

# Implementation of Lean Manufacturing in Increasing Production Efficiency in Small and Medium Enterprises (SMEs) of Hand-drawn Batik in Malang City

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## Abstract

This study aims to analyze the implementation of lean manufacturing in batik SMEs in Malang City in order to improve the efficiency of the production process. The research method uses a case study approach on three different batik SMEs, with data collection techniques in the form of observation, in-depth interviews, and questionnaires. The results of the study indicate that the lean 5S principle and waste identification can reduce waiting time between processes and improve work layout. However, limitations in mastering technology and production management are still major obstacles. Recommendations are given in the form of ongoing training and mentoring based on the specific needs of batik SMEs.

**Keywords:** Lean Manufacturing, UKM, efisiensi produksi, 5S, Value Stream Mapping (VSM)



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## Introduction

Small and medium industries (SMEs) have a strategic role in the Indonesian economy, especially in job creation and preserving local culture. One of the SME sectors that continues to survive and develop is the hand-drawn batik industry, including in Malang City. Small and Medium Enterprises (SMEs) in Malang City are important pillars in local economic development. Based on data from the Malang City Cooperative and SME Service, there are thousands of SME units operating in various sectors, dominated by culinary, fashion, and crafts, including hand-drawn batik. The existence of SMEs not only contributes to the absorption of labor, but is also part of the preservation of cultural heritage. However, this sector faces various challenges in terms of production efficiency, quality, and competitiveness. Many batik SMEs still use traditional production methods that tend to be less efficient and not well documented, so they tend to be inefficient. Common problems faced include less than optimal work layout, long processing times, and lack of standardization of procedures. This results in low productivity and relatively high production costs. Therefore, a modern production management approach is needed, such as Lean Manufacturing, which can be adapted to the characteristics of SMEs, without requiring radical changes to the manual and traditional processes that have been used so far.

Lean Manufacturing is a systematic approach that aims to improve the efficiency of the production process by identifying and eliminating waste at every stage of the process. This concept was first introduced by the Toyota Production System and then popularized globally by Womack and Jones (1996). Lean emphasizes creating value from the customer's perspective using fewer resources. There are seven types of waste (*muda*) classified in Lean, namely: production that exceeds market demand, causing excess stock, unproductive waiting time between processes, unnecessary movement of goods/materials, excessive work processes that do not add value, accumulation of raw material

inventory, semi-finished goods, or finished products, inefficient worker or machine movements, and defective products that require rework or disposal.

The principles of lean 5S and Value Stream Mapping can be flexibly applied to small-scale industries, including those based on hand-drawn batik crafts. The application of lean principles is expected to help batik SMEs improve operational efficiency without having to change the traditional and artistic character of their production. This study aims to analyze the extent to which the application of Lean Manufacturing, especially the 5S principle, can improve production efficiency in hand-drawn batik SMEs in Malang City. The main focus of the study is on identifying waste that occurs in the production process and improvements that can be applied through a lean approach.

The application of Lean Manufacturing in the hand-drawn batik sector has proven effective in reducing waste and increasing efficiency, although the production process is traditional and highly dependent on manual labor. The hand-drawn batik industry in Malang City, as one of the SME sectors that maintains a distinctive skill-based coloring technique, faces quite complex production efficiency challenges. However, the lean approach can be adapted contextually without requiring high-tech investment.

Lean Manufacturing, as stated by Rother and Shook (2003), emphasizes more on process understanding and value stream visualization than reliance on automation. In other words, lean principles focus on eliminating waste (*muda*) through process mapping and worker involvement in continuous improvement. In the context of hand-drawn batik, lean adaptation is applied primarily through the basic principles of 5S (*Seiri, Seiton, Seiso, Seiketsu, and Shitsuke*) and Value Stream Mapping (VSM).

Through the implementation of 5S, batik SMEs rearrange their work areas to be cleaner, more orderly, and efficient. The canting, wax, and dyeing tools are arranged according to the process sequence to minimize search time. The *Seiketsu* and *Shitsuke* principles encourage workers to maintain work standards consistently and be disciplined in maintaining neatness. On the other hand, value stream mapping (VSM) helps identify activities that do not add value, waiting time between processes or inefficient transfer of goods. For example, before the implementation of lean, the coloring process in several batik SMEs required a waiting time of 2-3 days due to limited space and the irregularity of the work area. After the rearrangement and implementation of 5S, the waiting time was successfully reduced to 1 day, so that the production cycle became faster. This shows that lean can significantly improve production performance without changing the basic nature of production which is manual and artistic. Thus, the implementation of lean manufacturing in batik SMEs not only improves operational efficiency, but also forms a more productive and organized work culture. The implementation of lean is based on process awareness

and work discipline can be the right strategy in encouraging the competitiveness of traditional SMEs in an increasingly competitive industrial era.

## **Methods**

### *Research Design*

This study uses a case study approach with mixed methods that combines qualitative and quantitative techniques. This approach was chosen to obtain a comprehensive picture of the implementation of Lean Manufacturing in batik SMEs in Malang City (Creswell, 2014).

### *Research Location and Subjects*

The study was conducted in three batik SMEs located in Blimbing, Kedungkandang, and Lowokwaru Districts, Malang City. Subject selection was carried out purposively, with the criteria that the SMEs:

- (1) have been actively producing batik for at least the last two years,
- (2) have more than five workers,
- (3) are willing to undergo direct observation and interviews.

### *Data Collection Techniques*

Data collection was carried out using three main methods. Direct observation, to identify production flow, work layout, and potential waste (Rother & Shook, 2003). Semi-structured interviews, conducted with business owners and workers to understand work processes and challenges faced. Questionnaires, distributed to workers to evaluate knowledge and application of 5S principles and perceptions of work efficiency.

### *Research Instruments*

The research instruments consisted of:

Waste observation checklist based on seven types of waste (muda): overproduction, waiting, transport, over-processing, inventory, motion, and defects (Womack & Jones, 1996).

Value Stream Mapping (VSM), to describe the initial conditions and after lean intervention.

5S is a visual management method for creating and maintaining a clean, tidy, and efficient workplace.

The term 5S comes from five Japanese words:

1. Seiri – Sort (Separate necessary and unnecessary items)
2. Seiton – Arrange (Arrange items so they are easy to find and use)
3. Seiso – Sweep (Clean the workplace regularly)
4. Seiketsu – Standardization (Create standards to maintain the first 3S)
5. Shitsuke – Synergy / Discipline (Cultivate good habits and adhere to standards)

5S Questionnaire, with a Likert scale to assess the condition of the work area

Criteria Score

- 1 Not implemented at all
- 2 Implemented inconsistently
- 3 Implemented but not well documented
- 4 Implemented consistently and documented
- 5 Very well implemented, sustainable and there is innovation

### *Data Analysis Techniques*

Qualitative data were analyzed using thematic techniques, while quantitative data were analyzed descriptively. Comparisons were made between conditions before and after lean interventions on the following parameters: production cycle time, amount of waste identified, and productivity level (units/employee/month). The analysis was performed using Microsoft Excel and simple process mapping software to support visualization of results (before-after analysis).

## **Results and Discussions**

### **1. Results**

The following is a Fishbone diagram (Ishikawa Diagram) for the problem Implementation of Lean Manufacturing in Increasing Production Efficiency in Small and Medium Enterprises (SMEs) of Hand-drawn Batik in Malang City with a focus on the implementation of Lean Manufacturing as a solution.

## Implementation of Lean Manufacturing in Increasing Production Efficiency

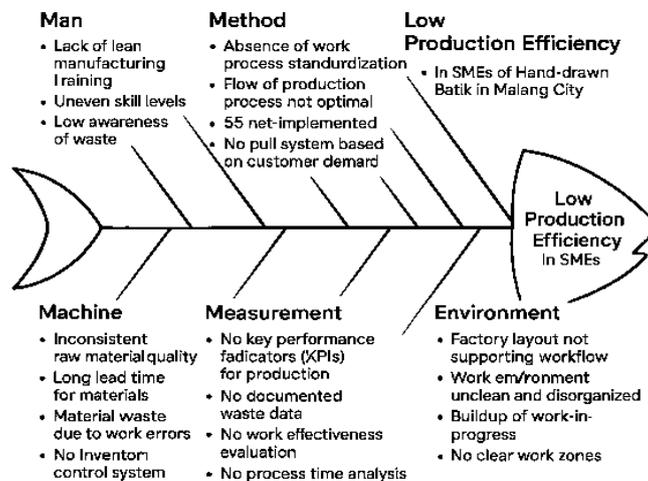


Figure 1. Fishbone diagram (Ishikawa Diagram)

Based on figure 1 the problem of low production efficiency in Small and Medium Enterprises (SMEs) of Batik Tulis in Malang City can be analyzed using the Fishbone Diagram approach, which groups the causal factors into six main categories: manpower, method, material, machine/equipment, measurement, and work environment. In terms of manpower, it was found that most workers have not received adequate training related to the principles of Lean Manufacturing. Uneven skills and minimal awareness of non-productive activities or waste also contribute to low productivity. In addition, the involvement of workers in the continuous improvement process is still limited. In terms of methods, the production process is generally not standardized, does not flow efficiently, and has not consistently implemented the 5S principle (Seiri, Seiton, Seiso, Seiketsu, Shitsuke). The work process is also still based on a push system, without considering real-time customer demand. This causes an imbalance between production capacity and market needs. In terms of materials, problems arise due to unstable raw material quality, late supply, and high levels of waste due to errors in processing. In addition, suboptimal inventory management causes material accumulation and waste of space and time.

Furthermore, in terms of machinery and equipment, SMEs still rely heavily on traditional tools that have low efficiency, long setup times, and high levels of damage. The absence of the Total Productive Maintenance (TPM) system and visual control also worsen the performance of production equipment. In terms of measurement, the majority of SMEs do not yet have structured Key Performance Indicators (KPIs) to measure production effectiveness. Work evaluation and waste recording have not been carried out systematically, and a comprehensive process time analysis has not been implemented.

Finally, work environment factors also contribute to low efficiency. The layout of the work area does not support a smooth process flow, the condition of the workplace is poorly organized, and there is often a pileup of semi-finished products. The absence of clear work area marking and grouping of work activities causes disruption in the production flow. By identifying these factors, the comprehensive implementation of Lean Manufacturing becomes a strategic step to increase production efficiency, reduce waste, and strengthen the competitiveness of Batik Tulis SMEs in Malang City.

### *Identification of Waste in the Production Process*

The results of the observation show that all SMEs of hand-drawn batik that were the objects of the study experienced seven types of waste (seven wastes) as explained by Womack and Jones (1996). The most dominant waste is:

Waiting workers often wait for dry cloth, dyes, or their turn to use the wax stamp tool. Motion (inefficient movement) unorganized work areas cause workers to often walk far to get tools or materials. Inventory raw materials are stored in large quantities without planning, causing accumulation and risk of damage. The following table summarizes the number of waste findings per type:

Table 1. Waste findings per type

Type of Waste	Average Frequency per Day Percentage of Total Waste	Type of Waste	Average Frequency per Day Percentage of Total Waste	Type of Waste	Average Frequency per Day Percentage of Total Waste
Waiting		8 incidents		34%	
Motion		6 incidents		25%	
Inventory		4 incidents		17%	
Transport		3 incidents		13%	
Over-processing		1 incident		6%	
Defect		1 incident		3%	
Overproduction		0 incidents		0%	

After the implementation of the 5S principle and the restructuring of the work layout based on the flow-oriented approach, there were several significant improvements, namely: The production cycle time was reduced from an average of 7 days to 5 days per unit of batik cloth. The distance traveled by workers during the production process was reduced by 38% after the layout was improved using the spaghetti diagram approach. The amount of waste decreased by 41% in This finding is in line with a study by Suryanto (2021), which shows that lean can increase efficiency by up to 25% in the small-scale batik industry.

#### *Worker Perception of 5S*

The questionnaire results showed that 82% of respondents felt that the work area was more comfortable and tidy after implementing the 5S principle. In addition, 76% stated that they could work faster because tools and materials were easier to find.

Table 2. 5S Questionnaire Results

No	Questionnaire Question	Number of Respondents Who Agree	Total Respondents	Percentage (%)
1	Has the work area become more comfortable and tidy after implementing 5S?	41	50	82%
2	Do you feel that you can work faster because the tools and materials are more organized?	38	50	76%
3	Is the cleanliness of the work area maintained routinely?	40	50	80%
4	Is it easier for you to find work equipment since implementing the 5S principle?	37	50	74%
5	Do you know and follow the 5S work standards or work procedures?	35	50	70%

6	Do you feel more disciplined in maintaining neatness and cleanliness of the work?	33	50	66%
7	Do you actively participate in maintaining an orderly work environment?	36	50	72%

Total Average Score =  $(82\% + 76\% + 80\% + 74\% + 70\% + 66\% + 72\%) / 7 = 74.3\%$

Based on table 2, the average level of acceptance and impact of the 5S principles on comfort, efficiency, and cleanliness of the work area is 74.3%, which is quite good but still requires strengthening, especially in the aspects of standardization and discipline (Shitsuke).

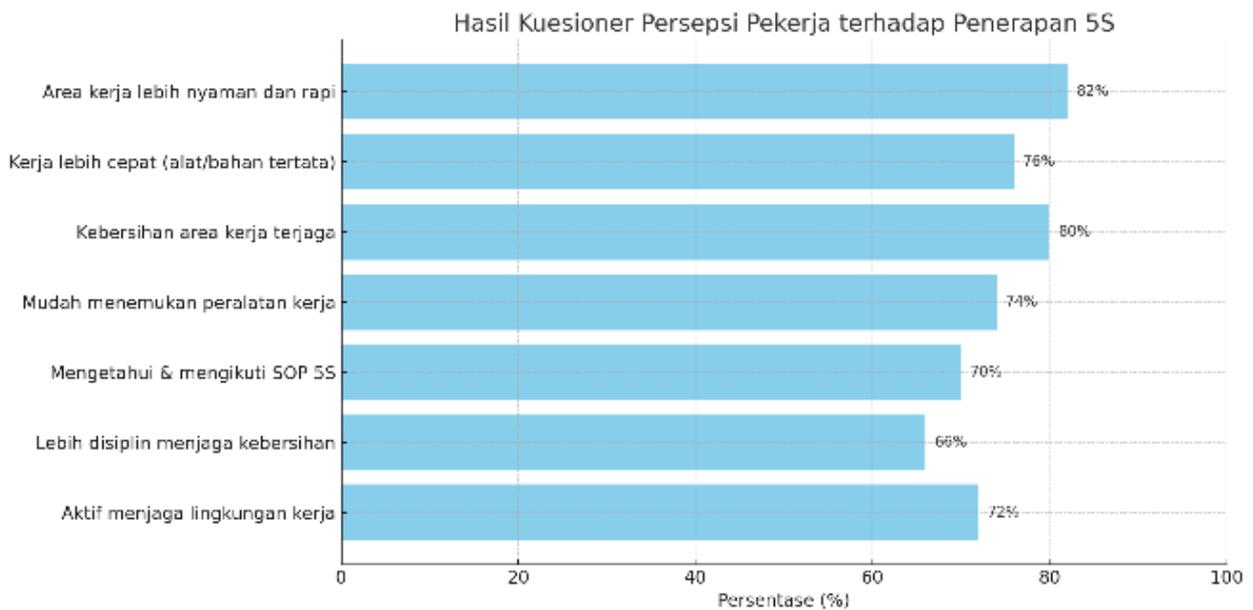


Figure 2. Results of the worker perception questionnaire regarding the implementation of the 5S principles.

### Lean Implementation Challenges

Although the benefits of lean are quite significant, several obstacles have also been found in the implementation process, including: Resistance to change, especially from senior workers who are accustomed to the old system, Lack of documentation of procedures, causing inconsistencies in the implementation of daily activities and Limited knowledge of lean, both among owners and workers. According to Shah and Ward (2007), the success of lean is highly dependent on the culture of the organization and the involvement of all levels in the continuous improvement process. SMEs often have limitations in:

#### 1. Resource Limitations

Investment funds for lean training and supporting equipment, Skilled workforce that understands lean concepts and Physical infrastructure to support efficient production layouts. (Womack & Jones, 1996) emphasize that lean requires long-term commitment and competency development, which are not always available in SME environments.

#### 2. Lack of Understanding of Lean Concepts

Many SMEs do not fully understand the basic principles of lean value stream, pull system, or continuous improvement (kaizen), so they tend to carry out half-hearted implementations without real results.

#### 3. Lack of Supportive Work Culture

Cultural change from conventional to lean work systems requires high commitment and discipline. Workers are often reluctant to change because they feel the old method is more comfortable or because they do not see the benefits of lean directly.

#### 4. Difficulty in Process Standardization

SMEs often rely on individual skills rather than standardized processes.

Work processes are not documented, making it difficult to implement Standard Work, which is one of the pillars of lean.

#### 5. Lack of Managerial Support

SME owners or managers often have not made lean a primary business strategy. The decision to implement lean is often reactive, not strategic.

#### 6. Resistance to Change

The implementation of lean tools 5S, Kanban, or Value Stream Mapping (VSM) is sometimes considered to increase the workload.

Employees need time and a persuasive approach to accept change.

#### 7. Lack of Performance Measurement

Many SMEs do not have performance indicators or historical production data that can be used to objectively evaluate the impact of lean.

## 2. Discussion

The application of Lean Manufacturing in the hand-drawn batik sector has proven effective in reducing waste and increasing efficiency despite its traditional and labor-intensive nature. Lean adaptation in SMEs does not always require high technology, but rather more on understanding the workflow and discipline in applying the basic principles of 5S and value mapping (Rother & Shook, 2003). The application of Lean Manufacturing in the hand-drawn batik sector has proven effective in reducing waste and increasing efficiency, although the production process is traditional and highly dependent on manual labor. The hand-drawn batik industry in Malang City, as one of the SME sectors that maintains a distinctive skill-based coloring technique, faces quite complex production efficiency challenges. However, the lean approach can be adapted contextually without requiring high-tech investment.

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## Conclusion

The implementation of Lean Manufacturing in batik tulis SMEs in Malang City has been proven to increase production efficiency through waste elimination and improvement of work process governance. The success of lean implementation requires active involvement of SME management and ongoing mentoring.

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