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Implementation of Lean Six Sigma in Linen Management: A Case Study at Samarinda Medika Citra Hospital

Syamsul Bahri[1], A. Rohendi[2], Oke Andikarya[3]

[1] Universitas Adhirajasa Reswara Sanjaya, Bandung; Indonesia; 7777syamsul@gmail.com
[2] Universitas Adhirajasa Reswara Sanjaya, Bandung; Indonesia; arohendi@ars.ac.id
[3] Universitas Adhirajasa Reswara Sanjaya, Bandung; Indonesia; roke@ars.ac.id

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ABSTRACT

Hospitals deliver healthcare services supported by both medical and non-medical ancillary units. The laundry unit functions as a non-medical support service that provides linen, particularly for inpatient care during cleaning procedures. Samarinda Medika Citra Hospital, a type C hospital with a capacity of 174 beds and a Bed Occupancy Rate (BOR) of 84% in 2024, faces several issues in linen management. These include linen loss, undocumented handovers between ward staff and laundry staff, discrepancies between the quantity of soiled linen collected and clean linen delivered, and the presence of worn-out linen with duplicate identifiers. This study aims to analyze the implementation of linen management using the Lean Six Sigma approach, identify existing challenges, and formulate improvement strategies based on Lean Six Sigma principles. This research employs a qualitative method with a descriptive case study design. The findings show that the application of Lean Six Sigma in linen management at Samarinda Medika Citra Hospital provides a foundation for enhancing efficiency and service quality through waste identification, workflow improvements, and strengthening of standard work procedures. Key challenges include staff understanding of efficiency principles and continuous improvement–based work standards, limitations in infrastructure, administrative systems, and management support. Improvement efforts include strengthening staff understanding and compliance with standard procedures through regular socialization and training, enhancing supporting facilities, developing digital recording systems, and promoting an adaptive, improvement-oriented work culture through coaching and performance-based incentives.

Corresponding Author:
Syamsul Bahri
Universitas Adhirajasa Reswara Sanjaya, Bandung; Indonesia; 7777syamsul@gmail.com

1. INTRODUCTION

Linen management is an important component in supporting the quality of hospital services, especially in the inpatient room. The availability of clean, sufficient, and timely linen has a direct effect on patient comfort and the smooth work of health workers. Inefficiencies in linen management can cause service delays, increased staff workload, and decreased patient satisfaction (Efitasary, E., Susanto, S., Wulandari, L., & Matrahman, 2023; MacIntyre, C., Dung, T. C., Chughtai, A. A., Seale, H., & Rahman, B., 2020). At Samarinda Medika Citra Hospital (SMC Hospital), a type C hospital with a BOR of 84% in 2024, a significant loss of linen was found based on the March 2025 stock, as well as weak handover documentation, differences in the amount of linen entering and exiting, and linen identification problems. This condition shows the existence of waste and weak control of operational processes.

Linen management problems are also found in many other hospitals in Indonesia, especially related to limited infrastructure, human resource competence, compliance with SOPs, and weak monitoring systems and internal policies (Febriyanti, M., Zulfa, & Putra, A. S., 2025; Ningsih, S., Sriatmi, A., & Suhartono, 2023; Ningtias, D. A. R., Asih, A. Y. P., & Fasya, A. H. F., 2023;Drie et al., 2022). Although some hospitals have met the minimum standards for linen management, there are still significant obstacles in their implementation (Dewi Nur Fadila & Siregar Jihan Luthfiyyah, 2021). The phenomenon of linen loss is often only a symptom of more complex managerial issues, such as unclear workflows and weak integration between units, which have the potential to affect hospital image and service quality (Drie, I., Rahmani, D., & Nuthea, M., 2022).

Lean Six Sigma is an effective process improvement approach in identifying and reducing waste and improving healthcare operational performance (Persis, D. J., Anjali, S., Sunder M, V., Rejikumar, G., Sreedharan, V. R., & Saikouk, T., 2022). A number of studies show that the application of Lean Six Sigma is able to reduce linen loss through strengthening the monitoring and process control system Fitriasari, N., Haryanto, T., & Yuliansyah, N., (2018), and increase efficiency in other hospital support units Gwen, M. R., Erna, K., & Firman., (2024). However, some research still focuses on technical and quantitative aspects, while an in-depth understanding of implementation dynamics at the operational level is still limited (Istyana Renny Dwi Ning, Rohendi A, Andikarya Oke., 2024).

Based on these conditions, this study aims to analyze the implementation of Lean Six Sigma in linen management at SMC Hospital through a qualitative approach of case studies, by tracing workflows, interactions between units, as well as supporting and inhibiting factors for its implementation. This research is expected to be able to produce contextual and applicable improvement recommendations to strengthen linen governance and support the development of hospital management based on continuous improvement.

2. METHODS

This study uses a qualitative approach with a descriptive case study design to explore in depth the linen management process at Samarinda Medika Citra Hospital (SMC Hospital). The case study approach allows researchers to understand phenomena contextually, examine operational dynamics, and formulate alternative solutions systematically (Komara Endang, Syaodih erliany, Andriani Rian., 2022). The Lean Six Sigma framework with the DMAIC (Define, Measure, Analyze, Improve, Control) cycle is used as the main analysis tool to identify waste, assess process performance, formulate improvements, and ensure the sustainability of control. The focus of the research is not only on the final results, but on the workflow, interaction patterns between units, decision-making, and documentation systems that run in linen management.

The main instrument in this study is the researcher, who plays a role in determining the focus of the research, selecting informants, collecting data, verifying the validity of the data, and conducting

analysis and drawing conclusions (Sugiyono, 2020). Data collection was carried out through direct observation of the linen management process, in-depth interviews with selected participants through purposive sampling, and document studies in the form of SOPs, distribution logs, and linen handover records. The data collected includes linen management workflows, operational issues such as loss and delays, compliance with procedures, officer experience, and the monitoring and evaluation system implemented by hospitals. Source triangulation approaches and techniques are used to improve the validity and reliability of the data.

Data analysis is carried out qualitatively and takes place from the stage of problem formulation to the preparation of research reports, with emphasis during the data collection process in the field (Sugiyono, 2020). The data is analyzed through the stages of organizing, sorting, grouping, coding, and categorization to build key themes that represent the real state of linen management (Komara Endang et al., 2022). Furthermore, the data is mapped into DMAIC stages to identify the main problem (Define), measure the existing conditions (Measure), analyze the root cause (Analyze), formulate remedial solutions (Improve), and establish a continuous control mechanism (Control). This approach allows for the integration of qualitative thematic analysis and the Lean Six Sigma framework resulting in contextual, applicative, and sustainability-oriented improvement recommendations.

3. FINFDINGS AND DISCUSSION

Research Results

Linen Management Flow from Service Unit to Return in Clean Condition

Based on the results of in-depth interviews and field observations, a number of problems were found in the linen management flow starting from the collection stage to distribution back to the service unit. At the collection stage, the sorting of linen has not been carried out consistently according to the standards. The informant said that non-infectious linen was often not put in a plastic bag as was the procedure, but rather directly placed in the linen bin, as revealed by R5:

> *"The management of non-infectious linen is not put in black plastic bags, directly in the barrel (green place)"* (Interview R5, 04/10/2025).

In addition, the officers' understanding of the SOP for linen sorting is still limited, because information is obtained through PPI's appeal and not through formal socialization, as stated:

> *"The SPO for linen sorting is not yet known, knowing this because there is an appeal from PPI"* (Interview R5, 04/10/2025).

Although there are units that have sorted according to the infectious and non-infectious categories, the practice is not uniform, as R6 points out:

> *"The linen sorting has been sorted in the room, infectious linen is stored in yellow plastic, non-infectious directly into the linen barrel"* (Interview R6, 01/10/2025).

The observation results also showed that officers had not fully used complete personal protective equipment (PPE) when handling linen:

> *"The officer did not use complete PPE"* (Observation R2, R3, R4, 27/09/2025).

This condition indicates a potential risk of infection and weak compliance with occupational safety standards.

At the reception and recording stage, it was found that the handover process between the room staff and the laundry staff had not been carried out formally and documented. Informant R1 stated that

> *"The collection of dirty linen is not carried out by handing over to the room nurse"* (Interview R1, 07/10/2025).

Meanwhile, R5 confirms that after the implementation of the linen centralization system, the practice of handover in rooms is no longer carried out:

"After the centralization of linen, the handover of linen in the room is never done again" (Interview R5, 04/10/2025).

In addition, the amount of dirty linen taken from the room is not known for sure because the counting process is only carried out in the laundry unit, as revealed by R6:

"Dirty linen was delivered to the laundry unit, but did not know the amount of dirty linen taken by the laundry officer. Dirty linen is counted in the laundry unit" (Interview R6, 01/10/2025).

These findings point to weaknesses in the system of recording and accountability, which have the potential to lead to data discrepancies and loss of linen.

At the stage of distribution of clean linen (distribution), problems were also found in the aspect of counting and documentation of handover. The informant said that clean linen was not counted during the delivery process, and the handover form was only signed without recording the amount of linen received. This is stated by R6:

"Clean linen is not counted when delivered, the officer only directly asks for a signature on the linen handover form. There is no documentation regarding the amount of clean linen received" (Interview R6, 01/10/2025).

This practice shows that the distribution process has not fully implemented the principles of control and traceability, so it has the potential to cause stock mismatches, complicate the monitoring process, and hinder continuous improvement efforts in hospital linen management.

Obstacles Often Faced in the Linen Management Process

Based on the results of interviews and field observations, it was found that various obstacles are often faced in the linen management process, starting from the stage of reception, washing, ironing, storage, to linen distribution. At the reception stage, the implementation of linen handover between laundry staff and room nurses has not been running optimally and consistently. Informant R1 said that the standard handover operational procedures are still considered ambiguous and often cannot be applied optimally due to the limited time of nurses, so the handover process is only carried out through the signing of a form without direct verification, as stated:

"The SPO handover linen with the nurse is still a bit ambiguous, sometimes I want to hand over it with the nurse but the nurse is still busy, the nurse just signs the handover form" (Interview R1, 07/10/2025).

This condition is reinforced by the statement of the R5 informant who stated that there was no evidence of handover kept as documentation:

"No evidence of handover was kept as evidence" (Interview R5, 04/10/2025).

These findings show a weak linen handover and recording system which has the potential to cause data mismatches and low process accountability.

At the washing stage, the main obstacles were found in facilities and infrastructure, especially the drying machine which often experienced operational disruptions. The R1 informant said that the two dryers often suffered damages, such as fires that did not burn or often went out on their own, as well as the engine doors that could not be closed tightly, as stated:

"Both dryers often make errors, the dryer fire does not want to come out and often turns off on its own and the dryer door cannot be closed" (Interview R1, 07/10/2025).

This problem indicates that the condition of the work equipment is not optimal and has the potential to slow down the linen processing process. The impact of the disruption is also felt in the ironing stage, where the management of the officer's workload must be adjusted to maintain service continuity. Informant R1 explained that when there was a machine malfunction, the officers were divided into three shifts and if one of the washing machines was malfunctioned, the washing process was transferred to the external laundry, as conveyed:

"When there is a breakdown in the dryer, to meet the service needs of the officers are divided into 3 shifts. If there is damage to one of the washing machines, the linen washing process will be transferred to an external laundry service" (Interview R1, 07/10/2025).

This condition shows that the limitations of facilities have a direct impact on the effectiveness of workflows and operational efficiency.

At the stage of storing clean linen, the results of the interview showed that there were problems related to the number of stocks, the quality of linen, and the linen control and identification system. The R1 informant said that the linen stock was only at level 3 BAR and there was still linen that was thin but could not be withdrawn because it had not been replaced, as revealed:

"The amount of linen stock is only 3 BAR, thin linen cannot be withdrawn because it has not been replaced" (Interview R1, 07/10/2025).

This is reinforced by the statement of another informant who stated that linen was still found in a thin and torn condition:

"There are still findings of thin linen" (Interview R5, 04/10/2025) and *"There are still many thin linens found and some are found to be torn, not sorted by the laundry unit"* (Interview R6, 01/10/2025).

In addition, linen from another unit was also found that was still in a service unit, as revealed:

"The linen in the unit is still there, linen from another unit was found" (Interview R6, 01/10/2025).

These findings show weak stock management, sorting systems, and linen distribution controls, which have the potential to disrupt service continuity.

At the distribution stage, as a crucial process that demands punctuality, quantity suitability, and linen quality, irregularities are still found in its implementation. The R1 informant said that linen requests are often made outside of the predetermined delivery schedule, thus disrupting the laundry unit's workflow:

"Before the linen delivery schedule, the room attendant asked for linen that did not match the delivery time" (Interview R1, 07/10/2025).

In addition, the R6 informant revealed that sometimes there was a discrepancy in the amount of linen delivered and the found linen in a damaged condition:

"Sometimes it is found that the quantity is not in accordance and the linen delivered is damaged" (Interview R6, 01/10/2025).

This condition reflects weak distribution control, which has the potential to trigger waste, increase workload, and reduce the quality of service in the treatment unit.

Suggestions for Improvement Efforts to Linen Management Obstacles at SMC Hospital

Based on the results of interviews and observations of the participants, several suggestions for improvement were obtained to improve the effectiveness of linen management at SMC Hospital, especially at the collection and handover stages of linen. Informant R6 suggested that non-infectious linen bins be immediately fitted with plastic bags or linen placed in cloth bags inside the trolley that can be directly picked up by the officers, as stated that

"Non-infectious linen bins are installed directly in plastic bags or linen containers are prepared from cloth bags in trolleys that can be taken directly" (Interview R6, 01/10/2025).

This proposal aims to simplify the process of picking up linen while minimizing the risk of contamination and transmission of infection.

In addition, improvements are also directed at the linen handover mechanism to be more orderly and well documented. Informant R5 proposed that each trolley be equipped with a handover form so that each handover process always has administrative proof, as conveyed that

"The handover form is plotted for one trolley, so that every handover always has a handover form" (Interview R5, 04/10/2025).

To support the smooth operation, the R6 informant also suggested the involvement of cleaning service officers in the process of delivering and picking up dirty linen, with a statement

"Cleaning service officers are involved in the delivery of dirty linen and the collection of dirty linen" (Interview R6, 01/10/2025).

This practice is reinforced by the statement of the R5 informant who emphasizes the importance of the involvement of room attendants in the process of verifying the amount of linen, namely

"When handing over, it is ensured that the room officer sees and correctly calculates before storing it in the storage cabinet" (Interview R5, 04/10/2025).

These proposals show the need to improve cross-unit coordination, administrative order, and direct supervision in the linen handover process.

Other proposed improvements are related to the fulfillment of infrastructure facilities and the availability of linen stock. The R1 informant conveyed the need for the addition of dryers and washing machines for infectious linen, namely

"Addition of a 1unit dryer and a washing machine for infectives" (Interview R1, 07/10/2025).

In addition, the R1 informant also emphasized that the current amount of linen stock is still at the level of 3 BAR, even though ideally 4 BAR is available, so it is necessary to procure new linen to replace thin linen, as stated that

"The current amount of linen stock is only 3 BAR, 4 BAR should be provided, the procurement of linen to replace thin linen" (Interview R1, 07/10/2025).

This was reinforced by the R6 informant who said that

"Linen that is already thin is replaced" (Interview R6, 01/10/2025).

The adequacy of the amount of linen stock is an important factor in ensuring service continuity, preventing the use of inappropriate linen, and maintaining a smooth washing and distribution cycle. With the addition of equipment and the replacement of linen that is no longer suitable for use, it is hoped that the quality of service and operational efficiency of linen management at SMC Hospital can increase sustainably.

Discussion

The application of Six Sigma in healthcare generally uses the DMAIC (Define, Measure, Analyze, Improve, Control) cycle as a framework for continuous improvement Pandiyan et al., (2023). The results of problem identification show that problems occur at almost all stages of linen management, from collection to distribution. At the collection stage, it was found that there was a risk of infection due to the transportation of linen that did not fully meet the principles of infection prevention and control. The reception stage still faces obstacles in handover and recording linen that has not been carried out according to standard procedures. In the washing and ironing stage, the problem is related to work equipment that is not optimal, while in the storage stage, there is a limited amount of linen, the existence of linen that is not suitable for use, and the arrangement of linen that has not been arranged. At the distribution stage, linen delivery is often not on schedule and linen is still found to be damaged, so it has the potential to interfere with the quality of service and patient safety. This condition shows the need for integrated and continuous improvement, given that hospital linen management plays an important role in preventing the transmission of infections, damage, and loss of linen. The linen management flow includes the receipt of dirty linen, sorting, washing, drying, ironing, storage, and distribution, while damaged linen is sent to the sewing room (Departemen Kesehatan RI, 2004).

The measurement results showed that of the 11-service units observed, not a single unit (0%) carried out the handover of dirty linen formally and documented according to the SPO, while in the handover of clean linen most of the units (55%) had not carried out the formal handover and some units that had done it had not been accompanied by verification of the amount of linen together. This

condition shows weak control over the implementation of operational standards. In terms of infection risk, observations of three laundry workers showed that the use of PPE was not fully up to standard, where only closed shoes, aprons/robes, and masks were used consistently. Head coverings were only used by one officer (33%), while face shields were not used by all officers (0%). In addition, linen transport trolleys do not have covers and some non-infectious linens do not use protective plastic bags, increasing the potential for contamination. In terms of work equipment, two dryers with an ideal capacity of 17 kg are only able to operate around 10 kg per cycle due to mechanical breakdowns, with an operating time of 8–9 hours per day, longer than the ideal time of about 6 hours, thus reducing efficiency and increasing workload. In terms of linen availability, inventory results show that of a total of 143 linens in the laundry area, only 62.2% are still suitable for use, while 37.8% have experienced a decrease in quality. The highest damage was found in pillowcases (71.4%) and laundry (55.8%). In Unit RPU 1, the imbalance in the number between types of linen causes only 5 sets of complete linen to be available, even though the ideal standard states the need for at least 5 pairs of linen stock to ensure continuity of service (Departemen Kesehatan RI, 2004).

The root cause analysis showed that the problem of linen handover was influenced by weak recording facilities, indecisive procedures, low officer discipline, weak supervision, and working environment conditions. The risk of infection is affected by limited PPE, low compliance with SPO, weak supervision, and inadequate linen transportation facilities. Work equipment problems are influenced by technical factors of the machine, the absence of routine maintenance, the skills of the officers, and the work environment. Meanwhile, the problem of availability and distribution of linen is closely related to an unstructured inventory system, weak stock recording, unbalanced linen rotation, and inadequate storage facilities. Based on the results of the analysis, improvement efforts are focused on standardizing handover forms, implementing routine controls and audits, increasing compliance with SPOs, providing complete PPE, strengthening K3 training, regular repair and maintenance of machines, improving the technical competence of officers, and structuring the linen inventory system through stock recording, linen rotation, and the implementation of visual management. The control stage is carried out through standardization of procedures, periodic performance monitoring, internal audits, and continuous evaluation to ensure the sustainability of improvements.

4. CONCLUSION

Research on the implementation of Lean Six Sigma in linen management at Samarinda Medika Citra Hospital shows that the DMAIC (Define, Measure, Analyze, Improve, and Control) approach has been systematically applied to analyze actual conditions, identify the root of the problem, and formulate and control improvement efforts. The results of the study revealed that linen management still faces various obstacles, including limited quantity and quality of linen, an unstructured inventory system, weak implementation and supervision of standard operating procedures, limited competence and awareness of officers, suboptimal equipment performance, and inadequate managerial support and measurement systems. In response, hospitals have carried out an integrated improvement strategy through strengthening SPO, improving infrastructure facilities, developing officer competencies and discipline, implementing a data-based inventory system, optimizing equipment maintenance, and strengthening control functions through monitoring, internal audits, and reward and punishment systems, so that it is hoped that linen management can run safer, more efficiently, sustainably, and oriented towards service quality and patient safety.

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