

## Conference Paper

# Reducing Linen Loss in Hospital Using Lean Six Sigma Approach

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## Abstract

Laundry service is one of the non-medical support services that carries out hospital linen management. Linen handling is necessary to prevent nosocomial and cross-infection, so it provides satisfaction and comfort for the patient. The results of preliminary study at X Hospital show that linen-loss incident was as much as 3.4%. This study aims to identify linen-loss problem and propose improvement suggestion through Lean Six Sigma approach. The research was conducted by integrating Lean and Six Sigma methods. Lean Six Sigma method is a systemic and systematic approach to identify and eliminate waste through continuous improvement in the flow of products (materials, work-in-processes, and output) and information using pull systems to achieve quality and excellence. Lean Six Sigma approach uses DMAIC Method (Define-Measure-Analyze-Improve-Control). The define stage was conducted with Focus Group Discussion (FGD), the obtained results is 'monitoring and control system in linen management to reduce linen loss' as a prioritized problem in Linen and Laundry Unit. Measure phase obtained low achievement of Minimum Service Standard on Laundry Service because there was still linen-loss incident as much as 3.4%. Analyze phase was done using Root Cause Analysis by making Ishikawa diagram (Fishbone) through questionnaires with Likert-scale, followed by arranging alternative solutions using Mc. Namara filtering theory. The selected solutions were creating procedures and a monitoring and control system document, as well as dissemination of linen-loss monitoring and control system. Improve phase was done by creating a handbook of linen-loss monitoring and control system consisting of four standard operating procedures in the Linen Room (Requirement Fulfillment SOP, Procurement SOP, Storage SOP, and Usage SOP), a standard operating procedure in Laundry Room (Distribution SPO), and eight supporting documents (linen inventory card, linen stock card, linen distribution form, linen checklist, dirty linen checklist, outgoing linen checklist, substitution form, and linen monthly report). The fifth phase (control) was to conduct short-term and long-term implementation evaluations. Short-term implementation is implemented for two weeks. Short-term implementation evaluations were performed by calculating a four-day Minimum Service Standard achievement by observing total linen on linen stock cards, linen checklists, dirty linen checklists, and linen distribution forms. Evaluation results obtained achievement of 100% Minimum Service Standard. Long-term implementation was carried out through

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creating Plan of Action (POA) covering the preparation, implementation and three-month and six-month evaluation. Lean Six Sigma approach in reducing linen loss is done through the application of linen-loss monitoring and control system. This system consists of five standard operating procedures and eight supporting documents. The result of the implementation of monitoring and control system gives a result of 100% no linen-loss incidence through simulation of Minimum Service Standard achievement.

**Keywords:** linen loss, lean, six sigma, DMAIC, monitoring and control system, minimum service standard

## 1. Introduction

Laundry service is one of non-medical support services that carries out hospital linen management. Linen supervision is regulated in linen management starting from planning, organizing, directing, and supervision of control [1]. The objectives of linen management are (a) to prevent cross-infection and nosocomial infection for patients and hospital personnel by managing and controlling linen materials, (b) to maintain hospital image by creating the availability of linen material in accordance to vision and mission and philosophy of the hospital, (c) to manage hospital resources to provide linen for the needs and expectations of hospital customers. Good laundry service can provide patient satisfaction and comfort [2]. Therefore, laundry service should refer to the established service standard, one of them is Minister of Health Regulation Number 129/Menkes/SK/II/2008 about Minimum Service Standard of Hospital on the absence of linen loss incident [3].

Linen loss incidents indicate waste that can have a disadvantage effect to the hospital. The missing linen will also degrade the quality of laundry service because the linen par stock decreases. Good linen management should use 1: 5 par stock, for 1 TT there are 5 par linen with 1 par linen being used, 1 par linen washed, 1 par linen as a reserve, while 2 par linen kept must be 1 par linen folded neatly and 1 par sheet-shaped linen [4]. Results of 2014 Annual Report at X Hospital in Malang showed the achievement of Minimum Service Standard for linen loss incidence was as much as 3.4%. This requires the hospital to improve the service quality by conducting efficiency and effectiveness to the laundry service. One of the efforts that can be done is service system implementation through Lean Six Sigma approach.

Lean method is derived from Toyota Production System (TPS) which creates added value by eliminating waste in its production activities. Lean is a continuous effort to eliminate waste and increase added value of product both goods and services to deliver value to customers. Lean applied in the whole company is called lean enterprise, lean on manufacture is called lean manufacturing, while when applied in hospital, it is called lean hospital. Lean hospital is to use less time, money, inventory and space to increase the value from the patient perspective [5].

The six sigma principle was first introduced by General Electric Company. Six Sigma principle is improving processes, creating good products and processes, and reducing degradation of product and process quality [6].

Lean Six Sigma is a different concept of management science. Lean prioritizes a system that will produce products or services quickly (speed), while Six Sigma priority is to the creation of products or services with minimal defect/damage. Lean Six Sigma method is a systemic and systematic approach to identify and eliminate waste through continuous improvement in the flow of products (materials, work-in-processes, and outputs) and information using pull system to achieve quality and excellence [6].

This study aims to identify linen loss problem and propose improvements through Lean Six Sigma approach.

## 2. Materials and Methods

This research was conducted by integrating Lean and Six Sigma method. Lean Six Sigma approach used in this research is the DMAIC Method (Define-Measure-Analyze-Improve-Control). Define aims to unify opinion from a team about the improvements to make. Measure aims to measure performance of a process at the present time in order to make comparison with the set target. Analyze aims to analyze causal relationship to determine the dominant factors needing control. Improve aims to optimize process using analyses to determine and control optimum conditions of a process. Control aims to continuously control a process to improve process capability toward Six Sigma target [7]. This research was conducted in September-October 2015 in X Hospital.

## 3. Results

The define phase was conducted with Focus Group Discussion (FGD) on 12 September 2015 with 8 participants consisting of the Director of X Hospital, the Vice Director of Service and Nursing, the Vice Director of General Affairs, the Head of Nursing, the Vice

Head of Nursing, the Chairman of Infection Prevention and Control Committee, the Head of Pharmacy Installation, and the Vice Head of Pharmacy Installation. The results of the FGD showed three problems related to linen loss, that is, planning system in linen management to reduce linen loss, organizing system in linen management to reduce linen loss, and monitoring and control system in linen management to reduce linen loss. The next step was to choose one problem by setting a priority scale of problems. The priority scale of problem was done by assessing the level of risk and its impact if no intervention was taken and how much effort was needed if improvements would be made. Assessment was done by giving points on the existing problems based on USG (urgency, severity, growth). The scoring step method using USG was done by making a list of problems or causes of the problem, determining assessment criteria by using USG, creating table of priority problem matrix, scoring from 1 to 5, finding the factor weight, and making the final decision by looking at the highest value as the priority problem [8]. The USG results revealed the priority problem in Linen and Laundry unit that was 'Monitoring and Control System in Linen Management to Reduce Linen Loss'. This is in accordance with Minimum Service Standard that has target achievement of 100% no linen loss.

The measure phase showed low achievement of Minimum Service Standard in Laundry Service because there was still linen loss incidence as much as 3.4%. Linen that often loss are patient clothes (1.1%), thick blanket (0.8%), and *steek laken* (0.67%). The highest linen loss occurred in Stroke Care Unit (36.6%), Intensive Care Unit (24.4%), and Jasmine Room (9.6%). The target set is 100% no linen loss.

The analyze phase was conducted using Root Cause Analysis by making Ishikawa (Fishbone) diagram, followed by compiling alternative solutions through Mc. Namara filtering theory. The concept of fishbone diagram is placing the fundamental problem on the head of the skeleton of the fish bone. The cause of the problem is described on the fins and the thorns. Common categories of problem cause include materials, machines and equipment, manpower, methods, money, and marketing [8]. The making of Ishikawa (Fishbone) diagram was initiated by distributing questionnaires. The questionnaire was completed with a Likert scale column, ranging from strongly disagree to strongly agree within 5 scales. The results of questionnaire were processed and brainstorming was done with the hospital management, then the analysis of the root of the problem was prepared holistically in the form of Ishikawa (Fishbone) diagram (Figure 1). Resolving the root of problem not to recur needs to be prepared some alternative solutions to the problem through identifying alternative solution method. The method used was Mc. Namara filtering theory by determining 3 criteria assessed

from each alternative, that is, effectiveness, efficiency, and convenience. Alternative solutions are said to be effective if they are able to solve problems and provide added value for organization. Low cost alternative solution had the highest score. The third aspect is the ease of implementation whether the alternative solutions that we submitted could be implemented or not. Each criterion was given score from 1 to 5. The highest total score was the solution of the selected problem [8]. The selected solutions were preparing procedure manual and monitoring and control system documents, and also socialization of linen loss monitoring and control system.

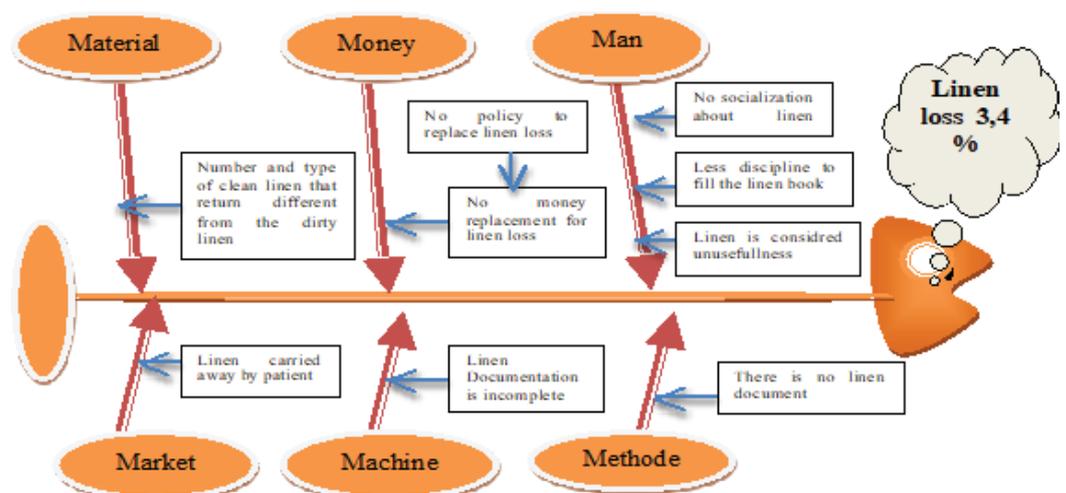


Figure 1: Root Cause Analysis by making Ishikawa (Fishbone) diagram.

Improve phase was done by creating a handbook of linen loss monitoring and control system. The preparation of this book was based on a literature study and results of following Linen Management Workshop on September 22–23, 2015. The draft of the handbook was discussed with the hospital management and approved by the Director of X Hospital. After the approval of the director, the Nursing Division that oversees Laundry Linen Unit copied the handbook for socialization preparation. The monitoring and control system includes supervision and control in linen and laundry rooms. The established monitoring and control system comprises four standard operating procedures in the Linen Room (Requirement Fulfillment SOP, Procurement SOP, Storage SOP, and Usage SOP) (Figure 2), a standard operating procedure in Laundry Room (Distribution SOP) (Figure 3), and eight supporting documents (linen inventory card, linen stock card, linen distribution form, linen checklist, dirty linen checklist, outgoing linen checklist, linen substitution form, and linen monthly report). The noticeable difference in the monitoring and control system is the authorization and event chronological creation. Authorization is a mechanism for matching linen counts when taking dirty linen and returning clean linen between Linen Laundry and Inpatient Unit personnel.

Matching is done with an authorization in the Linen Distribution Form. If any linen is missing, the lost linen replacement mechanism is performed by event chronological creation.

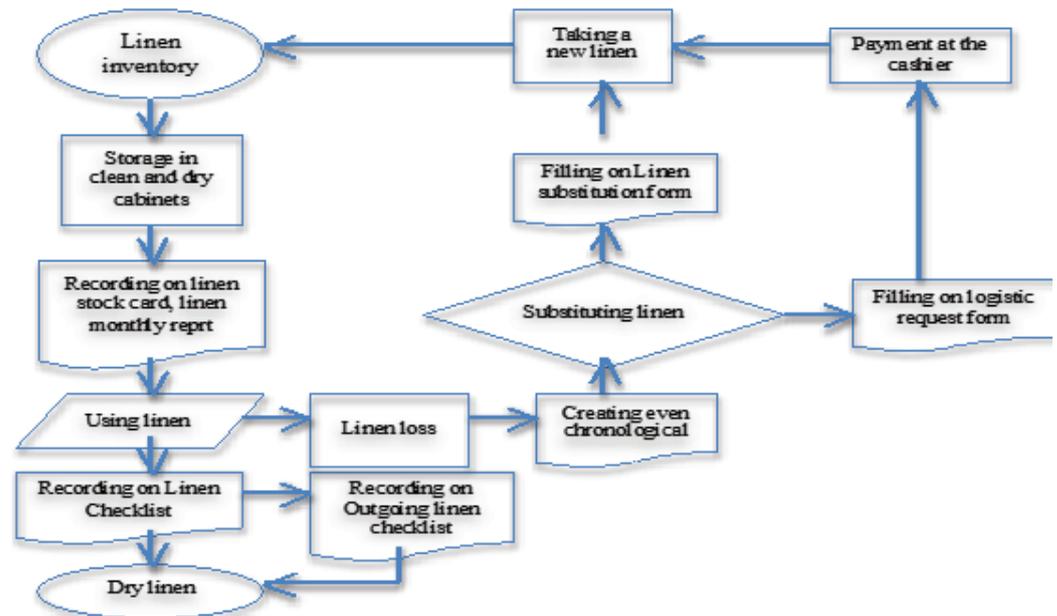


Figure 2: The monitoring and control system in the Linen Room.

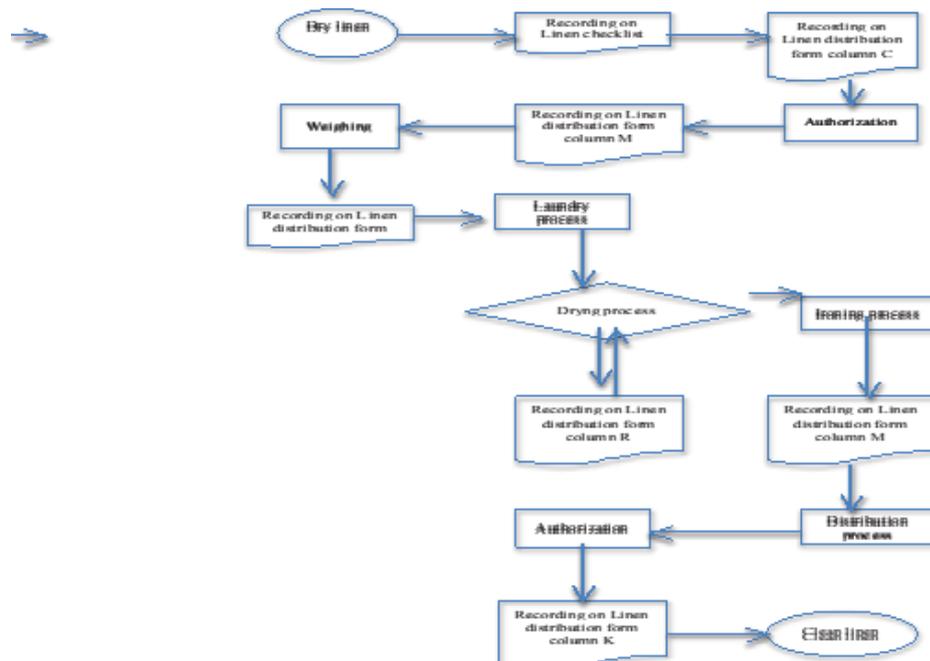


Figure 3: Standard Operating Procedure in Laundry Room.

Handbook of monitoring and control system of linen loss socialization was conducted on October 3, 2015 which was attended by 14 people, namely the Head of Nursing, the Vice Head of Nursing, and each Head of Rooms. Each participant continued

to socialize the handbook to the staffs in each room. The head of the room and staffs implemented the manual starting from 7–18 October 2015.

The fifth phase (control) was to conduct short-term and long-term implementation evaluations. Short-term implementation was carried out for two weeks. Short-term implementation evaluation was done by simulating the calculation of Minimum Service Standard achievement in accordance with standard formula. The numerator used was the number of linen counted in 4 days of sampling in one year. The denominator was the number of linen that should have existed on the day of the sampling. Linen sampling was conducted on 14–17 October 2015 by observing linen stock card documents, linen checklists, dirty linen checklists, and linen distribution forms. Evaluation results showed achievement of 100% Minimum Service Standard. Long-term implementation was carried out through creating Plan of Action (POA) covering preparation, implementation, and three-month and six-month evaluation. Preparation was done by reviewing the need for duplication of linen monitoring and control system document, designing monitoring and evaluation programs for implementing linen monitoring and control system, and determining the budget. Implementation includes implementation monitoring on monitoring and control system in each room by the Implementation Team by observing the completion of monitoring and control system document and conducting monthly routine meetings led by the Head of Implementation Team to present the monitoring results. Assessment/evaluation was done through a re-observation of the compliance to fill the document of monitoring and control system, calculating linen every three months and six months to compare the lost linen incidence before and after the intervention.

## 4. Conclusion

Lean Six Sigma approach can reduce linen loss through the application of linen loss monitoring and control system. This system consists of five standard operating procedures and eight supporting documents. The result of monitoring and control system implementation gives result of 100% no linen loss incidence through simulation of Minimum Service Standard achievement.

The advice that can be given is that the hospital must perform consistent and structured linen loss monitoring and control system through organizing. Further research is needed to know the cost efficiency of linen loss monitoring and control system.

## References

- [1] Arifin, M. (2017). Strategi Manajemen Perubahan dalam Meningkatkan Disiplin di Perguruan Tinggi. *J. Ilmu Pendidik. dan Ilmu Sos.*, vol. 3, no. 1.
- [2] Nugraheni, E. (2014). Analisis Tingkat Kepatuhan Petugas Linen Laundry terhadap SOP Pencucian Linen Laundry di Rumah Sakit X di Yogyakarta Tahun 2013. *Med. Respati*, vol. 9, no. 2.
- [3] Mansur, M. (2015). Peningkatan Mutu Pelayanan RSI Unisma Malang melalui Reformasi Manajemen Laundry dan Linen. *J. Kedokt. Brawijaya*, vol. 28, no. 2, pp. 148–152.
- [4] Fitriasari, N., Hariyanto, T., and Yuliansyah, N. (2016). Sistem Pengawasan dan Pengendalian Linen sebagai Strategi Mengurangi Angka Linen Hilang. *J. Kedokt. Brawijaya*, vol. 29, no. 3, pp. 279–284.
- [5] Fourie, C. J. and Umeh, N. E. (2017). Application of lean tools in the supply chain of a maintenance environment. *The South African Journal of Industrial Engineering*, vol. 28, no. 1, pp. 176–189.
- [6] Vendrame Takao, M. R., Woldt, J., and da Silva, I. B. (2017). Six Sigma methodology advantages for small-and medium-sized enterprises: A case study in the plumbing industry in the United States. *Advances in Mechanical Engineering*, vol. 9, no. 10, p. 1687814017733248.
- [7] Furterer, S. L. (2012). Applying lean Six Sigma to reduce linen loss in an acute care hospital. *International Journal of Engineering, Science and Technology*, vol. 3, no. 7, pp. 39–55.
- [8] Khasanah, Y. U. (2013). Perencanaan Sistem Rekam Medis Berdasarkan Input Dan Proses Di Tempat Pendaftaran Pasien Rawat Jalan Puskesmas Banguntapan li Kabupaten Bantul Tahun 2011. *J. Kesehat. Masy. (Journal of Public Health)*, vol. 5, no. 1.