ISSN 2962 - 2069
JISEM
Journal of Industrial System Engineering and Management.

Journal of Industrial System Engineering and Management Vol 4 No 1 June, 2025

Transforming Small-Scale Garment Production: Lean Manufacturing and VSM Strategies for Enhanced Productivity in Makassar's MSMEs

Asrul Fole[1], Khoerun Nisa Safitri[2*]

[1,] Departemant Industrian Engineering, Muslim University Indonesia, Indonesia.

[2*,] Departemant Logistic Engineering, Ibnu Sina University, Indonesia.

ARTICLE INFORMATION

Riwayat Artikel:

Received: April 3, 2025
Revised: may 20, 2025
Accepted: June 4, 2025

Keyword:
Lean Manufacturing,
Value Stream Mapping,
Productivity,
MSMEs,
Garment Industry.

***Penulis yang sesuai**

Nama : Khoerun Nisa Safitri
E-mail: khoerunnisas@uis.ac.id

ABSTRACT

This study investigates the application of Lean Manufacturing and Value Stream Mapping (VSM) to enhance productivity in micro, small, and medium enterprises (MSMEs) within the garment sector in Makassar. It focuses on identifying and reducing waste by analyzing cycle times and activity mapping to reveal bottlenecks that impede operational efficiency. The results indicate that implementing Lean principles can significantly improve production processes, evidenced by a reduction in cycle time from 31,619.2 seconds to 29,009.2 seconds after applying the method. Additionally, the research emphasizes the importance of eliminating non-value-added activities and integrating advanced technologies, such as automation and real-time tracking systems, to further boost efficiency. These findings provide valuable insights for industry practitioners and practical guidance for optimizing production processes, leading to a reduction of 2,610 seconds. By adopting Lean strategies, garment MSMEs in Makassar can enhance their competitiveness in a challenging market while contributing to regional economic development. This study aims to serve as a reference for researchers, practitioners, and policymakers in their efforts to create a more efficient and sustainable garment industry in Indonesia.

http://dx.doi.org/10.30656/jisem.v4i1.41

INTRODUCTION

The garment industry is a strategic sector that supports economic growth in Indonesia, particularly within the Small and Medium Enterprises (MSMEs) scale. This sector not only absorbs local labor but also contributes to regional income through the production of clothing for both domestic needs and exports [1]. However, many garment MSMEs, especially in regions like Makassar, face challenges in production process efficiency, often due to high levels of waste at various stages of production [2]. This waste includes waiting times, overproduction, defects, and suboptimal resource utilization, ultimately impacting productivity and competitiveness [3].

In addressing these challenges, the Lean Manufacturing approach has emerged as a widely adopted solution in both manufacturing and service industries [4]. The Lean Manufacturing concept focuses on identifying and eliminating waste to create added value for customers [5]. One of the primary tools in implementing Lean Manufacturing is Value Stream Mapping (VSM), which allows for a comprehensive analysis of material and information flow within the production process. By utilizing VSM, garment MSMEs can identify critical areas that require improvement and develop data-driven optimization strategies [6].

The application of Lean Manufacturing and VSM in the garment MSME sector holds significant potential for enhancing operational efficiency and productivity. However, limitations in understanding the concepts, human resources, and access to technology often pose major obstacles to the implementation of these strategies at the MSME level [7]. Therefore, in-depth studies are needed to examine how these approaches can be effectively applied in the garment sector, particularly in Makassar, while considering local characteristics and specific industry needs.

Makassar, as one of the economic centers in Eastern Indonesia, hosts numerous garment MSMEs that have the potential to drive regional economic growth. However, the lack of adoption of efficient operational strategies has hindered their ability to compete in an increasingly competitive market [8]. Through the implementation of Lean Manufacturing and VSM methods, garment MSMEs in Makassar can optimize resource utilization, minimize waste, and enhance overall productivity. This not only supports business sustainability but also improves the competitiveness of MSMEs at both national and international levels [9].

Previous research on Lean Manufacturing and Value Stream Mapping (VSM) in small-scale garment production highlights the effectiveness of VSM in identifying and reducing waste, improving operational efficiency, and enhancing productivity [10]. Studies have demonstrated its application in various contexts, showcasing its potential to optimize processes and support competitiveness in the garment industry [11]. Furthermore, research conducted in the clothing sector has illustrated how VSM can lead to significant improvements in production workflows by pinpointing inefficiencies and streamlining operations. For instance, a study focused on a garment manufacturing company in India revealed that implementing VSM resulted in a 30% reduction in lead time and a notable increase in overall equipment effectiveness [12]. These findings underscore the relevance of VSM as a critical tool for garment SMEs in Makassar, where similar challenges of waste and inefficiency persist.

Additionally, earlier studies have emphasized the importance of adapting Lean principles to local contexts, particularly in developing regions. By tailoring Lean Manufacturing strategies to the specific needs and characteristics of the garment industry in Makassar, researchers can provide valuable insights that not only enhance productivity but also foster sustainable growth. This body of work supports the current research's objective of exploring how Lean Manufacturing and VSM can be effectively implemented in the local garment sector, ultimately contributing to the broader economic development goals of the region [13].

This research aims to analyze the application of Lean Manufacturing and Value Stream Mapping in identifying and reducing waste in the production processes of garment MSMEs in Makassar. The findings of this study are expected to provide practical guidance for business practitioners to optimize productivity while strengthening the position of garment MSMEs as a key sector in regional economic development.

RESEARCH METHODS

This study employs a descriptive qualitative approach with a case study on one of the garment MSMEs in Makassar. The Lean Manufacturing method is applied using the Value Stream Mapping (VSM) tool to identify the value stream in the production process and to identify various types of waste [14]. The data collection in this research is divided into two categories: primary data, which is obtained from observation activities, interviews, and direct data acquisition in the form of production process steps, production processing times, labor numbers, and activity categories in production, which are recorded in the Current Data observation sheet. The second category is waste weighting data, which is obtained through interviews with several informants who are experts in the production process at the MSME. Secondary data is collected from the internet, reference books, journals, or literature related to the research as a basis for problem-solving. The required data includes company profile data, labor numbers, and production flow.

After the data is collected, data processing analysis for optimizing the production process using Lean Manufacturing and Value Stream Mapping is conducted through the following stages:

1. Cycle Time of the Production Process
2. Activity Mapping Process
3. Current State Value Stream Mapping (CVSM)
4. Waste Weighting
5. Future State Value Stream Mapping (FVSM)

RESULTS AND DISCUSSION

A. Results of Cycle Time Determination for the Production Process

The determination of the cycle time for the production process was conducted by directly calculating each activity and performing tests on each data activity, including data sufficiency tests and data uniformity tests. By determining the test data, it can be concluded that the data is considered sufficient and uniform, not exceeding the control limits of UCL (Upper Control Limit) and LCL (Lower Control Limit). The results of the cycle time determination for the production process are as follows:

Table 1. Results of Cycle Time Calculation for the Production Process

Production Process	Activity	Kode	Time (Secon)	Total Time (Secon)
Production Planning	Ordering: Customers submit product specifications, such as design, size, quantity, and type of material.	PP1	850,2	3031,2
	Scheduling: The garment SME determines the production schedule based on the agreed deadline with the customer.	PP2	501	
	Material Procurement: Fabrics, threads, accessories (such as buttons or zippers), and other supplies are prepared.	PP3	1100	
	Moving materials to the next process	PP4	180	
Fabric Cutting	Pattern Making: Patterns are created based on the desired design and size. These can be made manually or using design software (e.g., Corel Draw).	FC1	2700	4920
	Cutting: The fabric is cut according to the pattern using manual cutting tools or automatic cutting machines to produce precise fabric pieces.	FC2	2100	
	Moving materials to the next process	FC3	120	
Printing/ Embroidery	Printing: If the clothing requires a design or logo, printing is done on the fabric pieces before sewing.	PE1	2700	5520
	Embroidery: An alternative is embroidery, usually used for logos or specific ornaments on the fabric.	PE2	2700	
	Moving materials to the next process	PE3	120	
Sewing	The prepared fabric pieces are joined together through the sewing process.	S1	2600	7440
	This process is carried out in stages, such as sewing the body, sleeves, and then assembling all parts of the garment.	S2	2700	
	Each stage of sewing is often inspected to ensure the quality of the stitches.	S3	900	

Production Process	Activity	Kode	Time (Secon)	Total Time (Secon)
	Moving materials to the next process	S4	240	
Initial Quality Check	The sewn products are inspected to ensure there are no stitching defects, loose threads, or untidy parts.	IQC1	318	760
	If issues are found, the products will be repaired before proceeding to the next stage.	IQC2	210	
	Moving materials to the next process	IQC3	240	
Finishing	Accessory Installation: This stage includes adding additional elements such as buttons, zippers, labels, or brand tags.	F1	3600	6300
	Ironing: The clothing is ironed to appear neat and ready for packaging.	F2	600	
	Folding and Packaging: The products are neatly folded and packaged according to customer requests, either in plastic or special packaging.	F3	1800	
	Moving materials to the next process	F4	300	
Final Quality Check	The finished products are re-inspected to ensure quality meets the standards desired by the customer.	FQC1	900	1740
	This process is important to ensure customer satisfaction and minimize complaints.	FQC2	600	
	Moving materials to the next process	FQC3	240	
Shipping	The finished and packaged products are delivered to the customers according to the agreed schedule.	S1	1500	3300
	In some cases, delivery can be done directly or through logistics services.	S2	1800	

In Table 1 above, it can be observed that the determination of cycle times for each activity in the production process begins with the Production Planning stage, which takes a total of 2,851.2 seconds. The subsequent stages include Fabric Cutting, which requires 4,800 seconds; Printing/Embroidery (Optional), totaling 5,400 seconds; Sewing, which takes 7,200 seconds; Initial Quality Check, requiring 520 seconds; Finishing, which takes 6,000 seconds; Final Quality Check, totaling 1,500 seconds; and Shipping, which requires 3,300 seconds. The production process involves 10 workers, and the working time set by the garment MSME is 9 hours, equivalent to 32,400 seconds. This detailed breakdown of cycle times highlights the areas where efficiency can be improved, aligning with the objectives of Lean Manufacturing to minimize waste and enhance productivity.

The findings from this analysis reinforce previous research that emphasizes the importance of optimizing production processes in the garment industry [4]. Studies have shown that by identifying and addressing inefficiencies, such as excessive cycle times in specific activities, MSMEs can significantly improve their operational performance [11]. For instance, the application of VSM has been proven to facilitate the identification of bottlenecks and waste, leading to more streamlined workflows. By implementing the insights gained from this study, garment MSMEs in Makassar can enhance their competitiveness in the market, ultimately contributing to the broader economic development goals of the region.

B. Analysis of Activity Mapping Process

In determining the results of the activity mapping process, necessary information is provided for each activity, including distances and inventory levels for each production process. The activity mapping is categorized into five types of activities: operation, transportation, inspection, delay, and storage. The results are as follows:

Table 2. Analysis of Activity Mapping Process

NO	Code	Equipment/Tool	Time (Secon)	Activity O	T	I	S	D	VA/NVA/N NVA
1	PP1	Computer	850,2	✓					VA
2	PP2	Computer	501	✓					VA
3	PP3	Manual	1100	✓					VA
4	PP4	Manual	180		✓				NVA

 http://dx.doi.org/10.30656/jisem.v4i1.41

NO	Code	Equipment/Tool	Time (Secon)	Activity					VA/NVA/NNVA
				O	T	I	S	D	
5	FC1	Computer	2700	✓					VA
6	FC2	Band Knife, Rotary Cutter	2100	✓					VA
7	FC3	Manual	120		✓				NVA
8	PE1	Printing Machine	2700	✓					VA
9	PE2	Sewing Machine	2700	✓					VA
10	PE3	Manual	120		✓				NVA
11	S1	Sewing Machine	3600	✓					VA
12	S2	Sewing Machine	2700	✓					VA
13	S3	Manual	900			✓			NVA
14	S4	Manual	240		✓				NVA
15	IQC1	Manual	318			✓			NVA
16	IQC2	Manual	210					✓	NNVA
17	IQC3	Manual	240		✓				NVA
18	F1	Sewing Machine/Manual	3600	✓					VA
19	F2	Iron	600	✓					VA
20	F3	Manual	1800				✓		NVA
21	F4	Manual	300		✓				NVA
22	FQC1	Manual	900			✓			VA
23	FQC2	Manual	600					✓	NNVA
24	FQC3	Manual	240		✓				NVA
25	S1	Car/Motorcycle	1500		✓				VA
26	S2	Transportation Services	1800					✓	NNVA

In Table 2 above, it can be observed that the determination of the activity mapping process reveals the number of activities categorized as O (Operation), which includes 10 processes with a total working time of 22,051.2 seconds. The T (Transportation) category consists of 3 processes with a working time of 4,800 seconds, while I (Inspection) includes 3 processes with a total working time of 2,118 seconds. The S (Storage) category has 1 process with a working time of 1,800 seconds, and D (Delay) comprises 2 processes with a total working time of 810 seconds. Furthermore, the analysis of Value Added (VA) activities shows that there are 14 activities in the production process with a cumulative working time of 27,751.2 seconds. In contrast, Non-Value Added (NVA) activities consist of 3 activities with a working time of 2,118 seconds, and Non-Necessary Value Added (NNVA) includes 2 activities with a total working time of 810 seconds.

These findings align with previous research that emphasizes the significance of distinguishing between value-added and non-value-added activities in production processes. By identifying and quantifying these activities, MSMEs can better understand where improvements can be made to enhance efficiency and reduce waste [14]. Studies have shown that focusing on value-added activities not only streamlines operations but also contributes to overall productivity and profitability [11]. The insights gained from this analysis can guide garment SMEs in Makassar to implement Lean Manufacturing principles effectively, ultimately leading to improved operational performance and competitiveness in the market.

C. Analysis of Current State Value Stream Mapping (CVSM) Determination

Based on the results obtained from the previous activity mapping process, the Current State Value Stream Mapping (CVSM) activities are illustrated as follows. CVSM is a tool used to analyze and visualize the flow of value in the production process, with the aim of identifying areas that require improvement. By mapping the current state, CVSM helps organizations understand the contribution of each step to the final value received by the customer. This process involves collecting data on cycle times, waiting times, and non-value-added activities, allowing for the identification of waste. This information enables the team to design strategies to reduce waste and improve efficiency. Additionally, CVSM facilitates better communication among team members, providing a clear picture of the existing processes and serving as a foundation for improvement steps to achieve optimal efficiency in production.

http://dx.doi.org/10.30656/jisem.v4i1.41

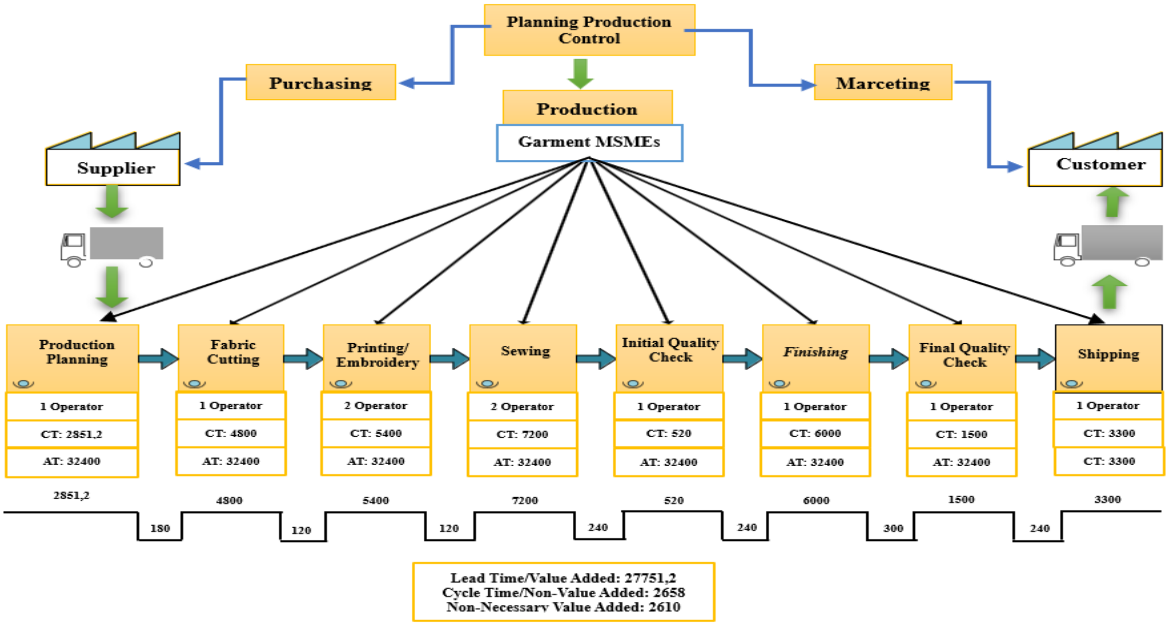

Fig. 1. Current State Value Stream Mapping (CVSM)

In Figure 1 above, it can be observed that the illustration of the CVSM reveals a total lead time of 27,751.2 seconds, a cycle time of 2,658 seconds, and a Non-Necessary Value Added (NNVA) time amounting to 2,610 seconds. This data provides a comprehensive overview of the current production process, highlighting areas where time is spent and identifying potential inefficiencies that can be addressed to improve overall performance.

These findings are consistent with previous research that emphasizes the importance of analyzing lead times and cycle times in production environments. By understanding these metrics, organizations can pinpoint bottlenecks and areas of waste, allowing them to implement targeted improvements [12]. Studies have shown that reducing NNVA time is crucial for enhancing operational efficiency and increasing competitiveness in the market. The insights gained from this CVSM analysis can serve as a foundation for garment MSMEs in Makassar to adopt Lean Manufacturing practices, ultimately leading to streamlined processes and better resource utilization.

D. Weighting of Waste

In the process of weighting waste, observations were conducted on all workers in the garment MSMEs in Makassar using a questionnaire instrument. The data obtained from the questionnaire were analyzed using the Borda method to determine the importance level of each factor. The seven types of waste considered are overproduction, delay, transportation, processes, inventories, motions, and defective products. The application of the Borda method begins with assigning ranks from 1 to 7, where rank 1 indicates the highest level of importance and rank 7 indicates the lowest. After the ranking process is completed, the next step is to calculate the weights based on the ranking results obtained.

Table 3. Results of Weighting the 7 Wastes in Garment SMEs

Type of Waste	**Ranking**							**Total**	**Rank**
	1	**2**	**3**	**4**	**5**	**6**	**7**		
Overproduction	0	2	3	5	6	1	0	50	6
Delay	5	4	3	2	1	0	0	70	1
Transportation	4	3	4	1	2	1	0	63	2
Processes	2	3	3	2	3	1	0	52	4
Inventories	2	3	4	5	1	1	0	61	3
Motions	1	2	4	5	1	2	0	51	5

Type of Waste	Ranking							Total	Rank
	1	2	3	4	5	6	7		
Defect Products	0	1	3	4	3	1	2	36	7
Weight	6	5	4	3	2	1	0	383	

In Table 3 illustrates the weighting results of the 7 wastes in garment MSMEs, revealing that Delay has the highest waste value at 70, ranked 1, while Defect Products has the lowest at 36, ranked 7. This categorization provides a clear visualization of waste ranking, enabling targeted interventions for the most significant issues in the production process. These findings are consistent with previous research emphasizing the detrimental impact of delays on operational efficiency, as they contribute to increased lead times and reduced productivity. Although defective products are a concern, their lower ranking indicates they may not be as urgent as delays. By prioritizing the most critical waste factors, garment MSMEs can implement effective strategies to enhance processes, ultimately improving performance and competitiveness in the market.

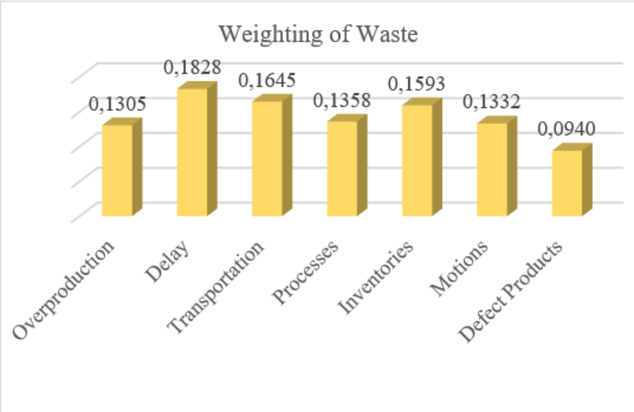

Fig. 2. Graph of Weighting the 7 Wastes

In the graph shown in Figure 2 above, minimizing waste delay in small-scale garment production is crucial for enhancing efficiency and sustainability. By implementing lean production techniques and utilizing AI for demand forecasting, factories can significantly reduce overproduction and material waste, ultimately leading to cost savings and a smaller environmental footprint. Research indicates that the highest weighted waste in the garment industry is waste delay, with a significant weight of 0.1828. This finding highlights the need for MSMEs in the garment sector to minimize delays. Effective training and quality control can improve operational efficiency and reduce waste delays, enhancing productivity and competitiveness [15]. Additionally, integrating advanced technologies like Artificial Intelligence can optimize production through better planning and resource allocation. Addressing waste delays not only results in financial savings but also meets the growing demand for sustainable practices in manufacturing. By prioritizing waste reduction, garment producers can improve their performance while attracting environmentally conscious consumers.

E. Proposed Improvements for Waste

Improvements to waste delay can be implemented through policies established by SMEs. The following proposals aim to support SMEs in developing effective strategies to reduce non-value-added activities, thereby enhancing operational efficiency and reducing cycle time in the production process within the garment sector in Makassar. By applying improvement methods using the 5 W + 1 H approach, differences in processing times before and after improvements can be identified.

Waste delay occurs when there are activities that do not add value, leading to delays in production and distribution processes. The transportation model for each line still relies on manual activities, resulting in significant wasted time. In IQC2, delays arise from repeated inspections or inefficient repairs, prolonging production time before products can move on to the next stage. In FQC2, which is responsible for ensuring customer satisfaction, delays occur due to excessive checks without coordination with previous processes, causing bottlenecks. As a result, products must wait longer before being approved for shipment. In the S2 process, which involves shipping, delays can occur due to a lack of coordination in document processing or unpreparedness of logistics services. If left unaddressed, these issues will impact operational efficiency, increase production costs, and decrease customer satisfaction. Therefore, evaluation and improvement are necessary to prevent delays that hinder the smooth flow of production and distribution [16].

To address waste delays in IQC2, FQC2, and S2, steps to enhance efficiency are required. In IQC2, standardizing inspections and repairs can reduce repeated checks. The use of automation systems helps detect defects more quickly, expediting repairs. In FQC2, integrating previous processes with customer satisfaction evaluations can reduce work backlogs. Digitalization systems and quality management software facilitate faster analysis and validation of products before shipment [17]. In S2, implementing a real-time shipment tracking system improves coordination with logistics providers to ensure timely deliveries. Additionally, the Just in Time (JIT) method helps reduce unnecessary waiting times, ensuring products reach customers promptly. With these improvements, processes become more efficient, reducing delays and enhancing productivity and customer satisfaction [18]. Below are the results of the comparison of processing time improvements.

Table 4. Results of Process Time Comparison

Activity	Before		After	
	Quantity	**Total Time (Seconds)**	**Quantity**	**Total Time (Seconds)**
Operation	11	23951.2	11	18651.2
Transport	8	2940	8	2340
Inspection	3	2118	3	2118
Storage	0	0	0	0
Delay	3	2610	0	0
TOTAL		31619.2		29009.2
Lead Time/ VA + NNVA	14 + 3	28961.2	14 + 0	20769.2
Cycle Time/ NVA	10	2658	10	2340

Based on the data presented in Table 4, it is evident that the total production time for garment manufacturing in Makassar was 31,619.2 seconds. After conducting an analysis and implementing proposed improvements, this time was reduced to 29,009.2 seconds, resulting in a significant difference of 8,510 seconds. This reduction highlights the effectiveness of the strategies employed to minimize waste delays and enhance operational efficiency. The findings underscore the importance of continuous evaluation and improvement in production processes, particularly in MSMEs where efficiency can directly impact competitiveness and profitability.

Previous research supports these findings, indicating that targeted interventions, such as standardizing inspection processes and integrating automation, can lead to substantial time savings in production. Studies have shown that addressing non-value-added activities not only streamlines operations but also improves overall productivity and customer satisfaction [7]. By focusing on waste reduction and process optimization, MSMEs can achieve better resource utilization and faster turnaround times, ultimately leading to enhanced market responsiveness. The results from this analysis serve as a compelling case for the adoption of lean manufacturing principles in the garment sector, demonstrating that even small changes can yield significant improvements in efficiency and effectiveness [9].

F. Analysis of Future State Value Stream Mapping Determination

The Future State Map can serve as a foundation for making improvements in actual work areas. This map is created by considering the findings obtained from the Current State Map. Based on the improvement suggestions previously proposed, the design of lean manufacturing can be implemented through future state value stream mapping in the production process of SMEs in the garment sector. The results can be seen in the following image.

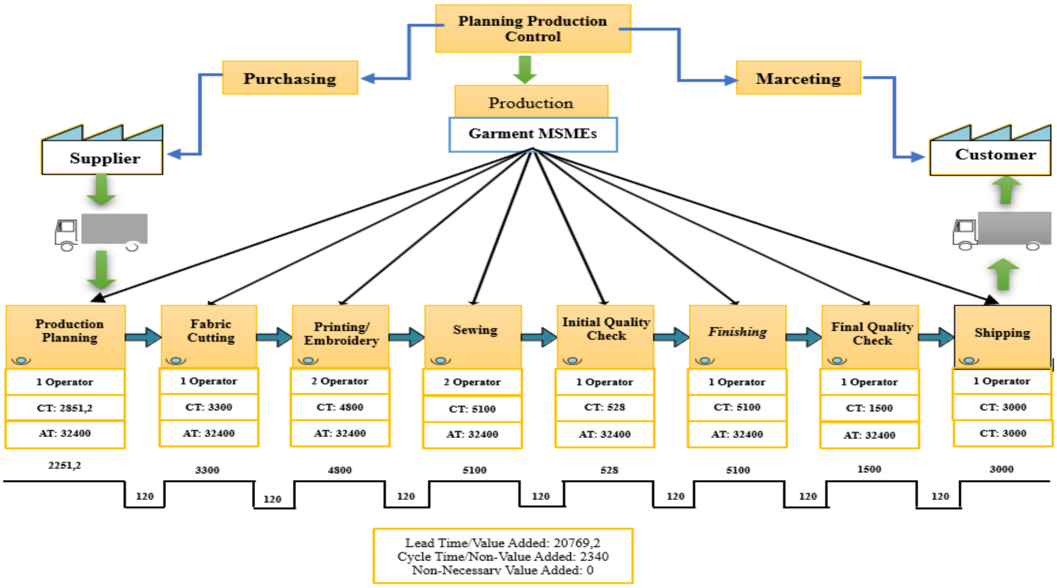

Fig. 3. Future State Value Stream Mapping (FVSM)

In Figure 3 above, it can be observed that the Future Value Stream Mapping (FVSM) process results in a lead time of 20,769.2 seconds, a cycle time of 2,340 seconds, and a non-value-added time (NNVA) of 0 seconds. This significant reduction in lead time and cycle time indicates the effectiveness of the proposed improvements in streamlining the production process. By eliminating non-value-added activities, the FVSM provides a clearer pathway for enhancing operational efficiency, ultimately leading to faster production cycles and improved responsiveness to customer demands.

Previous research supports these findings by demonstrating that the implementation of lean manufacturing principles, such as value stream mapping, can lead to substantial improvements in production efficiency [14]. Studies have shown that organizations that adopt FVSM not only reduce waste but also enhance their overall productivity and quality of output [15]. By focusing on optimizing processes and eliminating delays, SMEs can achieve a competitive advantage in the market. The results from the FVSM analysis reinforce the importance of continuous improvement efforts in the garment sector, highlighting that even small adjustments can lead to significant gains in efficiency and customer satisfaction.

G. Discussion on the Implementation of Lean Manufacturing and VSM

The research presented in this study highlights the critical role of Lean Manufacturing and Value Stream Mapping (VSM) in enhancing productivity within small-scale garment production in Makassar. The analysis of cycle times and activity mapping reveals significant opportunities for efficiency improvements, particularly in the areas of production planning, fabric cutting, and sewing. By identifying specific bottlenecks and non-value-added activities, this study aligns with previous research that emphasizes the necessity of optimizing production processes to reduce waste and improve operational performance. For instance, studies by [10] have shown that the application of lean principles can lead to substantial reductions in cycle times and overall production costs, reinforcing the findings of this research [9].

Furthermore, the results from the Future Value Stream Mapping (FVSM) indicate a remarkable reduction in lead time and cycle time, demonstrating the effectiveness of the proposed improvements. The elimination of non-value-added activities not only streamlines workflows but also enhances responsiveness to customer demands, which is crucial in a competitive market. This finding is consistent with the work of [15], who argue that VSM is an essential tool for visualizing and improving production processes [7], [10]. By adopting these lean strategies, garment MSMEs in Makassar can position themselves more favorably in the market, ultimately contributing to the broader economic development goals of the region.

In addition, the integration of advanced technologies, such as automation and real-time tracking systems, further supports the optimization of production processes. The research underscores the importance of addressing waste delays, which have been identified as a significant challenge in the garment industry. Previous studies, including those by [13], [16], [18], have highlighted the impact of waste reduction on operational efficiency and profitability. By implementing the insights gained from this analysis, garment MSMEs can not only enhance their productivity but also align with sustainable manufacturing practices, appealing to environmentally conscious consumers. Overall, this research contributes to the growing body of literature on lean manufacturing in the garment sector, providing practical guidance for MSMEs seeking to improve their operational performance and competitiveness.

CONCLUSION

In conclusion, this research highlights the significant benefits of Lean Manufacturing and Value Stream Mapping (VSM) in improving productivity within small-scale garment production in Makassar. The analysis identified key bottlenecks and non-value-added activities that impede operational efficiency. By implementing the proposed improvements, such as reducing waste and optimizing production processes, garment MSMEs can achieve notable reductions in lead time and cycle time, enhancing their competitiveness in the market. These findings are consistent with previous studies that emphasize the effectiveness of lean principles in streamlining operations and boosting overall productivity. Additionally, the integration of advanced technologies, like automation and real-time tracking systems, can further address waste delays and improve resource allocation. This research not only adds to the existing knowledge on lean manufacturing in the garment sector but also offers practical guidance for MSMEs seeking to enhance their operations. By focusing on continuous improvement and adopting sustainable practices, garment producers can improve their performance while meeting the increasing demand for environmentally friendly manufacturing. Ultimately, the insights from this study serve as a valuable resource for business practitioners and policymakers, demonstrating the potential of lean strategies to drive economic development and strengthen the garment industry in the region.

ACKNOWLEDGMENTS

I would like to express my heartfelt gratitude to everyone who contributed to the success of this research. My sincere thanks go to my advisors and mentors for their invaluable guidance and support throughout the study. I am also grateful to the participants from the garment MSMEs in Makassar for their cooperation and insights, which were essential for this research. Additionally, I appreciate the encouragement from my colleagues and friends, who motivated me during challenging times. Finally, I would like to thank my family for their unwavering support and understanding. Your contributions have been instrumental in this journey. Thank you all!

REFERENCES

[1] I. Buchori, A. Zaki, P. Pangi, A. W. Sejati, and A. Pramitasari, “Garment industry-led urbanization and women workers: factory- and home-based work in Indonesia,” *International Review of Sociology*, vol. 34, no. 2, pp. 357–377, May 2024, doi: 10.1080/03906701.2024.2366348.

[2] D. Sjarifudin and H. Kurnia, “The PDCA Approach with Seven Quality Tools for Quality Improvement Men’s Formal Jackets in Indonesia Garment Industry,” *Jurnal Sistem Teknik Industri*, vol. 24, no. 2, pp. 159–176, Jul. 2022, doi: 10.32734/jsti.v24i2.7711.

[3] S. Wahyuni and D. Rahmasari, “Investigating the antecedents and outcomes of work-life balance: evidence from garment industries in Indonesia,” *Diponegoro International Journal of Business*, vol. 5, no. 1, pp. 1–11, Jun. 2022, doi: 10.14710/dijb.5.1.2022.1-11.

[4] G. Robertsone, I. Mezinska, and I. Lapina, “Barriers for Lean implementation in the textile industry,” *International Journal of Lean Six Sigma*, vol. 13, no. 3, pp. 648–670, May 2022, doi: 10.1108/IJLSS-12-2020-0225.

[5] L. Driouach, B. Zitouni, and Z. Khalid, “Proposing a Lean Manufacturing Framework Adapted to Very Small Businesses: Multiple Case Studies,” *International Journal of Technology*, vol. 14, no. 3, p. 460, May 2023, doi: 10.14716/ijtech.v14i3.5417.

[6] A. Bashar, A. A. Hasin, and Z. H. Adnan, “Impact of lean manufacturing: evidence from apparel industry in Bangladesh,” *International Journal of Lean Six Sigma*, vol. 12, no. 5, pp. 923–943, Oct. 2021, doi: 10.1108/IJLSS-01-2020-0005.

[7] S. Bhat, E. V. Gijo, A. M. Rego, and V. S. Bhat, “Lean Six Sigma competitiveness for micro, small and medium enterprises (MSME): an action research in the Indian context,” *The TQM Journal*, vol. 33, no. 2, pp. 379–406, Aug. 2020, doi: 10.1108/TQM-04-2020-0079.

[8] M. A. Samad, J. Abdullah, and Md. A. H. Rifat, “Reduction of Manufacturing Lead Time by Value Stream Mapping of a Selected RMG Factory in Bangladesh,” *Asian Journal of Engineering and Applied Technology*, vol. 12, no. 1, pp. 10–17, May 2023, doi: 10.51983/ajeat-2023.12.1.3578.

[9] G. A. de Freitas, M. H. de P. e Silva, and D. A. L. Silva, “Overall lean and green effectiveness based on the environmentally sustainable value stream mapping adapted to agribusiness,” *International Journal of Lean Six Sigma*, vol. 16, no. 1, pp. 25–53, Jan. 2025, doi: 10.1108/IJLSS-10-2023-0173.

[10] P. Saha, S. Talapatra, H. M. Belal, V. Jackson, A. Mason, and O. Durowoju, “Examining the viability of lean production practices in the Industry 4.0 era: an empirical evidence based on B2B garment manufacturing sector,” *Journal of Business & Industrial Marketing*, vol. 38, no. 12, pp. 2694–2712, Nov. 2023, doi: 10.1108/JBIM-01-2023-0029.

[11] R. Alditama, R. A. Apriani, N. L. Kirana, and D. E. Basuki, “Optimalisasi Proses Produksi Kemeja Lengan Pendek Menggunakan Pendekatan Lean Manufacturing dan Kaizen,” *Journal Of Industrial And Manufacture Engineering*, vol. 8, no. 2, pp. 194–207, Nov. 2024, doi: 10.31289/jime.v8i2.12867.

[12] I. Komariah, “Penerapan Lean Manufacturing Untuk Mengidentifikasi Pemborosan (Waste) Pada Produksi Wajan Menggunakan Value Stream Mapping (VSM) Pada Perusahaan Primajaya Alumunium Industri Di Ciamis,” *Jurnal Media Teknologi*, vol. 8, no. 2, pp. 109–118, Apr. 2022, doi: 10.25157/jmt.v8i2.2668.

[13] A. Fole and J. Kulsaputro, “Implementasi Lean Manufacturing Untuk Mengurangi Waste Pada Proses Produksi Sirup Markisa,” *Journal of Industrial Engineering Innovation*, vol. 1, no. 1, pp. 23–29, Jul. 2023, doi: 10.58227/jiei.v1i1.59.

[14] C. I. Parwati, I. W. A. Arsa, and I. Sodikin, “Pendekatan Lean Manufacturing Dengan Value Stream Mapping (VSM) Dan Kaizen Pada Proses Produksi Tas Kulit,” *Nusantara of Engineering (NOE)*, vol. 6, no. 1, pp. 74–81, Apr. 2023, doi: 10.29407/noe.v6i1.19906.

[15] E. B. Kurniawan and N. L. P. Hariastuti, “Implementasi Lean Manufacturing Pada Proses Produksi Untuk Mengurangi Waste Guna Lebih Efektif Dan Efisien,” *Jurnal SENOPATI : Sustainability, Ergonomics, Optimization, and Application of Industrial Engineering*, vol. 1, no. 2, pp. 85–95, Apr. 2020, doi: 10.31284/j.senopati.2020.v1i2.537.

[16] A. Fole, “Peningkatan Kinerja Pada Industri Kerajinan Songko Recaa (Studi Kasus : UKM ISR Bone),” Yogyakarta, Jul. 2022. Accessed: Aug. 06, 2024. [Online]. Available: https://dspace.uii.ac.id/handle/123456789/39404

[17] A. Fole, Y. Herdianzah, W. Astutik, and J. Kulsaputro, “The Effect of Marketing Digitalization on the Performance and Sustainability of Culinary MSMEs in the New Normal Era,” *Proceeding of Research and Civil Society Desemination*, vol. 2, no. 1, pp. 375–386, 2024, doi: 10.37476/presed.v2i1.81.

[18] A. Fole *et al.*, “Gap Analysis And Enhancement Strategy For Supply Chain Performance In The Handicraft Industry of ISR Bone SMES: A SCOR Racetrack Approach,” *Journal of Industrial Engineering Management*, vol. 9, no. 3, pp. 23–32, Dec. 2024, doi: 10.33536/jiem.v9i3.1865.