), inspection (I), transportation (T), waiting (D), and storage (S) are all included in PAM as part of a production process [15]. To determine the value ratio for the t-shirt production process, the PAM value analysis data are used. Additionally, the analysis employs the Root Cause Analysis (RCA) method, commonly referred to as 5why, to determine the underlying reasons for issues that are discovered or occur in the field as a result of observations or interviews.

After the analysis is complete, improvement comes next. Enhancements are based on non-value-added activities that take place during the t-shirt production process and are recognized in the PAM, as well as the root cause of the problem as revealed by the RCA from the problems disclosed. Issues are categorized, and conversations are had about the issues that need to be fixed and potential repair techniques with owners and specialists.

A group of specialists selected the 5S Method, Visual Management, and Standardization to address work environment issues that have the most effects on the t-shirt production process. To achieve work methods and work time, the 5S approach can be used to maintain the state of the work system [16].

3. RESULTS AND DISCUSSION

The SIPOC approach is used to identify business processes, and it considers the following factors: conditions, acceptable and unacceptable processes, control and uncontrolled processes, risk and opportunity processes, and threat and constraint processes (as shown in Figure 2). The process identification results revealed 13 issues with the actual conditions of the t-shirt production process. Specifically, the issues occurred in two areas: one related to people, one to machines, one to materials, two issues with methods, and seven issues with the environment throughout the t-shirt manufacturing business process.

Following the identification of the business processes, the PAM approach is used to analyze the activities while taking time and movement studies into account (see Table 1). With an average total actual working time per product of 19.7 minutes, more than 87 sub-activities were identified from 6 t-shirt production workstations based on the PAM analysis results. Of these, 13 were value-added (VA), 21 were non-value-added (NVA), and 53 were non-value added but calculated (NNVA). In contrast, just 15% of activities add value according to the value ratio, which indicates issues that need to be fixed (see Table 2).

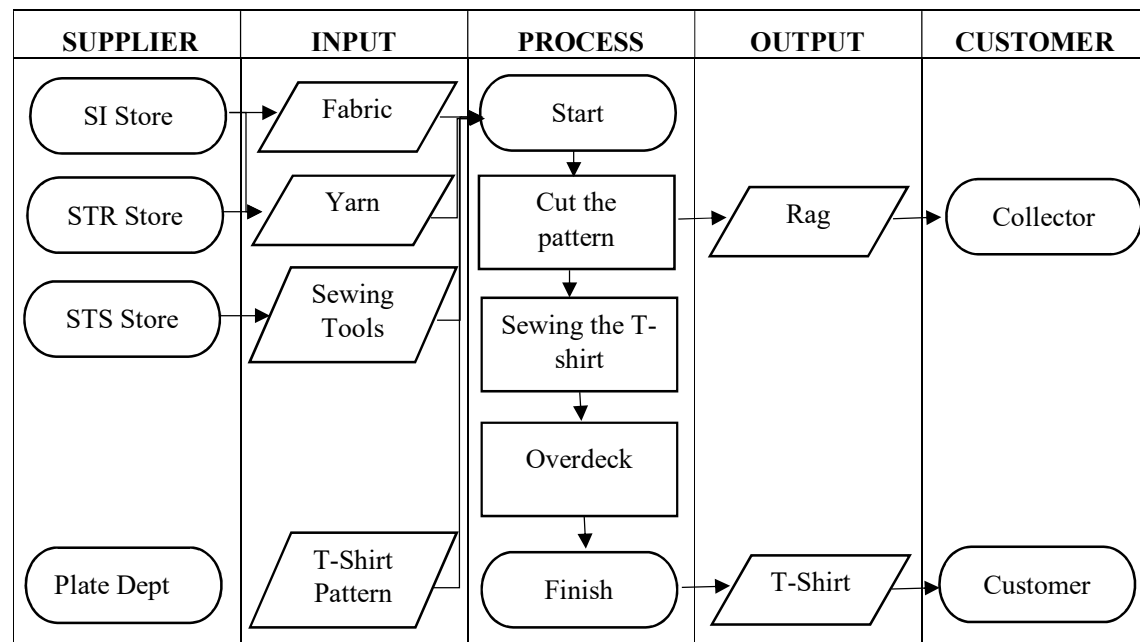


Figure 2. Company business process map (SIPOC).

Table 1. Example of PAM.

NO	Activity	Sub Activity	Tools	Range (cm)	Time (S)	O	T	I	S	D	Value Analysis
1	Material Preparation	Searching for materials			5	O					NVA
		Selecting materials			4	O					NVA
		Grasp material			1	O					NNVA
		Transport loaded		210	4		T				NNVA
		Inspect materials			9			I			NVA
		Search for plate pattern			12	O					NVA
		Selecting pattern			7	O					NVA
		Grasp the pattern			3	O					NNVA
		Transport loaded		304	10		T				NNVA
		Inspect for pattern			20			I			NVA

Table 2. Value ratio

Classification	Total Activity	Value Ratio	Total Time (s)	Time Ratio
NNVA	53	61%	417	35%
NVA	21	24%	273	23%
VA	13	15%	491	42%
Total	87	100%	1181	100%

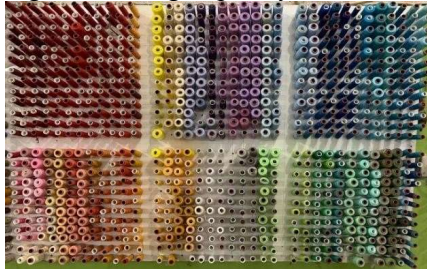
The issue has been located. The next step is to use the Root Cause analytical (RCA) approach, also referred to as 5why. Table 3 shows analytical example 5why. The lack of work instructions, or SOPs, for every task in the business process, has been linked to seven distinct issues. The 5S principles are used to fix issues found in the RCA. These principles are based on the categories of seiri, seiton, seiso, seiketsu, and shitsuke and are maintained by standardizing design. Table 4 provides more information and examples of changes.

Table 3. Detail Improvement.

Steps	Aspect
Seiri	- Sorting is done by using a used tag on goods and machines that will be utilized, i.e., positioned far from the t-shirt production area or far from users, some objects and machines are rarely used. - Some threads are damaged and used up, but they are still on the thread board. To sort the threads, discard the damaged and used-up threads since they are no longer usable.
Seiton	- Creating arrangements for arranging quality materials on shelves depending on the kind of fabric and organizing them by the color of the fabric. - Creating designs for thread boards that are arranged according to the warm and cool color groups of threads. - Labeling equipment (such as scissors, rulers, and pens) especially for the manufacture of t-shirts. - Making labels on trash cans and places
Seiso	- Provide a place for leftover cloth (patchwork) with a label. - Making a cleaning schedule - Creation of area cleanliness standards and cleaning tools
Seiketsu	- Making work instructions for handling fabric - Making work instructions for using thread
Shitsuke	- Preparation of the 5S program - Making 5S posters

Steps	Aspect
SOP	Preparation of 5S Program SOPs for CV ND

Table 4. Examples of Improvements.

	Before 5S	After 5S	Information
S E I T O N	The thread board remains disorganized, unclean, and not placed in color groups	There are no unclean or worn-out threads since the threads have been organized and grouped by color	The threads on the board are already sorted into groups of warm and cool colors based on color gradation.
			

The creation and execution of the 5S program at CV ND Konveksi Lampung is the outcome of enhancing the work system in the t-shirt production process. Because there is a reduction in NNVA activity by 22 and NVA by 13, this design leads to increased performance productivity as evaluated by the value ratio, which witnessed a 10% improvement. The 30% process time efficiency percentage, which shows a reduction in production time from 19.7 minutes to 13.9 minutes for a single t-shirt, further supports this. A score of 22% was also obtained for activity efficiency, meaning that 15 tasks might be deleted because they were unimportant and provided little value.

The standard operating procedure (SOP), which contains an identification sheet checklist and check sheet for stages seiri, seiton, and seiso as well as form problem findings, repair forms, and audit forms from 3S, 4S, and 5S, can be used to maintain the continuity of the 5S program at CV ND Konveksi Lampung. By creating a dedicated staff for the 5S program, regular assessments, audits, and training ensure that the SOPs that have been created and authorized are always followed.

4. CONCLUSION

There are seven issues with CV. Nanda Konveksi's t-shirt production process, all seem to be related to the same fundamental issue, which is the absence of work instructions or standard operating procedures (SOPs) that are enforced throughout the process. Improvements based on the 5S principles were implemented in response to these issues, bolstered by visual management, and upheld by a standardization procedure. This innovation has led to a 30% process time efficiency and a 22% activity efficiency.

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