Jurnal Akuntansi, Ekonomi dan Manajemen Bisnis
Vol. 12 No. 2, Desember 2024, 103-110
E-ISSN: 2548-9836

Article History
Received Oktober, 2024
Accepted Desember, 2024

Supply Chain Management Efficiency Measurement Using Value Stream Mapping Method to Reduce Production Waste PT Tirta Investama

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Abstract

PT Tirta Investama is a prominent Indonesian enterprise specialising in mineral water under the Aqua brand. This study aims to ascertain the nature of its waste using Value Stream Mapping methodology to assess supply chain management. A comparison of the current and future state maps shows how the Value Stream Mapping (VSM) method for measuring Supply Chain Management (SCM) has enhanced efficiency at PT Tirta Investama. The State Map showed that VA accounted for 40% of process time, and NVA accounted for 3,780 seconds. 60% of the process.By contrast, the Future State Map demonstrates a big increase in value-added activities (VA), which now account for 75% of total process time. Non-value-added activities (NVA) have dropped significantly to 25%.

Keywords: Supply Chain Management, Value Stream Mapping, Current State Map, Future State Map

1. Introduction

The intensifying competition within the industrial sector necessitates that companies not only survive but also continuously enhance their effectiveness and efficiency across the entirety of the production process. In light of the accelerated pace of technological and innovative advancement within the manufacturing industry, it is imperative for industry stakeholders to be equipped with the requisite capabilities to effectively navigate the evolving competitive landscape. This requires a consistent commitment to the improvement of operational performance. In order to compete effectively and capitalise on existing market opportunities, it is essential that companies implement continuous improvements in productivity. It is therefore imperative that companies implement productivity improvements in order to maintain competitiveness in the face of intense market competition and to meet the demands of a dynamic and highly competitive consumer market (Rahman, 2021).

PT Tirta Investama is a prominent entity within the Indonesian packaged beverage industry, particularly renowned for its Aqua brand of bottled mineral water. The company was established in 1998 and produces a range of mineral water products utilising advanced technology to ensure product quality and safety. PT Tirta Investama maintains an extensive distribution network covering all of Indonesia and is committed to sustainable practices and social responsibility, including responsible water resource management and recycling initiatives. Innovation and customer satisfaction are the company's primary focus, and it strives to meet international standards and make a positive impact on society (Hardiyanto, 2023).

The term 'supply chain management' (SCM) was first introduced by Oliver and Weber in 1982 (see Oliver & Weber, 1982; Lambert et al., 1998). The term "supply chain" denotes the physical network comprising organisations engaged in the processes of raw material procurement, product manufacturing and delivery to end consumers. In contrast, SCM encompasses the tools, methods and approaches deployed to manage the supply chain in an effective manner. (Pujawan, 2017)

Supply Chain Management (SCM) represents a fundamental aspect of business operations, encompassing the movement of goods and services from one location to another. SCM is not solely concerned with the delivery of the final product to consumers; it also encompasses a complex and interconnected series of activities. The initial stage of the production process is marked by the procurement of raw materials, which are required for the subsequent stages of production. Once the requisite raw materials have been obtained, the process advances to the production stage, wherein these materials are transformed into semi-finished or finished goods. Furthermore, SCM encompasses the storage and management of inventory, as well as the control of information flow related to the status and location of products. The ultimate objective is the efficient distribution of finished products to end customers, either through an extensive distribution network or directly to consumers (Nabila et al., 2022). Consequently, SCM encompasses the entire chain of activities from upstream to downstream, ensuring that each stage operates smoothly and efficiently to meet customer needs and expectations (Setiawan & Setiyadi, 2017).

PT Tirta Investama frequently encounters difficulties in the production process, particularly in relation to process efficiency, quality management, and the flow of raw materials and finished products. The production process, which encompasses stages from water treatment to packaging, frequently encounters challenges such as prolonged wait times, material wastage, and difficulties in coordinating activities between departments. To address these challenges, the company has adopted Value Stream Mapping (VSM), a methodology designed to analyse and optimise the flow of value throughout the production process. By implementing VSM, PT Tirta Investama can comprehensively map its workflow, identify areas of waste, and streamline processes to enhance efficiency and reduce production cycle times. This strategy enables the company to enhance productivity, reduce costs, and deliver high-quality products to consumers in a more efficient and timely manner.

Value Stream Mapping (VSM) is a technique used to map the flow of materials and information within a production process, from the initial raw materials to the final product. This method allows companies to identify waste and its underlying causes by providing a comprehensive overview of the process as a whole, rather than focusing on individual processes in isolation. In VSM, activities are illustrated using symbols that distinguish between value-added and non-value-added activities (Aisyah, 2020).

The objective of this study is to conduct a comprehensive examination of waste within the operational processes of PT, with the aim of identifying areas of inefficiency that may impact overall performance. The application of the Value Stream Mapping (VSM) method enables a systematic approach to the evaluation of the efficiency of the company's supply chain management practices. The objective of the study is to identify specific instances where resources may be underutilised or misallocated through the application of VSM. This will enable PT to enhance productivity, reduce unnecessary costs and improve the flow of materials and information throughout the supply chain. The comprehensive analysis will contribute to a deeper understanding of supply chain efficiency, highlighting actionable insights for continuous improvement in operational effectiveness.

2. Research Method

This study examines the efficacy of measuring Supply Chain Management (SCM) at PT Tirta Investama through the utilisation of the Value Stream Mapping (VSM) method, with the objective of identifying and rectifying inefficiencies within the production process. The research methodology encompasses a series of fundamental stages, with a particular emphasis on the analysis of secondary data and the strategic deployment of VSM to enhance operational efficiency.

The preliminary phase of this investigation entails the compilation of secondary data, encompassing information pertaining to the production process flow, material flow, and pertinent temporal data. This data is procured from internal corporate sources, including production reports, material flow records, and process time logs. The collection of secondary data is pivotal for providing an accurate representation of the present state, obviating the necessity for direct primary data collection.

Once the secondary data has been collected, the next step is to create a Current State Map utilising the Value Stream Mapping tool. This map provides a detailed overview of the existing production process, including the material and information flow, as well as the time required for each stage of the process. The development of the Current State Map facilitates a comprehensive visual representation of the current process flow and assists in the identification of potential points of waste.

The results of the analysis inform the development of solutions aimed at reducing waste. These solutions may entail modifications to the production process, the introduction of new technologies, or enhanced interdepartmental coordination to reduce wait times and material waste. The objective of this phase is to enhance efficiency and achieve a substantial reduction in waste.

The final stage of the process is the creation of a Future State Map, which illustrates the optimal condition that will be achieved following the implementation of waste reduction solutions. The Future State Map identifies improvements in production process flow, cycle time reduction and enhanced efficiency. This map serves two purposes: firstly, it represents the target to be achieved and secondly, it provides guidance on how to implement the planned changes.

Once the Future State Map has been developed, implementation is carried out in accordance with the designed solutions. This process includes the monitoring of outcomes and the evaluation of the effectiveness of the changes. The evaluation is conducted with the objective of ensuring that the implemented improvements yield the desired results and of making any necessary adjustments.

The objective of this study is to gain a comprehensive understanding of the ways in which the VSM method can be employed to optimise SCM efficiency at PT Tirta Investama, with a particular focus on the identification and reduction of waste within the production process.

3. Research Result

Current State Map

The current state map is a method used to analyse and comprehend the trajectory of materials and information within a system from inception to conclusion. This process comprises several key steps, commencing with the identification of all principal processes involved and concluding with the collation of data pertaining to cycle time, waiting time, inventory levels and flow information. The final step is the visualisation of the flow, which serves to highlight areas of waste and inefficiency. The image below depicts the current state value stream mapping, which provides an overview of the material and information flow throughout the process.

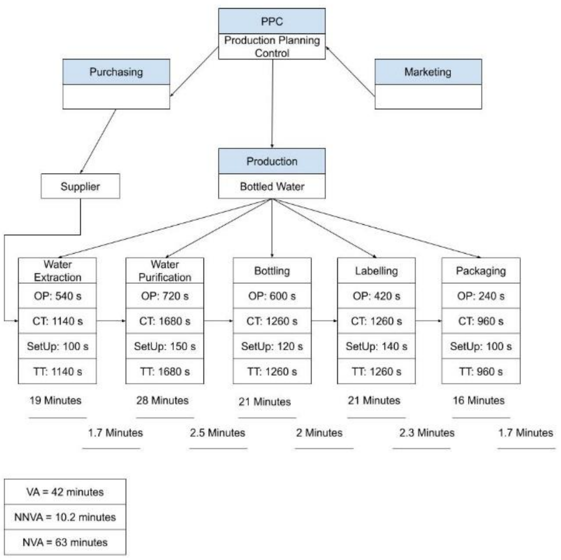

Figure 1: Current State Value Stream Mapping in Bottled Water Production

The data obtained through process activity mapping is presented below:

TABLE 1
DATA FROM PROCESS ACTIVITY MAPPING - CURRENT STATE MAP (CSM)

Activities	Total	Time (sec)	Percentage (%)
Operation	5	2520	40
Transportation	3	1560	24,7
Inspection	2	1320	21
Inspection	2	600	9,5
Delay	1	300	4,8
Total	13	6.300	

The analysis conducted indicates that the collected activity data reveals several important insights. The data indicates that the operational activity is the most time-consuming, with a total duration of 2,520 seconds, accounting for 40% of the total time of 6,300 seconds. This suggests that the operational process is a critical component that requires greater attention to enhance efficiency.

Moreover, the transportation activity accounted for 1,560 seconds, or 24.7% of the total time. This considerable duration underscores the necessity for a comprehensive assessment of the prevailing logistics system and transportation methodologies. The optimisation of this area has the potential to reduce the time required to transport goods from one point to another within the supply chain. The initial inspection activity required 1,320 seconds, representing 21% of the total time, while the subsequent inspection lasted 600 seconds, accounting for 9.5%. The combined duration of the two inspection activities represents 30.5% of the total time, indicating that the inspection process is a relatively time-consuming aspect of the procedure. A reduction in the frequency of inspections or an enhancement of inspection methods could result in a notable reduction in time expenditure. Lastly, the Delay activity required 300 seconds, representing 4.8% of the total time, indicating the presence of wait times that could be optimised. The minimisation of these wait times is an essential step in improving process flow and reducing the overall cycle time. Overall, the current process mapping provides a clear overview of time distribution across each activity, enabling the identification of areas that require improvement. With this analysis, corrective measures can be designed to reduce waste and enhance process efficiency.

The Current State Map is an essential method in lean manufacturing analysis that focuses on the flow of materials and information within a system. In previous research, this process began with the identification of all key processes, followed by the collection of data related to cycle times, wait times, inventory levels, and information flow, which were then visualized to identify areas of waste and inefficiency. In this study, it was found that the Operations activity consumed the most time, totaling 2,520 seconds or 40% of the total time of 6,300 seconds. The Transportation activity contributed 24.7% of the time, while Inspection activities accounted for a total of 30.5% of the overall time, indicating that inspection is a particularly time-consuming process. Although the Delay activity represents only 4.8% of the total time, it remains critical to optimize.

A study conducted by Hardianza and Vanany (2016) at PT. X employed a comparable methodology, namely Process Activity Mapping (PAM), for the analysis of the production of twin beds. The data indicated that the operations activity accounted for 75% of the total time of 28,855.52 seconds, or 6 hours, representing the largest proportion. The transportation process accounted for 14% of the total time, while delay contributed 4%. This comparison demonstrates that in both studies, the operational process is a primary component that requires further attention to enhance efficiency. However, the study on the production of twin beds also considered the storage process, which, although only 0.3%, was not identified in the current process mapping study of bottled water production.

Analysis of Value-Added (VA) and Non-Value-Added (NVA) Activities

The analysis of value-added and non-value-added activities represents a fundamental approach within the domain of supply chain management and process improvement. The principal objective of this analysis is to discern those activities that engender tangible value for the final product, and those that do not, thereby facilitating optimisation or elimination to enhance efficiency.

TABLE 2
TOTAL TIME OF VA AND NVA ACTIVITIES

Activities	Value Added (VA)	Non-Value Added (NVA)
	Second	Second
Water Extraction	540	600
Water Purification	720	960
Bottling	600	660
Libelling	420	840
Packaging	240	720
Subtotal	2520	3780
Total	6300	

The total time dedicated to value-added (VA) activities is 2,520 seconds, while non-value added (NVA) activities account for 3,780 seconds out of a total time of 6,300 seconds. This indicates that over half of the total process is spent on activities that do not add value. By reducing or eliminating NVA activities, the company can improve process efficiency, shorten cycle times and increase value for customers. This can be achieved through lean manufacturing approaches, automation and continuous improvement at each stage of the process. Thus, the production efficiency for water can be calculated as follows:

$$Production\ Efficiency \quad (1)$$

$$= \frac{Processing\ Time}{Total\ Production\ Time}\ X\ 100\% \quad (2)$$

$$` = \frac{2520}{6300}\ X\ 100\% = 40\% \quad (3)$$

The results of the calculations indicate that the current production process is not yet optimal and requires improvements to achieve a higher level of efficiency, with a value of 40% being obtained.

The examination of value-added and non-value-added activities represents a pivotal methodology in the domains of supply chain management and process enhancement. The principal objective of this analysis is to ascertain which activities contribute to the creation of the final product and which do not, thus facilitating the optimisation or elimination of non-value-adding activities and enhancing overall efficiency. The study revealed that the total time dedicated to value-added activities was 2,520 seconds, whereas non-value-added activities accounted for 3,780 seconds, representing 6,300 seconds in total. This indicates that over half of the total process time is spent on non-value-adding activities. By focusing on the reduction or elimination of non-value-adding activities, the company can enhance process efficiency, reduce cycle times and increase customer value. This optimisation can be achieved through lean manufacturing approaches, automation and continuous improvement at each stage of the process. Based on production efficiency calculations, a value of 40% was obtained, indicating that the current production process is not yet optimal and requires improvements to achieve a higher level of efficiency.

In a previous study conducted by Hardianza and Vanany (2016), a comparable analysis was performed on twin bed production at PT. X. The results indicated that VA activities (operations) consumed 21,750 seconds, representing 75% of the total time of 28,855.52 seconds. The remaining time was consumed by NVA activities (transportation, inspection, storage, and delay). The proportion of time allocated to transportation was 14%, inspection 6%, storage 0.3%, and delay 4%. This comparison demonstrates that, although both studies emphasise the importance of reducing non-value-adding activities to improve efficiency, Hardianza and Vanany's (2016) research revealed higher efficiency in value-adding activities compared to the bottled water production study, which achieved only 40%. This discrepancy may be attributed to variations in the complexity of production processes and the implementation of lean manufacturing in each company.

Identifying Waste

Waste in supply chain management (SCM) has the potential to impede operational efficiency and effectiveness. The following are examples of waste that could be identified in the SCM of PT Tirta Investama:

1. Overproduction
   Overproduction can be defined as the production of bottled drinking water by PT Tirta Investama in excess of the market demand. This phenomenon can result in a number of undesirable consequences, including the accumulation of inventory, elevated storage costs and the potential for product expiration. In order to address this issue, the company may wish to consider the implementation of a Just-In-Time (JIT) production strategy, which ensures that production is aligned with the actual market demand.
2. Waiting
   In the context of production and distribution, delays are often encountered when raw materials are not available at the scheduled time or when equipment malfunctions. Such delays result in inefficiencies due to the unproductive time spent by operators and equipment, ultimately reducing operational efficiency. To mitigate these delays and enhance productivity, PT Tirta Investama can adopt a strategy of preventive maintenance and improved management of raw material inventory.
3. Transportation
   Excessive transportation can be defined as the unnecessary movement of raw materials or products between various locations within the supply chain. This can result in a number of undesirable consequences, including wasted time and energy, as well as an increase in operational costs. PT Tirta Investama is well-positioned to address this issue through the redesign of the layout of production and distribution facilities, with the objective of reducing transportation distances and optimising material flow.
4. Excess Inventory
   The accumulation of excess inventory represents a significant challenge for many businesses, particularly in the context of raw materials and finished products. The costs associated with storage, coupled with the potential for damage or expiration, can be considerable. Implementing a Kanban system can facilitate more effective inventory control, enabling businesses to maintain only the necessary stock in alignment with actual demand.
5. *Defects*
   Defective products may necessitate reworking or even disposal, which is a waste of raw materials and production time. PT Tirta Investama can mitigate this issue through the implementation of a rigorous quality control system and the training of employees to ensure that products meet the requisite quality standards from the inception of the production process.
6. *Overprocessing*
   Overprocessing can be defined as the inclusion of additional steps in the production process that do not contribute to the value of the final product. Such processes may include excessive inspection or repackaging. A comprehensive process analysis can assist PT Tirta Investama in identifying and eliminating superfluous steps, thereby enhancing production efficiency.
7. *Motion*
   The term "excess motion" denotes inefficient operator movements, exemplified by the searching for misplaced tools or materials in an unorganised environment. Such actions result in the squandering of valuable time and energy resources, potentially culminating in operator fatigue. The PT Tirta Investama team is adept at devising ergonomically optimised workplaces and assuring comprehensive organisation and accessibility of essential tools and materials.
8. *Unused Talent*
   Unused talent can be defined as the situation whereby the abilities and ideas of employees are not fully utilised. This can have a detrimental impact on the potential for innovation and process improvement. In order to address this issue, employees are encouraged to participate actively in continuous improvement programmes and are provided with relevant training. This enables PT Tirta Investama to harness the full potential of its employees in order to improve production efficiency and quality.

In 2011, Gaspersz and Vincent identified seven distinct categories of waste commonly observed in production environments. The aforementioned categories of waste can be defined as follows: Overproduction represents a form of waste that arises when the volume of goods produced exceeds the level of demand from customers. Waiting time represents a form of waste that arises from the time spent by operators waiting. Transportation represents a form of waste that does not contribute to the value of the product. Process waste is a consequence of inefficiencies in the production process. A departure from established procedures may result in inefficiencies. Furthermore, unnecessary movements that do not contribute to the value of the product may also be considered a form of waste. Excessive inventory is also a form of waste, as it diverts resources and may lose value. Defective and non-conforming products are another type of waste. Without effective management, this can reduce efficiency and increase costs. Identifying and eliminating these wastes is crucial for lean manufacturing, as it makes operations more efficient and responsive to customer needs.

Future State Map

The Future State Map represents a technique that is employed in the design of more efficient and effective process flows. The objective of such design efforts is twofold: the reduction of waste, and the enhancement of added value for customers. Through this mapping, organisations gain insight into potential improvements and optimisations to processes that may be undertaken in the future.

TABLE 3
PROCESS ACTIVITY MAPPING-FSM DATA

Activities	**Amount**	**Times (sec)**	**Percentage (%)**
Operation	5	3600	75
Transportation	2	600	12,5
Inspection	1	300	6,25
Inspection	1	180	3,75
Delay	1	120	2,5
Total	10	4800	

The following table presents a comparative analysis of value-added (VA) and non-value-added (NVA) activities.

TABLE 4
TOTAL TIME OF VA AND NVA

Activities	**Value Added (VA)**	**Non-Value Added (NVA)**
	Times (sec)	Times (sec)
Water Extraction	600	300
Water Purification	900	300
Bottling	1200	300
Labelling	600	180
Packaging	300	120
Amount	3600	1200
Total	4800	

The efficiency of water production can be calculated as follows:

$$Production\ efficiency = \frac{Processing\ time}{Total\ production\ time}\ X\ 100\% \quad (4)$$

`$$= \frac{3600}{4800}\ X\ 100\% = 75\% \quad (5)$$

Table 2 and Table 4 indicate that the number of NVA values from the Current State map is 3780 (60%), while the NVA value from the Future State map is 1200 (25%). This decrease suggests a notable enhancement in process efficiency, characterised by a reduction in waste and the optimisation of activities that provide added value.

The Future State Map is a technique employed to design more efficient and effective process flows, with the objective of reducing waste and increasing added value for customers. The mapping process enables organisations to identify potential improvements and optimisations for future processes. The results of the activity analysis are presented in the following table. It can be seen that the total time for VA activities is 3600 seconds, while that for NVA activities is 1200 seconds out of a total time of 4800 seconds. This equates to a production efficiency of 75%. This comparison demonstrates a substantial enhancement in process efficiency when comparing the Current State Map, where the NVA value is 3780 seconds (60%), to the Future State Map, which has an NVA value of 1200 seconds (25%).

Previous research by Harsono, Arijanto, and Azlin (2010) also concentrated on the reduction of waste through the implementation of lean manufacturing techniques. In a case study conducted at PT PLN (Persero) Services and Production, Bandung Production Unit, the researchers proposed improvements that resulted in a notable reduction in NVA activity time. This study demonstrates that the implementation of lean manufacturing can effectively identify and reduce waste at various stages of production. This comparison illustrates that both the current research and previous research emphasise the importance of process mapping to identify areas of waste and optimise value-added activities, resulting in significant efficiency improvements.

Comparative Analysis of Current State map with Future State map

TABLE 5
COMPARISON ANALYSIS

Information	**Current State Map**		**Future State Map**	
	(VA)	(NVA)	(VA)	(NVA)
Times (sec)	2520	3780	3600	1200
Percentage	40	60	75	25

A comparative analysis of the current and future state maps reveals notable discrepancies in the allocation of time for value-added and non-value-added activities.

A comparative analysis of the current and future state maps reveals notable discrepancies in the allocation of time for value-added and non-value-added activities.

An increase in the percentage of VA from 40% to 75% indicates that future processes are more efficient and that a greater proportion of time is spent on activities that directly add value to the product or service. This demonstrates that the time spent on productive and value-added activities increases significantly, reflecting an improvement in operational performance.

The reduction in the percentage of NVA from 60% to 25% suggests a notable decrease in wastage and non-value-added activities. This could be attributed to a reduction in waiting time, the removal of superfluous activities, and enhancements to working methods. By eliminating or minimising inefficient activities, processes become leaner and more responsive.

The reduction of NVA time can facilitate an increase in productivity and a reduction in operational costs for companies. Furthermore, the acceleration of production cycle times enables a more rapid response to customer demand. The implementation of faster and more efficient processes allows companies to fulfil customer needs in a more timely and effective manner, thereby enhancing their competitiveness.

Higher Added Value: By dedicating a greater proportion of time to VA activities, the quality of the product or service can be enhanced, which in turn increases customer satisfaction and competitiveness in the market. A focus on value-added activities can also result in the production of superior quality products, thereby improving the reputation of the company and strengthening customer loyalty.

The comparison demonstrates that through process analysis and improvement, organisations can achieve enhanced efficiency, reduce waste, and augment the value they provide to customers. The Future State Map offers a more comprehensive view of the optimal process performance, facilitating the development of effective and sustainable improvement strategies that ensure long-term success.

Previous research conducted by Harsono, Arijanto, and Azlin (2010) yielded analogous findings, wherein the implementation of lean manufacturing at PT PLN (Persero) Services and Production, Bandung Production Unit, resulted in a notable reduction in non-value-added activities. This study corroborates the significance of process mapping in identifying areas of waste and optimising value-added activities, thereby leading to substantial efficiency enhancements.

4. Conclusions

Based on a comparative analysis between the Current State Map and the Future State Map, the implementation of the Value Stream Mapping (VSM) method for measuring Supply Chain Management (SCM) at PT Tirta Investama demonstrates a significant increase in efficiency. In the Current State Map, value-added (VA) activities account for only 2,520 seconds, or 40% of the total process time, while non-value-added (NVA) activities consume 3,780 seconds, or 60%. In contrast, the Future State Map shows an increase in VA activities to 3,600 seconds, or 75%, with NVA activities significantly reduced to 1,200 seconds, or 25%.

This comparison reveals that the use of VSM successfully identified and reduced waste within the production process, leading to an overall improvement in operational efficiency. With the reduction in NVA activities, PT Tirta Investama has been able to increase productivity, lower costs, and shorten production cycle times, ultimately contributing to higher product quality and customer satisfaction. These results highlight the importance of applying VSM in SCM to achieve greater efficiency and minimize waste in production.

Acknowledgments

I would like to express my profound gratitude to all those who have provided invaluable support and contributions to the creation of this academic journal, titled "Efficiency Measurement in SCM (Supply Chain Management) Using the VSM (Value Stream Mapping) Method to Reduce Production Waste at PT Tirta Investama." Furthermore, I would like to express my gratitude to the experts and practitioners who provided invaluable insights, data, and information, which were essential for the analysis presented in this journal. Additionally, I am grateful to my colleagues for their constructive feedback and technical support throughout the writing process. The support and contributions from all parties have been instrumental to the smooth progression and success of this research, and I deeply value the commitment and dedication demonstrated.

References

Aisyah, S. (2020). Perencanaan Lean Manufacturing Untuk Mengurangi Pemborosan Menggunakan Metode VSM Pada PT Y Indonesia. Jurnal Optimasi Teknik Industri (JOTI), 2(2), 56-59.

Gaspersz, dan Vincent. (2011), Lean Six Sigma for Manufacturing and Service Industries. Bogor: Penerbit Vinchristo Publication.

Hardianza, D. A., & Vanany, I. (2016). Implementasi lean manufacturing dengan metode value stream mapping pada PT. X. X. Surabaya: Program Pascasarjana Institut Teknologi Sepuluh Nopember.

Hardiyanto, F. Y. (2023). Strategi Komunikasi Organisasi Dalam Meningkatkan Motivasi Kerja Di PT Tirta Investama (DC Kawasan) (Doctoral dissertation, Sekolah Tinggi Ilmu Komunikasi Indonesia Maju).

Harsono, A. R., Arijanto, S., & Azlin, F. (2010). Usulan perbaikan untuk pengurangan waste pada proses produksi dengan metoda lean manufacturing (studi kasus di PT. PLN (persero) jasa dan produksi, unit produksi Bandung). In Proceeding Seminar Nasional IV Manajemen dan Rekayasa Kualitas (pp. 400-409).

Nabila, V. S., Lubis, M. I., & Aisyah, S. (2022). Analisis Perencanaan Supply Chain Management pada Seneca Coffe Studio Kota Medan. Jurnal Ilmu Komputer, Ekonomi Dan Manajemen (JIKEM), 2(1), 1734–1744.

Pujawan, I, N dan Mahendrawathi. 2017. Supply Chain Management. Yogyakarta: Andi Offset

Rahman, A. (2021, November). Penerapan lean manufacturing untuk meminimalkan waste dengan menggunakan metode VSM dan WAM pada PT XYZ. In Prosiding Seminar Nasional Penelitian LPPM UMJ (Vol. 2021).

Setiawan, E. B., & Setiyadi, A. (2017). Implementasi Supply Chain Management (Scm) Dalam Sistem Informasi Gudang Untuk Meningkatkan Efektifitas Dan Efisiensi Proses Pergudangan. Seminar Nasional Teknologi Informasi Dan Multimedia 2017.