Analysis of SQDCMPE based on Lean Concepts in the Daily Workwear Production Process at PT. XYZ's Convection Company

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Abstract
The garment industry, a cornerstone of Indonesia's economy, faces persistent challenges in efficiency and quality, as evidenced by PT. XYZ struggles with uneven stitching, loose buttons, and stained fabric in daily workwear production. This study employs Lean Manufacturing principles integrated with the SQCDMPE framework to address these issues. By utilizing tools like fishbone diagrams and SQCDMPE analysis, the root causes of production inefficiencies were pinpointed. Recommendations include implementing stringent quality controls, enhancing worker training, and optimizing operational processes to minimize waste and improve efficiency. These strategies aim to streamline production at PT. XYZ, enhancing product quality and meeting customer demands effectively in the competitive global garment market.

***Keywords*:** *Lean Manufacturing, SQCDMPE, Garment Industry, Quality Improvement, Waste Reduction.*

Abstrak
Industri garmen, yang menjadi salah satu pilar ekonomi Indonesia, menghadapi tantangan berkelanjutan dalam hal efisiensi dan kualitas, seperti yang terlihat dari masalah yang dihadapi PT. XYZ dalam produksi pakaian kerja sehari-hari, seperti jahitan yang tidak rata, kancing yang kendur, dan kain yang kotor. Mengatasi masalah ini, studi dilakukan menggunakan prinsip Lean Manufacturing yang terintegrasi dengan kerangka SQCDMPE. Alat yang digunakan seperti diagram tulang ikan dan analisis SQCDMPE, penyebab akar dari ketidakefisienan produksi berhasil diidentifikasi. Rekomendasi yang diajukan meliputi penerapan kontrol kualitas ketat, peningkatan pelatihan bagi pekerja, dan optimalisasi proses operasional untuk mengurangi pemborosan dan meningkatkan efisiensi secara keseluruhan. Strategi ini bertujuan untuk memperlancar produksi di PT. XYZ, meningkatkan kualitas produk, dan memenuhi

permintaan pelanggan secara efektif di pasar garmen global yang kompetitif.

Keywords**:** *Lean Manufacturing, SQCDMPE, Industri Garmen, Peningkatan Kualitas, Pengurangan Limbah.*

1. Introduction

The garment industry has become a crucial pillar in the global economy, providing clothing and textiles to meet consumer needs. In 2021, the export value of Indonesia's garment industry reached US$ 7.64 billion during January to November, with a growth rate of 19.59% compared to the same period the previous year (Kusnandar, 2022). Despite rapid growth, challenges persist, particularly related to quality, efficiency, and production effectiveness. This is true for PT. XYZ, a garment manufacturing company whose main product is daily workwear (DW). One common issue is process inconsistency, leading to waste. The company often faces difficulties in meeting customer demands, especially regarding timely product delivery. Problems such as uneven stitching, loose buttons, and stained fabric need to be addressed. These inconsistencies can hinder responsiveness to customer requests and result in unnecessary costs.

To tackle these issues, the concept of Lean Manufacturing provides a relevant solution. Lean Manufacturing is a methodology focused on minimizing waste in manufacturing systems while maximizing productivity (Prasad, Dhiyaneswari, Jamaan, Mythreyan, & Sutharsan, 2020). Lean principles help companies identify and eliminate waste, thereby improving efficiency and product quality.

The concept of lean manufacturing is often applied in the textile and garment industry, including research conducted in Tamil Nadu, India (Annamalai, Kumar, & Bagathsingh, 2020). By designing dynamic facility structures, processing time can be reduced, factory volume increased, and productivity improved. The study demonstrates enhanced organizational efficiency and employee satisfaction. Efficiency is measured through parameters such as quality, speed, flexibility, reliability, and cost. Meanwhile, employee satisfaction is assessed based on safety and ergonomics, generated income, partnerships, clarity of guidance from managers, colleagues, and support staff, as well as opportunities for skill development and career advancement.

Furthermore, lean manufacturing principles, including motion analysis, standardized work through time studies, and balanced production lines, can enhance productivity by minimizing issues and waste within the company, ultimately improving market competitiveness (Mulugeta, 2021). Implementing lean concepts to reduce non-value-added activities can also lead to operational time savings and increased productivity (Ewnetu & Gzate, 2023).

Given these considerations, a lean Manufacturing approach is essential to eliminate waste, reduce production lead time, and ensure product quality through Quality Assurance (QA). The common elements in product quality assurance include safety, quality, cost, delivery, morale, productivity, and environment (SQCDMPE), as abbreviated by Abdussalam and Wicaksono (2023). Therefore, this study employs Lean concepts with an SQCDMPE approach

to identify waste causes, minimize waste levels, and enhance efficiency in the production process. Recommendations for improvement are provided for PT. XYZ, is a garment company specializing in daily work uniforms (PDH).

2. Method

This study employs lean concepts through the application of lean manufacturing principles and the SQCDMPE method.

Lean Manufacturing with an SQCDMPE Approach

Lean manufacturing is an operational management approach aimed at eliminating waste in production processes (George, Nguyen, Nguyen, & Akbari, 2022). The principles of lean originate from the Toyota Production System (TPS) and have been adopted by various industries worldwide. Lean focuses on operational efficiency, quality, and sustainability. Some lean principles include:

- *Waste Reduction*: Identifying and eliminating activities that do not add value to products or services.
- *Employee Development*: Empowering employees to participate in process improvement.
- *Just-in-Time Production*: Producing only when needed to avoid excess inventory.
- *First Time Right Quality*: Preventing defects and ensuring high-quality products from the outset

The method used to identify waste involves the SQCDMPE framework, which comprises the following elements:

- *Safety*: Focus on reducing the risk of injuries and ensuring a safe working environment. Safety is a top priority because employee well-being is crucial;
- *Quality*: Concentrate on ensuring that products or services meet established quality standards. Good quality results in customer satisfaction and a positive reputation;
- *Cost*: Efficiently manage operational costs. Cost isn't just about budget cuts; it's also about optimizing resource utilization;
- *Delivery*: Ensure timely delivery of products or services to customers. Reliable and prompt delivery is essential for maintaining customer trust;
- *Morale*: Prioritize employee well-being and motivation. High morale contributes to overall productivity and performance;
- *Productivity*: Optimize output by efficiently using existing resources. Good productivity leads to growth and sustainability;
- *Environment*: Consider the operational impact on the environment. Companies should be responsible for sustainable and eco-friendly practices.

In this study, the integration of Lean Manufacturing concepts and SQCDMPE analysis is employed to enhance operational efficiency and quality at PT. XYZ for Daily Work Uniform products. The analysis focuses on stitching conditions, buttons, and product cleanliness before the packaging process. Qualitative analysis is conducted by identifying the root causes of issues and occurrences using a fishbone diagram.

The Fishbone Diagram, also known as a cause-and-effect or Ishikawa diagram, is a visual tool that helps identify the root causes of a problem or event (Ishikawa, 1985). Its shape resembles a fishbone, and it is commonly used in various fields such as manufacturing, industry, quality, and healthcare. The basic structure consists of a horizontal axis representing the problem to be solved and a vertical axis connecting the fishbone lines. These lines represent potential cause categories, such as "Man, Method, Machine, Material, Measurement, and Environment" (6M). Each fishbone line is filled with potential causal factors related to the issue. By analyzing potential causes in detail, this diagram assists in focusing improvement efforts and directing appropriate actions. The following steps were taken:

- *Data Collection*: Primary data was obtained through direct observation of the daily workwear production process at PT. XYZ;
- *Data Sources*: The study was conducted from May 10th to June 10th, 2024, to identify process flows experiencing delays and collect data on seven types of waste;
- *Research Design*: Data analysis was performed to translate information into useful insights. In waste identification, the study utilized value stream mapping with a fishbone diagram.
- Furthermore, SQCDMPE was employed to minimize waste and improve operational efficiency.

3. Result and Discussion

The production process of PDH involves several stages that must be followed to produce quality products. First, fabric, sewing thread, and buttons are used as inputs. The fabric to be processed must undergo an inspection stage to ensure its quality. Next, pattern making is done based on the desired design, and the fabric is cut according to the created pattern. The sewing stage transforms the fabric into the shape of PDH, and buttons are attached in the appropriate places. Before packaging, PDH goes through an ironing process to achieve a polished appearance. Afterward, the PDH product is ready for packaging and delivery to customers or for marketing. During the production process, three types of defects are identified: uneven stitching (**Figure 1**), loose buttons (**Figure 2**), and stained fabric (**Figure 3**). These failures impact customer demand fulfillment and production system inefficiencies due to waste. Some contributing factors to these failures include worker skill gaps, suboptimal environmental conditions, machine setting changes, and the use of inappropriate thread.

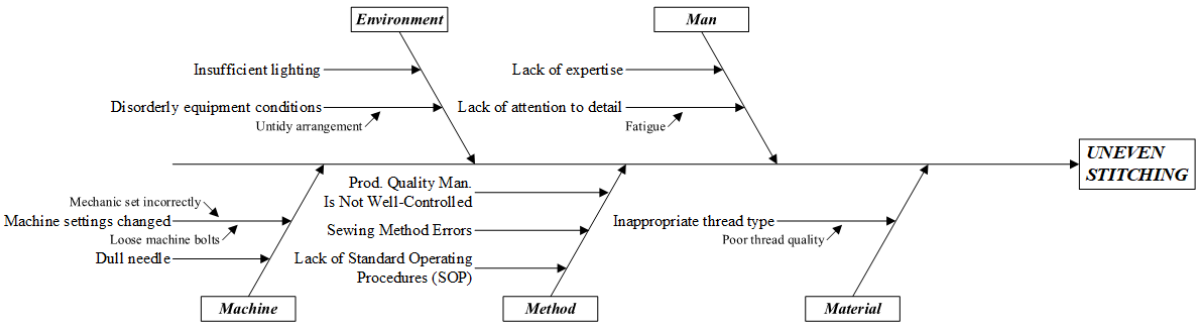

Figure 1. The Fishbone Diagram of Stitching Conditions

In Figure 1, we organize the potential causes of uneven stitching. It is evident that several factors require attention. Firstly, environmental factors, particularly inadequate lighting, result in poor visibility for workers during sewing. From a human perspective, insufficient worker skills, knowledge, and competence contribute to this issue. Additionally, lack of attention to detail during the sewing process often occurs, often due to worker fatigue. This also affects the buttons that have been attached before packaging (Figure 2), where some buttons from the daily work uniforms have come loose.

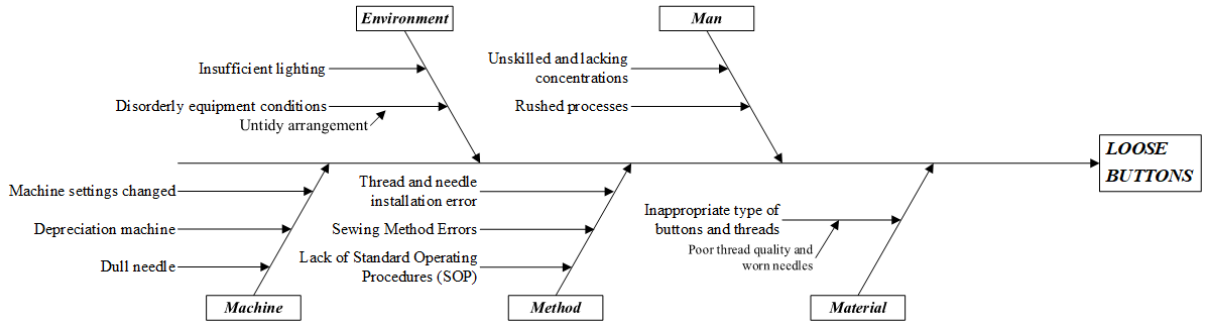

Figure 2. The Fishbone Diagram of Buttons Conditions

Meanwhile, the condition of some older machines and improper machine settings also plays a role in the declining stitch quality. Adjustments made without proper validation, along with loose or unsafe bolt conditions, affect needle wear during use. This is exacerbated by a cluttered shop floor or work location, leading to neglect of machine cleanliness. Consequently, packaged garments sometimes have stains or are lacking in cleanliness (Figure 3).

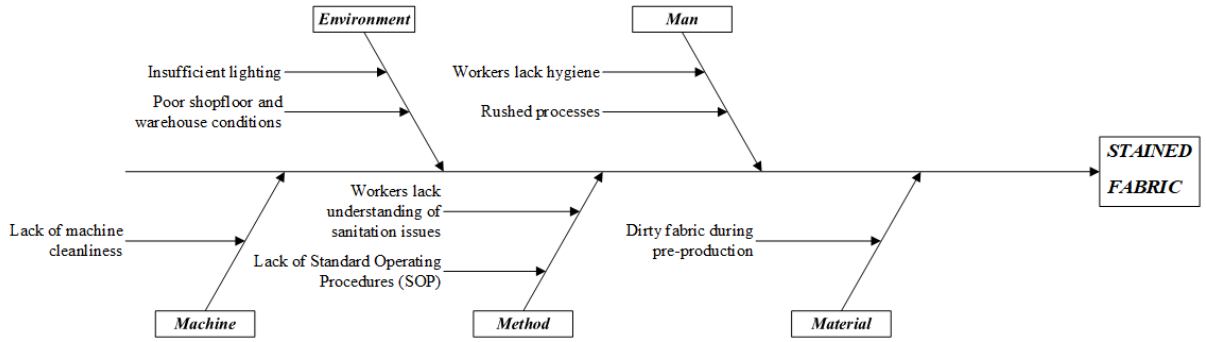

Figure 3. The Fishbone Diagram of Stained Fabric

The absence of Standard Operational Procedures (SOP) in the production process is crucial and needs to be established and adhered to. This is essential to avoid sewing method errors, button installation issues, and to improve shop floor cleanliness. After organizing the causes of defects in daily work uniform production using a fishbone diagram, the analysis continues using the SQCDMPE method to minimize waste.

Minimizing waste using SQCDMPE analysis

By using the perspective of the SQCDMPE method, the following analysis is obtained:

- **Safety:** Safety analysis for unskilled and rushed operators increases the risk of workplace accidents that can endanger themselves or others. A messy work environment and disorganized equipment can lead to tripping hazards or objects falling, posing safety risks.
- **Quality:** Quality analysis indicates that lack of attention to standard operating procedures (SOPs) and inappropriate work methods results in defective products that do not meet quality standards. The use of materials such as thread and fabric that do not match specifications leads to subpar stitching and products that fail to meet quality standards.
- **Cost:** Cost analysis occurs due to product defects during the production process, necessitating the disposal of clothing items. Errors in machine setup, use of low-quality materials, incorrect sewing methods, and lack of precision also contribute to increased costs.
- **Delivery:** Delivery analysis highlights long waiting times between order processing, production, and product delivery. These delays prevent the timely delivery of the finished products to customers. Additionally, unforeseen factors during delivery also contribute to time and cost losses.
- **Morale:** Moral analysis relates to the behavior of industry participants, particularly workers or operators. Unskilled, hasty operators who disregard SOPs can impact morale and productivity.
- **Productivity:** Productivity analysis reveals that product quality is not well controlled. Errors in sewing methods and the assembly of thread and needle components exist. Additionally, employee understanding of sanitation needs improvement.
- **Environment:** Environmental analysis in the garment production line highlights several issues, including inadequate lighting, disorganized equipment, untidy workplace arrangements, dirty production rooms, and storage warehouse conditions that require improvement.

From the perspective of SQCDMPE analysis, the improvements to enhance the quality of daily workwear production processes at the garment manufacturing company PT. XYZ. The data from safety measures that have been implemented using lean in a workplace with 100 employees, the total number of work hours achieved is 1,150,000 person-hours. At the same time, injuries that caused lost work time amounted to 15 incidents. The frequency rate obtained is 13, whereas it was previously 24, indicating a decrease of 45.83% .The total lost work hours decreased from 120 hours per year to 72 hours per year, resulting in a reduction in the loss cost from IDR 24,000,000 to IDR 14,400,000 per year.. Then, the quality data from daily production shows 7,200 workwear pieces per day, with an average defect of 180 pieces per day. After improvements were made, the defect rate decreased to only 30 pieces per day, resulting in a reduction from 2.5% to 0.04%. It can be outlined as follows:

Safety

Strengthened Supervision: Tighten supervision in the production area to ensure that operators remain focused and avoid disruptive activities, such as talking or joking during the process.

- *Workplace Safety Training*: Conduct regular training on workplace safety procedures and emphasize the importance of focus during work to reduce accident risks.
- *Incident Reporting System Implementation*: Introduce a system for reporting incidents or near-accidents to identify and address potential risks before serious accidents occur.
- *Strategic Placement of Standard Operating Procedures (SOPs)*: Display SOPs in easily accessible and visible locations for operators to reference while working.

Quality

- *Rigorous Quality Control*: Enhance quality supervision with layered inspection systems, where each production stage is monitored to ensure quality standards are met.
- *Routine Training on SOPs and Product Characteristics*: Provide regular training on SOPs and product specifications to ensure consistent and deep understanding among all operators.
- *Comprehensive Product Information Provision*: Make complete product information easily accessible to operators to prevent errors due to lack of information.
- *Kaizen Implementation*: Apply Kaizen principles to encourage continuous improvement through feedback from operators and the work team, allowing quick identification and rectification of any errors or defects.
- *Internal Checklist and Audit System*: Regularly implement internal checklists and audits to ensure adherence to procedures and maintain product quality.

Cost

- *Daily Machine Setting Checks*: Verify machine settings daily to ensure they remain at the initial configuration. Changes in settings can impact the type of garments produced and should align with customer preferences.
- *Collaboration with Fabric Suppliers*: Establish collaboration between the garment manufacturer and fabric suppliers to meet fabric requirements during clothing production. Effective collaboration facilitates finding suitable materials at more affordable prices.

Delivery

- *Order Processing Automation*: Utilize Enterprise Resource Planning (ERP) software or order management systems to expedite and automate order processing, reduce human errors, and streamline workflows.
- *Kanban Technique Implementation*: Implement the Kanban technique to organize production, ensuring that only what is needed is produced when needed.
- *Real-Time Tracking Adoption*: Employ real-time tracking to monitor deliveries. In case of delays or road issues, the company can promptly arrange alternatives.

Morale

- *Product Knowledge Training*: Provide production workers with a deep understanding of products, raw materials, and machinery used. This reduces errors due to human error and prevents production mistakes leading to product failures and wasted time and materials.

- *Strict Supervision*: Enhance supervision and enforce strict discipline policies related to behavior during the production process.
- *SOP Socialization*: Regularly communicate and refresh knowledge about applicable SOPs, conducting periodic inspections to ensure compliance.
- *Shift Scheduling and Break Times*: Organize work shifts with sufficient breaks and create a conducive work environment by providing dedicated rest areas.

Productivity

- *Quality Control*: Implement a rigorous and structured quality control system.
- *Employee Training*: Regularly schedule training sessions for employees on proper sewing techniques, thread and needle component installation.
- *Detailed SOPs*: Develop and apply detailed and clear Standard Operating Procedures (SOPs) for all production stages.
- *Sanitation Enhancement*: Increase awareness of sanitation through educational programs, training, and enforcement among employees, ensuring a clean work environment.

Environment

- *Improved Lighting*: Install additional or brighter lights in the production area to ensure optimal working conditions.
- *Equipment Arrangement*: Organize and arrange equipment neatly and systematically to enhance work efficiency.
- *Workplace Organization*: Implement the 5S principles (Sort, Set in order, Shine, Standardize, Sustain) to maintain workplace tidiness and order.
- *Production Area Cleanliness*: Schedule regular cleaning routines to maintain a clean production area.
- *Warehouse Hygiene*: Conduct routine cleaning and organization in the storage warehouse.

4. Conclusion

This study highlights the challenges faced by PT. XYZ in the garment industry, particularly concerning process inconsistency, production waste, and difficulties in meeting customer demands. To address these issues, the Lean Manufacturing approach with the SQCDMPE method was employed to identify and minimize waste causes, enhance operational efficiency, and improve product quality.

Recommended improvements include strengthening safety supervision, enhancing quality control, optimizing cost management, ensuring timely delivery, and efforts to boost employee morale and productivity. Implementing rigorous SOPs, using Kanban techniques, and improving cleanliness and lighting in the production area are also suggested.

By applying these approaches, PT. XYZ aims to enhance its competitiveness in the global market by reducing waste, improving production efficiency, and ensuring higher product quality

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