3123-11154-3-ED (9-18).docx

Institut Teknologi Dirgantara Adisutjipto

Document Details

Submission ID

trn:oid:::3618:118201731

Submission Date

Oct 24, 2025, 11:08 AM GMT+7

Download Date

Oct 24, 2025, 3:24 PM GMT+7

File Name

3123-11154-3-ED (9-18).docx

File Size

455.8 KB

9 Pages

3,805 Words

21,090 Characters

18% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography
- Submitted works

Match Groups

53 Not Cited or Quoted 14%
Matches with neither in-text citation nor quotation marks

13 Missing Quotations 3%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

2 Cited and Quoted 1%
Matches with in-text citation present, but no quotation marks

Top Sources

11% Internet sources

14% Publications

0% Submitted works (Student Papers)

Integrity Flags

0 Integrity Flags for Review

No suspicious text manipulations found.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

Match Groups

- **53** Not Cited or Quoted 14%
  Matches with neither in-text citation nor quotation marks
- **13** Missing Quotations 3%
  Matches that are still very similar to source material
- **0** Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- **2** Cited and Quoted 1%
  Matches with in-text citation present, but no quotation marks

Top Sources

11% Internet sources
14% Publications
0% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Internet	ejournals.itda.ac.id	2%
2	Publication	Ahmadi, Shaghayegh. "Simulation Based Assessment of Lean Manufacturing Resi...	1%
3	Publication	Fajar Mudzakkir, Firdaus Alamsjah. "Enhance Productivity In The Garment Indust...	<1%
4	Internet	www.researchgate.net	<1%
5	Publication	Elita Amrina, Rein Andryan. "Assessing Wastes in Rubber Production Using Lean ...	<1%
6	Publication	Ariel Julianus Pical, Desrina Yusi Irawati, David Andrian. "Lean Manufacturing An...	<1%
7	Publication	D T Setiyawan, P Deoranto, D Peranginangin. "Production process analysis using ...	<1%
8	Internet	jurnal-tmit.com	<1%
9	Publication	Fauzi Khair, Maria Loura Christhia, Rahmat Sabani, Gesang Catur Pribadi. "Fast-M...	<1%
10	Publication	Yobel Silambi, Rus Indiyanto. "Lean Manufacturing Analysis to Minimize Waste o...	<1%

11 Internet

dspace.uii.ac.id <1%

12 Internet

repository.uin-suska.ac.id <1%

13 Publication

Salma Putria Nabila, Sumiati Sumiati. "Warehousing Process Flow Analysis Using ... <1%

14 Internet

sersc.org <1%

15 Publication

M Z P Nugroho, S Hasibuan, H Adiyatna. "Application of lean manufacturing to im... <1%

16 Publication

Yadrifil, Rizky Anugerah Pratama, Annisa Marlin Masbar Rus. "Improvement reco... <1%

17 Internet

eprints.umg.ac.id <1%

18 Publication

Elizabeth A. Cudney, Sandra Furterer, David Dietrich. "Lean Systems - Application... <1%

19 Publication

Jagmeet Singh, Harwinder Singh. "Application of lean manufacturing in automoti... <1%

20 Internet

etd.iain-padangsidimpuan.ac.id <1%

21 Internet

www.coursehero.com <1%

22 Publication

Rich Charron, H. James Harrington, Frank Voehl, Hal Wiggin. "The Lean Managem... <1%

23 Internet

hig.diva-portal.org <1%

24 Internet

www.scielo.br <1%

25	Publication	
A Az Zahra, S Indrawati, J Sulistio. "Performance Improvement in Aerospace Prod...		<1%
26	Publication	
M.L. Emiliani, D.J. Stec. "Using value-stream maps to improve leadership", Leader...		<1%
27	Publication	
Susana Duarte, V. Cruz Machado. "Green and lean implementation: an assessmen...		<1%
28	Internet	
ftuncen.com		<1%
29	Internet	
isomase.org		<1%
30	Internet	
itegam-jetia.org		<1%
31	Internet	
www.econstor.eu		<1%
32	Publication	
Órfão, Luís Filipe Martins. "Lean and Agility in the Healthcare Sector: The Case of ...		<1%
33	Publication	
Adil F. Dalal. "The 12 Pillars of Project Excellence - A Lean Approach to Improving ...		<1%
34	Publication	
Lukmandono, N L P Hariastuti, Suparto, D I Saputra. "Implementation of Waste R...		<1%
35	Publication	
William G. Sullivan, Thomas N. McDonald, Eileen M. Van Aken. "Equipment replac...		<1%
36	Internet	
newinera.com		<1%
37	Internet	
repo.itera.ac.id		<1%
38	Internet	
www.diva-portal.org		<1%

39 Internet

www.mossymotors.com <1%

40 Publication

Nur Hamidah, Enik Sulistyowati, Iis Riyana. "Identifikasi Waste Defect Type 2 Den... <1%

41 Publication

Nurullaily Kartika, Faiz Prawira Setiawan. "Lean Production Implementation on C... <1%

42 Publication

"Advances in Manufacturing Processes and Smart Manufacturing Systems", Sprin... <1%

43 Publication

Bambang Suhardi, Maudiena Hermas Putri K.S, Wakhid Ahmad Jauhari. "Impleme... <1%

44 Publication

Lincoln H. Forbes, Syed M. Ahmed. "Modern Construction - Lean Project Delivery ... <1%

45 Publication

Sahrupi Sahrupi, Gerry Anugrah Dwiputra, Uswatun Chasanah. "Implementation ... <1%

JUMANTARA
Jurnal Manajemen dan Teknologi Rekayasa
ISSN: 2964-0741 (Print)
ISSN: 2962-7079 (Online)
Terakreditasi Sinta 4 dari Kemenristekdkti No: 10/C/C3/DT.05.00/2025
DOI: 10.28989/jumantara.v5i1.3123

Identification and Evaluation of Waste in Animal Feed Production Line Using an Integrated VSM and VALSAT Approach

Putri Anggita[1], Pigunawati[2], Sabiq Dimas Izzuddin[3], M. Nushron Ali Mukhtar[4,*]
Department of Industrial Engineering, Faculty of Engineering, PGRI Adi Buana University

Article Info

Article history:

Received July 1, 2025
Accepted October 23, 2025
Published January 1, 2026

Keywords:

Lean Manufacturing
VSM
VALSAT
Waste
Animal Feed

ABSTRACT

This study evaluates the application of Lean Manufacturing principles using the Value Stream Mapping (VSM) methodology to systematically identify and eliminate waste in the production operations of the breeding animal feed division of PT XYZ. This issue is crucial because the high demand for feed products, especially in the breeder division of PT XYZ, requires the company to make continuous process improvements. This study aims to evaluate the application of Lean Manufacturing principles using the Value Stream Mapping (VSM) and Value Stream Analysis Tools (VALSAT) approaches to identify and eliminate waste in the livestock feed production line. Primary data collection included direct observation studies, structured questionnaires, and in-depth interviews with operators, supplemented by secondary data obtained through a systematic literature review. The application of Value Stream Analysis Tools (VALSAT) revealed that process inefficiencies mostly stemmed from waiting time, product defects, and excessive production output. The VSM analysis of the current condition showed a value-added ratio of 69.05%, with the mapping of the future condition after intervention showing an increase to 70.49%. [Deleted]. This study produced actionable operational recommendations, enabling PT XYZ to align its production system with contemporary industry benchmarks for optimal performance.

Corresponding Author:

M. Nushron Ali Mukhtar,
Department of Industrial Engineering,
PGRI Adi Buana University,
Dukuh Menanggal Road, Gayungan, Surabaya, East Java 60234.
Email: nushron@unipasby.ac.id

1. INTRODUCTION

In the world of well-planned industry, the results obtained will be in line with the company's targets. Competition between companies is one of the reasons why companies must excel in quality and products. In addition to quality being an absolute necessity in competition, there is also the issue of production capacity and volume, which must be increased to meet consumer demand [1]. Productivity improvements can be achieved by reducing non-value-added waste and product defects. These can take the form of inefficiencies in raw material supply, material flow, machine factors, waiting times, rework, or human error [2]. Therefore, the application of Lean Manufacturing principles is becoming increasingly relevant to increase output by eliminating lead time from various forms of waste in company operations [3][4].

The research was conducted at PT XYZ, one of the animal feed manufacturing companies in East Java. PT XYZ has two production departments: buhler and breeder. In this study, the author will focus on the breeder production department. The selection of the Breeder Department as the object of research was based on its significant contribution to the total production volume of PT XYZ, which is around 60% of the company's total feed production capacity. In addition, this department has a high level of product variation and often experiences discrepancies between production targets and actual production, as shown by production data for the January–April 2025 period. The high demand for products in the breeder production department requires the company to maximize production, improve efficiency, and maintain quality to retain consumer trust. These conditions make the Breeder Department the ideal area for evaluating process efficiency using the Lean Manufacturing approach. Thus, this research is urgent in order to help the company improve its production capabilities while reducing potential waste in the main line. Process improvements and efficiency enhancements are necessary to enable the company to produce products at maximum capacity and increase productivity. The production process flow for feed in the Breeder production department is as follows: raw material retrieval from the raw material warehouse, followed by intake, pre-grinding, dosing, mixing, conditioning, pressing or pelleting, cooling, shifting, and bagging. The research at PT XYZ will observe the entire breeder feed production process because it is crucial to identify and reduce waste, improve product quality, and enhance production process efficiency in the breeder department.

In breeder production, there are several types of waste, namely waiting time, product defects, and unnecessary motion. The existence of waste at PT XYZ will certainly result in losses for the company. The forms of losses that the company may incur include cost losses that affect the efficiency of time used in feed production. Therefore, these wastes need to be identified and analyzed so that improvement suggestions can be made. An effective approach to identifying waste, resolving inefficiencies in the production process, and enhancing industrial production performance involves the application of the Lean manufacturing framework through the Value Stream Mapping (VSM) methodology. Several previous studies on the application of Lean Manufacturing in the manufacturing industry have been conducted, but most of them focus on the automotive and metal sectors, rather than the animal feed industry, which has continuous and organic-based process characteristics. In addition, previous studies generally used a single analysis method, such as Value Stream Mapping (VSM), without combining it with Value Stream Analysis Tools (VALSAT) for more detailed identification of waste. Therefore, this study offers novelty through the integration of VSM and VALSAT methods in the context of the animal feed industry, specifically in the Breeder Department of PT XYZ, to provide a more comprehensive analysis of sources of waste and opportunities for process improvement.

2. RESEARCH METHODS

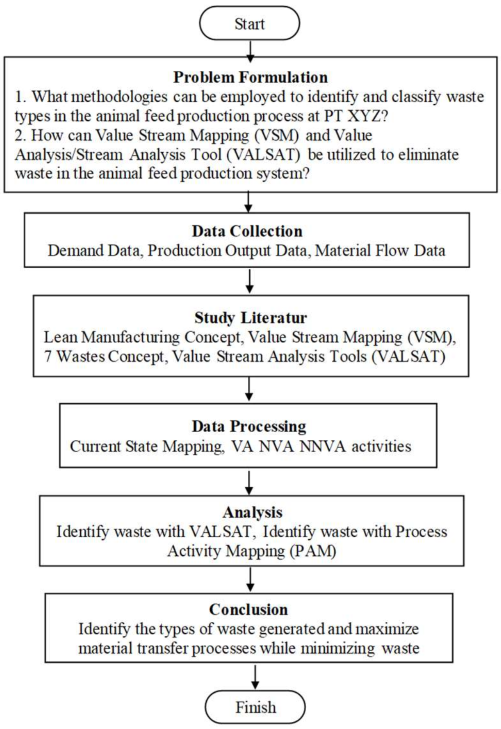

Figure 1. Flow Chart Of The Research Method

2.1 Data Collection

This study adopts a quantitative approach supplemented by qualitative analysis of primary data obtained from observations, questionnaires, and direct interviews with employees at PT XYZ in order to obtain information that is valid and relevant to the research objectives. In this study, questionnaires are one of the tools used to collect structured data from respondents. Respondents in this study were selected using purposive sampling, taking into account the individuals' direct involvement in the production process. The respondents consisted of nine operators working on the main line of the Breeder Department, including the raw material collection, mixing, pelleting, cooling, and packaging sections. These criteria were selected to ensure that the data obtained came from sources that understood the operational process thoroughly and had practical experience with potential waste at each stage of production. This method allows for efficient data collection from a number of participants with the same questions for all respondents, resulting in more consistent data that is easier to compare [5]. The data obtained from the questionnaire will be processed using VALSAT. The object of this study focuses on the application of the Lean Manufacturing concept to identify the impact of wasteful activities.

2.2 Study Literature

Literature studies were used as secondary data, which was obtained from journals supporting the theory, previous research related to the issue, and other sources supporting the study.

A. Lean Manufacturing Definition

First developed by Toyota and also known as Just-In-Time Manufacturing. This principle aims to improve the efficiency and competitiveness of a company. The term 'manufacturing' denotes the systematic conversion of raw materials into final products through various production processes. In contrast, 'lean' represents a production philosophy focused on maximizing output while minimizing resource utilization through the elimination of non-value-adding activities [6]. In other words, lean manufacturing is a production method that focuses on efficiency by maximizing added value and reducing waste, while optimizing added value in products, whether goods or services, to provide optimal benefits for customers (customer value) [1]. Lean manufacturing is a production concept that reduces waste, adapts to change, and continuously improves [7]. In practice, lean manufacturing encompasses a variety of tools and techniques, such as Value Stream Mapping (VSM) and waste analysis, which can be used to reduce lead time and increase production output [6].

B. Analysis Value Stream Mapping (VSM)

Value Stream Mapping (VSM) is an effective method for analyzing production flow activities and minimizing non-value-added activities. Every business must minimize operational costs and waiting times as much as possible, so that regular monitoring of production costs can drive efficiency levels. This has the potential to increase the implementation of lean manufacturing while strengthening the company's competitiveness, profits, and productivity [8]. According to [9] The results of the analysis using Value Stream Mapping (VSM) can show effective strategic instruments in detecting non-value added (NVA) activities while optimizing the production process for long-term operational sustainability. The implementation of Value Stream Mapping (VSM) is carried out through comprehensive monitoring of all stages of the production process, accompanied by measurements of operational parameters at each stage. This systematic approach aims to obtain a complete picture of process time, thereby enabling the identification and quantification of value-added and non-value-added activities [10]. In VSM mapping, Current State Mapping (CSM) is used as a special symbol designed to identify wasteful activities and areas that require modification or improvement [11].

C. Analysis 7 Waste

The seven main types of waste in Lean Manufacturing according to [11] These are overproduction, waiting, excessive transportation, inappropriate processing, unnecessary inventory, unnecessary motion, and defects. The effectiveness of waste elimination in lean implementation depends on the ability to identify three categories of operational activities Value Added Activities (VA) represent activities that directly enhance the value of products or services from the customer's perspective, Non-Value Added Activities (NVA) encompass activities that do not contribute meaningfully to the value of the output, Necessary Non-Value Added Activities (NNVA) are supporting activities that are inherently non-value-added but are necessary in the existing production system until a fundamental process reconfiguration is implemented [12]. Mapping these three dimensions of activity is a strategic prerequisite for creating an optimal value stream [13], [14].

D. Value Stream Analysis Tools (VALSAT)

Value Stream Analysis Tools (VALSAT) is a method developed by Hines and Rich that is used in selecting effective Value Stream Mapping Tools to evaluate waste in more detail [1]. In addition to being used to evaluate waste, Value Stream Analysis Tools (VALSAT) can also apply weighting for accurate waste analysis [15]. The tools used in VALSAT include Process Activity Mapping (PAM), Quality Filter Mapping (QFM), Supply Chain Response Matrix (SCRM), Production Variety Funnel (PVF), Demand Amplification Mapping (DAM), Decision Point Analysis (DPA), and Physical Structure Mapping (PSM), each of which serves to identify various types of waste in the production process [11].

3. RESULTS AND ANALYSIS

3.1. Production Data

The data collected for this study consisted of production output and product target data from the breeder production department, as presented in Table 1 below :

Table 1. Production Data

No	Bulan	Target	Aktual	Presentase
1	January	17.000.000	15931100	6,30%
2	February	19327000	18855150	2.44%
3	March	19327000	18742400	3,02%
4	April	19327000	15669250	18.9%

The data was collected from January to April 2025, showing the gap between the target and actual output of animal feed produced by the breeder production department.

3.2. Current State Value Stream Mapping

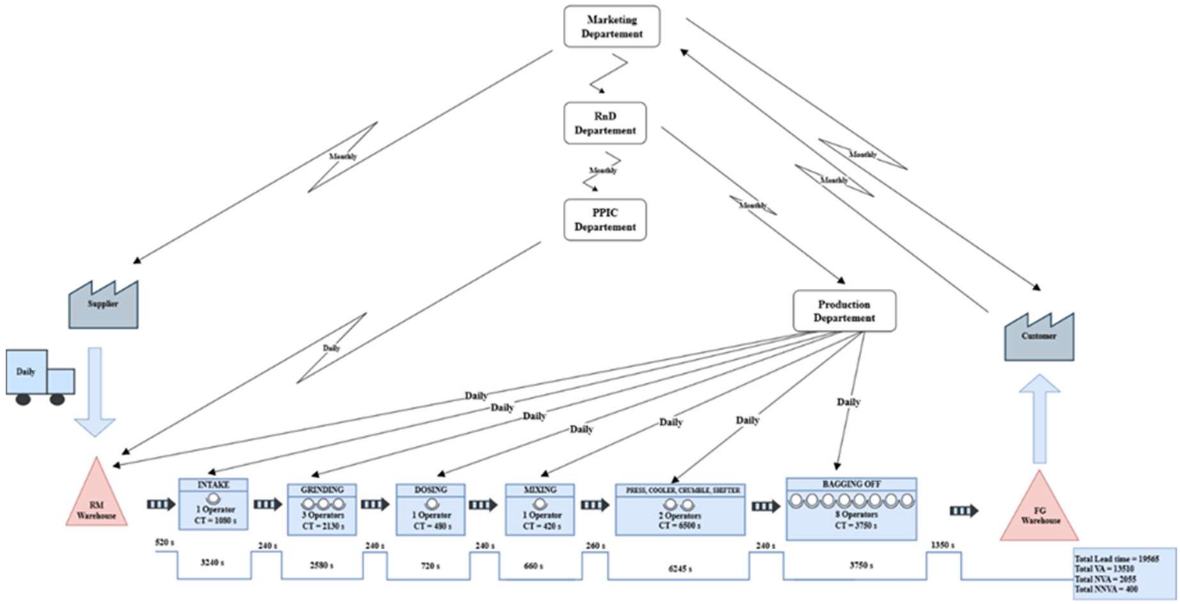

Figure 2. Current State Value Stream Mapping of Animal Feed Production Process

The Value Stream Mapping (VSM) diagram above shows the production process sequence, starting from the raw material reception stage in the warehouse (upstream) to the distribution of the final product to consumers (downstream). This VSM includes various critical stages, including grinding, mixing, forming, inspection, and packing. The primary function of VSM is to serve as a tool for identifying inefficiencies in production, such as delays between stages or excessive material accumulation, while also providing a basis for planning productivity improvements to optimize the entire production flow. Based on the diagram above, the Current State Mapping of the Animal Feed Production Process shows a total lead time of 19,565 seconds, with a total VA time of 13,510 seconds, NVA of 2,050 seconds, and NNVA of 400 seconds

3.3. Waste Identification

Based on the results of the questionnaire completed by operators regarding waste identification, the results are shown in Table 2 and Figure 3.

Table 2. Questionnaire Recapitulation Results

No	Waste	Respondent									Total Skor	Bobot %		Ranking
		R1	R2	R3	R4	R5	R6	R7	R8	R9				
1	Defect	2	2	3	2	3	3	2	2	2	21	16.67	%	2
2	Overproduction	2	1	2	2	2	2	3	2	3	19	15.08	%	3
3	Waiting	2	2	2	4	4	2	3	2	2	23	18.25	%	1
4	Unnecessary Motion	2	2	1	3	2	1	4	1	1	17	13.49	%	4
5	Innapropriate Processing	2	1	1	1	2	1	4	1	3	16	12.7	%	6
6	Excessive Transportation	2	3	1	1	2	1	1	1	1	13	10.31	%	7
7	Unnecessary Inventory	2	1	2	3	2	1	2	1	3	17	13.49	%	5
	TOTAL										126	100	%	

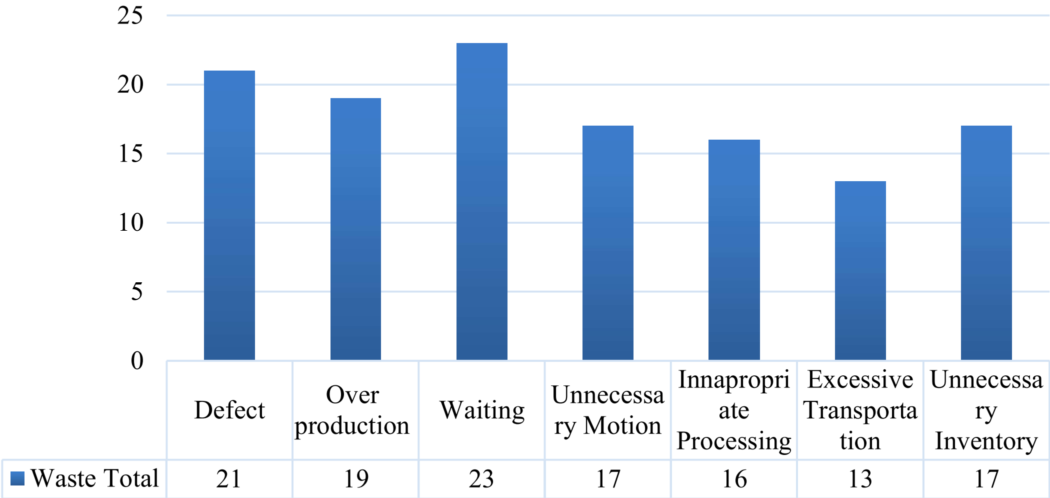

Figure 3. Waste Identification Results

The results of the waste identification questionnaire completed by nine operators or workers in the production department of PT XYZ yielded a total score of 126, with the highest amount of waste being wating, with a total score of 23 and a percentage weight of 18.25, and the lowest amount of waste being excessive transportation, with a total score of 13 and a percentage weight of 10.31%.

3.4. Value Stream Mapping Tools (VALSAT)

The weighting process for identifying waste produces basic data for determining the appropriate tools in the VALSAT approach, namely by multiplying the average score and weight value in the VALSAT matrix. The results of the VALSAT matrix conversion are presented in Table 3.

Table 3. VALSAT Matrix Conversion Results

WASTE	PAM	SCRM	PVF	QFM	DAM	DPA	PS
Defect	21			189			
Overproduction	19	171		19	57	57	
Waiting	207	207	23		69	69	
Unnecessary Motion	153	51					
Innapropriate Processing	144		48	16		16	
Excessive Transportation	117						39
Unnecessary Inventory	51	153	51		153	51	17
TOTAL	712	582	122	224	279	193	56
Ranking	7	6	2	4	5	3	1

3.5. Process Activity Mapping (PAM) Current Map

Based on the weighting results, the total and proportion of time for each process are presented in the following Tables 4 and 5.

Table 4. PAM Calculation

Activity	Total	Time (s)	Presentation (%)
Operation	14	12610	64.45%
Transportation	8	3105	15.87%
Inspection	6	1180	6.03%
Storage	1	900	4.6%
Delay	7	1770	9.05%
TOTAL	36	19565	100%

Table 5. PAM Classification Percentage

Activity	Total	Time (s)	Presentation (%)
VA	15	13510	84.62%
NVA	7	2055	12.87%
NNVA	14	400	2.51%
TOTAL	36	19565	100%

$$Process\ Cycle\ Efficiency = \frac{Value\ Added\ Process\ Time}{Total\ Process\ Lead\ Time} \times 100\% \quad (1)$$

$$= \frac{13510}{19565} \times 100\% = 69.05\%$$

The results of the Process Activity Mapping (PAM) Current Map weighting yielded a manufacturing lead time value of 19,565 seconds. With a value added value of 84.62%, a non-value added value of 12.87%, and a necessary non-value added value of 2.51%. Process Cycle Efficiency is a measure that describes the extent of a process's efficiency. This process is calculated by comparing Value Added and Lead Time.

3.6. Future State Value Stream Mapping

Future State Value Stream Mapping was created after processing data, analyzing the root causes of waste, and compiling suggestions for improvements to the production processes occurring on the production floor of PT XYZ. The proposed Future State Value Stream Mapping can be seen in Figure 4.

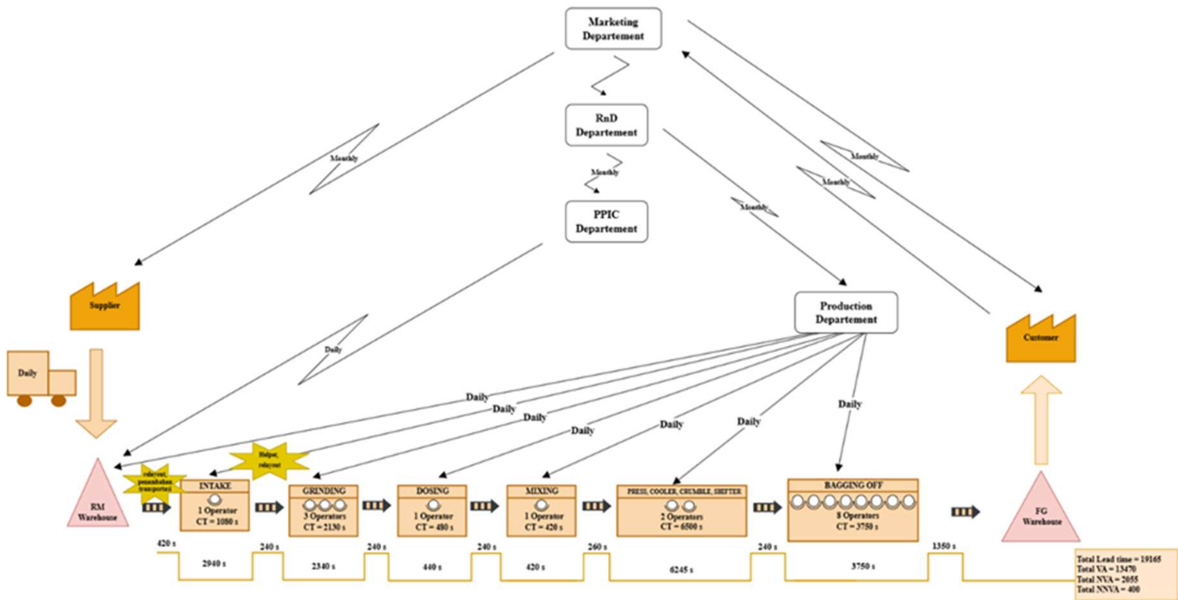

Figure 4. Future State Value Stream Mapping of Animal Feed Production Process

Figure 3 shows the Future State Value Stream Mapping after improvement. The efficiency improvement design was based on the results of waste identification through value stream mapping (VSM), VALSAT analysis, and evaluation using Process Activity Mapping (PAM). The objective of this stage is to measure the impact of changes post-implementation of the improvement phase. The implementation results show a reduction in production lead time, as seen in Figure 3. In the Future State VSM after improvement, the total production lead time for animal feed reached 19,165 seconds, indicating a significant improvement in process efficiency.

3.7. Process Activity Mapping (PAM) Future Map

Mapping future conditions will affect the number of activities in the process activity mapping table. The PAM table (Tables 4 and 5) shows that the number of activities counted as lead time, which was 19,565 seconds, has been reduced to 19,165 seconds with a total of 36 activities. The reduction in lead time in the PAM table will affect the number of VA, NVA, and NNVA activities. The following is a summary table of process activity mapping after future state mapping.

Table 6. Comparison of PAM Activity Before and After Repair

Activity	Before			After		
	Total	Time (s)	Presentation (%)	Total	Time (s)	Presentation (%)
Operation	14	12610	64.45%	14	12610	65.80%
Transportation	8	3105	15.87%	9	3305	17.28%
Inspection	6	1180	6.03%	6	1180	6.17%
Storage	1	900	4.6%	1	900	4.71%
Delay	7	1770	9.05%	6	1170	6.12%
TOTAL	36	19565	100%	36	19165	100%

Table 7. Comparison of PAM Classification Percentages

Activity	Before			After		
	Total	Time (s)	Presentation (%)	Total	Time (s)	Presentation (%)
VA	15	13510	84.62%	15	13510	70.49%
NVA	7	2055	12.87%	6	1355	7.07%
NNVA	14	400	2.51%	15	4300	22.44%
TOTAL	36	19565	100%	36	19165	100%

$$Process\ Cycle\ Efficiency = \frac{Value\ Added\ Process\ Time}{Total\ Process\ Lead\ Time} \times 100\% \quad (2)$$

$$= \frac{13510}{19165} \times 100\% = 70.49\%$$

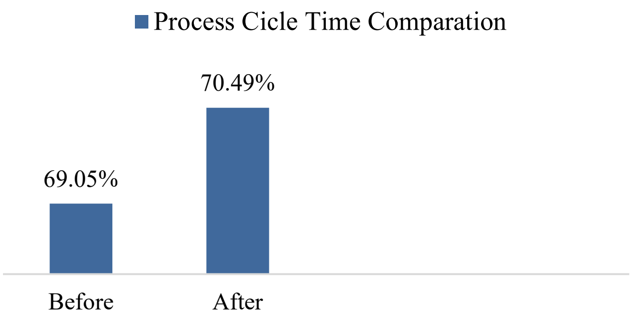

Figure 5. Graph Comparing PCE Values Before and After Improvement

The comparison between current state mapping and future state mapping shows an increase in PCE value due to waste reduction through the elimination of non-value-added time activities based on improvement recommendations based on VALSAT and PAM analysis. The implementation of these improvements successfully reduced production lead time by 400 seconds while increasing Process Cycle Efficiency to 70.49% to meet demand targets. The efficiency achieved can be utilized by the company to optimize operational productivity.

4. CONCLUSION

This study identifies and analyzes waste in the production line activities of the breeder animal feed department at PT XYZ using the Value Stream Mapping (VSM) and Value Stream Analysis Tools (VALSAT) methods. Based on the results of the questionnaire summary from nine respondents, the largest waste is waiting with a total score of 23 (18.25%), followed by defects (score 21; 16.67%) and overproduction (score 19; 15.08%). The VSM analysis of the current state shows a total production lead time of 19,565 seconds, with value-added (VA) activities totaling 13,510 seconds (69.05%), non-value-added (NVA) activities of 2,055 seconds (10.50%), and necessary non-value-added (NNVA) activities of 400 seconds (2.05%).

After implementing the proposed improvements through future state mapping, there was a significant increase in efficiency, marked by a decrease in lead time production from 19,565 seconds to 19,165 seconds. The total lead time decreased to 19,165 seconds (a reduction of 400 seconds), with an increase in the value-added ratio to 70.49%. In terms of effectiveness, the results of Process Activity Mapping (PAM)Process Activity Mapping (PAM) analysis revealed that operational activities dominate lead time (64.45% in the current state and 65.80% in the future state), while delay activities were reduced from 9.05% to 6.12%. Additionally, VALSAT tools such as Process Activity Mapping (PAM) are effective in identifying and prioritizing waste, with PAM achieving the highest score (712) as the most relevant tool.

Overall, the application of VSM and VALSAT integration methods has been proven to increase production process efficiency by 2.04%, reduce non-value-added activities by up to 45%, and strengthen operational effectiveness through a 32% reduction in delay activities. These results show that the application of measurable Lean Manufacturing can have a real impact on increasing productivity and process performance in the animal feed industry.

ACKNOWLEDGE

The authors would like to thank PT ABC for providing the facilities for this research. We would also like to thank all PT ABC employees and operators for their discussions and support. We would like to express our appreciation to our supervisors for their guidance and valuable input during this research.

REFERENCES

[1] D. S. Donoriyanto, Y. Falah, and M. F. Azhar, "Analisis Waste Pada Aktivitas Lini Produksi Dengan Menggunakan Lean Manufacturing Di Pt Abc," *Tekmapro : Journal of Industrial Engineering and Management*, vol. 15, no. 1, pp. 25–35, 2020, doi: 10.33005/tekmapro.v15i1.129.

[2] T. G. Nayoga and M. N. A. Mukhtar, "Analysis Of Defects In Laminated Doors Using Failure Mode And Effect Analysis (FMEA) And Fault Tree Analysis (FTA)," *Tibuana*, vol. 7, no. 2, pp. 152–160, 2024, doi: 10.36456/tibuana.7.2.9340.152-160.

[3] S. V. Buer, M. Semini, J. O. Strandhagen, and F. Sgarbossa, "The complementary effect of lean manufacturing and digitalisation on operational performance," *International Journal of Production Research*, vol. 59, no. 7, pp. 1976–1992, 2021, doi: 10.1080/00207543.2020.1790684.

[4] N. Kumar, S. Shahzeb Hasan, K. Srivastava, R. Akhtar, R. Kumar Yadav, and V. K. Choubey, "Lean manufacturing techniques and its implementation: A review," *Materials Today: Proceedings*, vol. 64, no. October, pp. 1188–1192, 2022, doi: 10.1016/j.matpr.2022.03.481.

[5] A. Hamid and F. A. Wandana, "Analysis of Factors in Decision Making of Ex-Rubber Farmers Regarding the Conversion of Rubber Plantations to Oil Palm (Case Study in Muara Jalai Village , Kampar Regency)," vol. 22, no. 1, pp. 1–8, 2024.

[6] N. R. Nurwulan, A. A. Taghsya, E. D. Astuti, R. A. Fitri, and S. R. K. Nisa, "Pengurangan Lead Time dengan Lean Manufacturing: Kajian Literatur," *Journal of Industrial and Manufacture Engineering*, vol. 5, no. 1, pp. 30–40, 2021, doi: 10.31289/jime.v5i1.3851.

[7] E. Julianti, M. Utami, and H. M. Sitorus, "a Survey on Lean Manufacturing Implementation: a Case Study in an Indonesian Aerospace Company," *International Journal of Economics, Business and Accounting Research*, vol. 5, no. 4, pp. 471–485, 2021.

[8] P. Gunaki, "Value Stream Mapping- Tool to Optimize the Process," *Journal of Mines, Metals and Fuels*, vol. 70, pp. 164–168, 2023, doi: 10.18311/jmmf/2022/31221.

[9] C. N. Wang, T. T. B. C. Vo, Y. C. Chung, Y. Amer, and L. T. Truc Doan, "Improvement of Manufacturing Process Based on Value Stream Mapping: A Case Study," *EMJ - Engineering Management Journal*, vol. 36, no. 3, pp. 300–318, 2024, doi: 10.1080/10429247.2023.2265793.

[10] Z. Ma'ruf, "Analisis Penerapan Lean Manufacturing dengan Metode Valsat untuk Memaksimalkan Produktivitas pada Proses Operasi Crusher," vol. 5, no. Kimu 5, pp. 10–20, 2021.

[11] K. Nasyirin, I. Ruwana, and T. Priyasmanu, "RANCANGAN LEAN MANUFACTURING PROSES PEMBUATAN PERMEN LOLIPOP DENGAN METODE VALUE STREAM MAPPING (VSM) DAN FAILURE MODE AND EFFECT ANALYSIS (FMEA) PADA UMKM XYZ," vol. 7, no. 2, pp. 355–362, 2024.

[12] W. T. W. Siagian and J. A. S. TEKMAPRO, "Analisis Penerapan Lean Manufacturing Dengan Metode Vsm (Value Stream Mapping) Guna Mengurangi Waste Dan Cycle Time Pada Proses Produksi Keramik Di Pt Xyz," *Tekmapro*, vol. 19, no. 2, pp. 242–253, 2024, doi: 10.33005/tekmapro.v19i2.419.
[13] F. Ramadhan, E. Prasetyaningsih, and C. R. Muhammad, "Penerapan Konsep Lean Manufacturing untuk Mereduksi Waste pada Proses Produksi Simbal Drum," *Bandung Conference Series: Industrial Engineering Science*, vol. 2, no. 1, 2022, doi: 10.29313/bcsies.v2i1.1716.
[14] N. A. Sandy, Y. Z. Yasrin, and S. Suhanto, "Analisis Waste Pada Produksi Pembuatan Meja dengan Pendekatan Lean Manufacturing," *Jurnal Manajemen dan Teknologi Rekayasa*, vol. 3, no. 1, pp. 43–52, 2024.
[15] L. Vioni, P. Jatmiko, and M. T. Safirin, "Waste Reduction in the Sickle Production Process Using the VALSAT Method and Value Stream Mapping," vol. 5, pp. 8–15, 2025.