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Business Process Improvement Promec Clinic Service System Using Time Motion Study and Value Stream Mapping Methods to reduce End-To-End Lead Times

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Abstract
Process efficiency is a key factor in improving the quality of healthcare services, especially in outpatient facilities such as clinics. This study presents a case study at Promec Clinic in Jakarta, aiming to identify bottlenecks and design process improvement recommendations to reduce end-to-end lead time. A descriptive and explanatory quantitative approach was employed, integrating Time and Motion Study (TMS) and Value Stream Mapping (VSM) as primary analysis tools. Data were collected through direct observation of 100 patients, interviews with staff, and operational process satisfaction questionnaires. The results indicate that the "during examination" stage contributes 73.6% of the total service time, while the "before examination" stage is the primary source of operational errors, particularly in form filling (45.59%) and data entry (39.71%). Pareto and Fishbone analyses reveal that manual procedures, lack of standardization, and reliance on informal communication are root causes of inefficiency. Improvement recommendations include digitizing patient forms using a dedicated registration system, implementing self-service kiosks, conducting periodic staff training, and developing Lean-based Standard Operating Procedures (SOPs). These findings offer practical contributions for clinic management in designing more efficient processes and serve as a reference for applying Lean methodologies in primary healthcare settings in Indonesia.

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1. INTRODUCTION

In the era of digital transformation and increasingly rapid service demands, process efficiency has become a crucial element in determining service quality in the healthcare sector. Clinics, as the spearhead of primary healthcare in Indonesia, are expected to provide services that are not only medically high-quality but also operationally efficient. However, in practice, many clinics still face challenges in optimally managing patient flow. Long waiting times, manual administrative processes, and a lack of system integration are often major obstacles to providing a satisfactory service experience for patients. This situation impacts not only customer satisfaction but also staff productivity, service capacity, and the reputation of the healthcare institution itself.

Promec Clinic, a private healthcare facility located in Jakarta, is one example of an institution that has strived to provide comprehensive services. However, like many other clinics, Promec Clinic faces challenges in the efficiency of its service processes, particularly related to patient care.*end-to-end lead time*—the total time a patient needs from

initial registration to completing payment and collecting medication. Based on data collected in Fransiska Mochtar's research (2025),*lead time*The average wait time at Promec Clinic is 3 hours and 16 minutes, with wide variations, ranging from 41 minutes to nearly 10 hours in extreme cases. This figure clearly falls short of the standard of excellent service, especially in the context of healthcare, which should prioritize speed and convenience.

This issue becomes more complex when analyzed in detail. The service process at Promec Clinic is divided into three main stages: pre-examination, during the examination, and after the examination. The analysis shows that although the "during the examination" stage accounts for the largest amount of time—an average of 2 hours and 24 minutes, or approximately 73.6% of the total service time—this stage is not the primary focus of improvement. This is because examination duration is highly influenced by individual clinical factors, such as the type of complaint, the complexity of the diagnosis, and the need for medical treatment, which are variable and cannot be drastically standardized without compromising the quality of medical care. Therefore, this study strategically focuses on the "pre-examination" and "after-examination" stages, which, despite their shorter duration, are the primary sources of inefficiency and operational errors.

In the pre-examination phase, patients must go through a series of highly manual administrative processes, including registration, filling out written identity and health history forms, document verification, and scheduling an examination. The average time spent on this process is 30 minutes, with a range of 10 minutes to 1 hour and 44 minutes, indicating significant inconsistency. Furthermore, a survey of operational process satisfaction revealed that the wait time before the examination had a satisfaction index of only 56%, well below the 80% threshold established as a quality criterion. This suggests that patients perceive this initial process as inefficient and time-consuming.

Meanwhile, in the post-examination phase, although the time contribution is relatively small (an average of 21 minutes), the payment and medication collection process remain a critical point. The satisfaction index for the payment process was only 77%, approaching the dissatisfaction threshold. Unorganized queues, payments that are not yet digitally integrated, and manual coordination between cashiers and pharmacies are the main causes of delays. In this context,*lean healthcare*, activities like these are often categorized as*waste*—waste that does not add value to patients, but still consumes resources and time.

To overcome this problem, Fransiska Mochtar (2025) proposed an approach of *Business Process Improvement (BPI)*systematic and data-driven, by integrating two classic yet highly effective methods: Time and Motion Study (TMS) and Value Stream Mapping (VSM).*Time and Motion Study* used to accurately measure the duration of each activity in the service process, so that it can be identified which activities take the longest time and become the most important of *bottleneck*. On the other hand, *Value Stream Mapping serves* as a value flow visualization tool, allowing researchers to map the entire process from the patient's perspective, identify valuable and non-valuable activities, and design more efficient flows.

This approach is reinforced by a Quality Evaluation Framework (QEF), which encompasses three main dimensions: time efficiency, service reliability, and technology utilization. These three dimensions were chosen because they are interrelated and provide a holistic picture of business process quality. Time efficiency reflects how quickly services are delivered, service reliability reflects the consistency and accuracy of procedures, and technology utilization indicates the extent to which a clinic utilizes digital innovation to support operations.

This research is highly relevant in the national context, given the rapid growth of private clinics and primary healthcare networks, which has not been matched by optimization of internal processes. Many clinics still rely on manual systems that are prone

to errors, delays, and patient dissatisfaction. By adopting scientific methods such as TMS and VSM, this research not only provides concrete solutions for Promec Clinic but also serves as a model for other clinics in Indonesia to implement a data-driven approach to process improvement.

Furthermore, this research addresses the increasingly pressing need for digital transformation in the healthcare sector. In the era of Society 5.0 and the digitalization of public services, clinics can no longer rely on conventional processes. Implementation of online registration systems, self-service kiosks (*self-service kiosk*), digital payments, and information system integration are no longer optional, but rather imperative to remain competitive and deliver services that meet the expectations of modern patients. This study provides concrete, step-by-step recommendations, including short-term solutions like the use of Google Forms, and long-term solutions like a dedicated registration platform that is more secure, scalable, and integrated.

Thus, this research is not only academic but also has significant practical value. Its findings and recommendations can be directly implemented by clinic management, serve as the basis for developing new standard operating procedures (SOPs), and serve as material for periodic operational performance evaluations. Through a systematic, measurable, and patient-value-oriented approach, this research contributes to broader efforts to create a healthcare system that is not only medically effective but also operationally efficient.

2. RESEARCH METHOD

This study used a quantitative approach with a descriptive and explanatory design. The object of the study was the service process at the Promec Clinic, which was divided into three main stages: before the examination, during the examination, and after the examination. The population included all patients and clinic staff, with a sample of 100 patients selected using a purposive sampling technique based on the criteria of 18–60 years of age and availability to participate in observations and surveys.

Data collection was conducted through three main methods: direct observation using Time and Motion Study to record the duration of each activity, process mapping with Value Stream Mapping to visualize the flow of value and waste, and an operational process satisfaction questionnaire filled out by patients and staff. The questionnaire was designed based on the Quality Evaluation Framework (QEF) which includes three dimensions: time efficiency, service reliability, and technology use. The questionnaire instrument was tested for validity and reliability, with the results of all 18 items declared valid (r count > r table = 0.195) and a Cronbach's Alpha coefficient of 0.827, indicating a high level of reliability.

Data analysis was conducted descriptively using the mean, standard deviation, minimum and maximum values, and median. To identify bottlenecks, Pareto Analysis was used to identify the most time-consuming and error-causing activities. Fishbone Diagrams were applied to analyze the root causes of problems, with categories of man, method, machine, material, measurement, and process. All data was then synthesized to formulate concrete and applicable process improvement recommendations.

3. RESEARCH RESULTS AND DISCUSSION

The results of the analysis of the service system at Promec Clinic provide a clear picture of the time structure, critical points in the operational process, and factors contributing to service inefficiency and unreliability. Through the integration of Time and Motion Study (TMS) and Value Stream Mapping (VSM) methods, the study successfully identified key bottlenecks and formulated recommendations for improvement that are not only technical but also strategic in the context of modern healthcare management. Initial

data indicated that the average end-to-end lead time at Promec Clinic reached 3 hours and 16 minutes, with wide variations—from 41 minutes to nearly 10 hours. Such a wide time range indicates inconsistencies in the service process, which not only disrupts the patient experience but also creates uncertainty in clinic capacity planning. By dividing the service process into three main stages—before the examination, during the examination, and after the examination—the study was able to map the time distribution in detail. The average time spent in the pre-examination phase was 30 minutes and 28 seconds, in the post-examination phase it was 2 hours, 24 minutes, and 31 seconds, and in the post-examination phase it was 21 minutes and 19 seconds. Cumulatively, the post-examination phase accounted for 73.62 percent of the total service time, followed by the pre-examination phase (15.52 percent) and post-examination phase (10.86 percent).

While the pre-examination phase seems reasonable given the clinical nature of the activity, further analysis using Pareto Analysis revealed that the focus of improvement should not be on this phase. This is because examination duration is highly influenced by individual and variable medical factors, such as the complexity of the complaint, the need for intervention, or follow-up consultations. Therefore, overly aggressive interventions to expedite this phase could potentially compromise the quality of medical care. Conversely, the pre-examination and post-examination phases, despite their smaller time contributions, are the primary sources of inefficiency and operational errors, and therefore are a top priority for improvement recommendations. To identify which activities most impact time efficiency, a Pareto Analysis was performed on all activities in the service process. The results showed that the pre-examination phase contributed the most to total service time, contributing 74 percent, followed by the pre-examination phase (16 percent) and post-examination phase (11 percent). Based on the Pareto principle, activities outside the cumulative 80 percent—in this case, the post-examination phase—are not a top priority. However, this finding does not necessarily negate the importance of improving these phases, especially when linked to other quality dimensions, such as reliability and patient satisfaction.

The operational process satisfaction survey, consisting of 18 questions and having undergone validity and reliability testing with a Cronbach's Alpha coefficient of 0.827, revealed two criteria with scores below the 80 percent threshold: waiting time before examination with a score of 56 percent and payment processing with a score of 77 percent. These low scores indicate that patients perceive these two processes as major obstacles in their service experience. Although the payment process still achieved a score above 75 percent, it is quite close to the dissatisfaction threshold and warrants serious attention. A deeper analysis of service reliability using Pareto Analysis of operational error types revealed that errors in filling out new patient forms were the biggest problem, with a frequency of 31 cases (45.59 percent), followed by data input errors by staff with 27 cases (39.71 percent), and ID card verification errors with 7 cases (10.29 percent). These three types of errors cumulatively accounted for 95.6 percent of all errors, indicating that the source of the problem was concentrated in the initial administrative process. This is crucial because errors in the initial stages will have a domino effect on the entire service flow, including potential errors in diagnosis, prescription writing, or billing.

To uncover the root causes of this inefficiency and unreliability, a Fishbone Diagram was used, with the categories man, method, machine, material, measurement, and process. The analysis revealed that the main factors contributing to the problem were complex manual procedures, a lack of process standardization, reliance on informal communication like WhatsApp, and minimal staff training in technology usage. Furthermore, the lack of an integrated information system resulted in the need for repeated patient data entry across multiple departments, increasing the risk of duplication and input errors. This situation

reflects waste in the form of overprocessing and defects, two of the seven types of waste in the Lean principles. Regarding technology utilization, the study found that Promec Clinic had used several digital platforms, such as Google Forms for new patient forms and Microsoft Excel for databases. However, the use of these technologies was still partial and not integrated. Google Forms, while easily accessible and quick to implement, has limitations in terms of data security, technical support, and integration capabilities with other systems. Furthermore, Microsoft Excel is prone to human error, lacks real-time updates, and cannot be accessed simultaneously by multiple users without risking conflicts. Therefore, even though clinics have adopted technology, its utilization is not yet optimal to support process efficiency and reliability.

The researchers' recommendations for improvement include both short-term and long-term solutions. In the short term, they recommend more intensive use of Google Forms, with improved filling guidelines and staff training. However, in the long term, they recommend implementing a dedicated registration system that is more secure, scalable, and integrated. This system could include features such as self-service kiosks at the registration area, allowing patients to fill out forms, scan their ID cards, and print queue numbers themselves. Additionally, digital verification and online queuing systems could be developed to reduce crowding and wait times. For the post-examination phase, recommendations include separating payment and medication collection channels, automating the billing system, and providing additional training for pharmacy staff to improve efficiency and accuracy. Implementing e-prescriptions integrated with the doctor's system could also speed up the medication dispensing process and reduce the risk of prescription errors.

For your consideration, the researchers present a comparison between using Google Forms and a dedicated registration system. In terms of cost, Google Forms is free, while dedicated registration systems require an initial fee and a subscription fee. However, in terms of features, dedicated systems offer full integration with clinical information systems and EHRs, digital identity verification, queue management, and automated notifications—features that are critical for modern clinics. In terms of data security, dedicated systems generally comply with regulatory standards like HIPAA, while Google Forms is not specifically designed for healthcare data. Technical support is also a benefit of dedicated systems, which provide customer service and implementation assistance, something that Google Forms lacks. While dedicated systems require more time and staff training to implement, their scalability and high level of personalization make them a strategic choice for long-term digital transformation.

Interestingly, the Pearson correlation analysis results show that examination duration has a very strong correlation ($r = 0.99$) with total service time, while other stages do not show a significant relationship. This reinforces the finding that although examination duration is a dominant factor in determining lead time, improvements in the administrative stage remain crucial because they directly impact reliability and patient satisfaction. Overall, the findings of this study align with the principles of Lean Healthcare, which emphasize the importance of eliminating waste and focusing on perceived value for patients. Process improvement does not necessarily mean speeding up each stage, but rather optimizing flow, reducing errors, and increasing consistency. With these recommendations, Promec Clinic has a significant opportunity to transform its service process from a manual and error-prone system to a more digital, efficient, and reliable one.

However, this study also has limitations. The lack of a post-implementation evaluation means that the actual impact of the improvement recommendations remains unmeasured. Therefore, the researchers recommend that future research calculate the efficiency of the recommended business processes and develop systematic forms of evaluation and

monitoring, such as a performance dashboard or periodic process audits. This way, process improvements will not only be theoretical recommendations but can also be measured, monitored, and maintained on an ongoing basis. This section explains the research results and provides a comprehensive discussion.

4. CONCLUSION

This study has successfully identified and analyzed critical aspects of the service system at Promec Clinic that affect time efficiency, service reliability, and technology utilization. By using a Business Process Improvement approach that integrates the Time and Motion Study and Value Stream Mapping methods, this study provides a systematic and measurable overview of the service process flow, and produces concrete and applicable improvement recommendations. Based on the analysis results, it can be concluded that the operational process quality criteria at Promec Clinic—including time efficiency, service reliability, and technology utilization—require structured improvisation to improve overall performance.

From a time efficiency perspective, Pareto Analysis results indicate that the examination stage contributes 73.62 percent of the total end-to-end lead time, making it the dominant activity in the service process. However, given its clinical nature and its significant impact on the complexity of patient cases, this stage has not been a primary focus for improvement. Conversely, the pre-examination and post-examination stages, despite their smaller time contribution, have proven to be major sources of inefficiency and waste. Manual administrative processes, such as registration, form completion, and data entry, act as bottlenecks that hinder patient flow and contribute to inefficient waiting times. This is reinforced by the results of the operational process satisfaction survey, where the pre-examination waiting time criterion only achieved a score of 56 percent, well below the 80 percent threshold set as the quality standard.

In the service reliability dimension, analysis of the frequency of operational errors revealed that two types of errors dominated: errors in filling out new patient forms (45.59 percent) and data input errors by staff (39.71 percent). These two activities cumulatively accounted for more than 85 percent of all errors, indicating that administrative processes are a critical point prone to defects. Fishbone analysis identified the main root causes, namely non-standardized procedures, reliance on informal communication such as WhatsApp, and a lack of regular and mandatory staff training. These conditions indicate waste in the form of overprocessing and defects, which directly reduce the reliability and consistency of service.

In terms of technology usage, although the Promec Clinic has utilized several digital platforms such as Google Forms and Microsoft Excel, their implementation remains fragmented and unintegrated. The lack of an integrated information system results in the need for repeated patient data entry, increasing the risk of duplication and errors. Furthermore, the lack of digital verification features, a queuing system, and automated notifications limits potential efficiencies. While Google Forms is easy to implement, its limitations in terms of data security, technical support, and scalability highlight the need to migrate to a dedicated registration system that is more secure, integrated, and equipped with customer service.

Based on these findings, the proposed improvement recommendations cover three main aspects. First, digitizing administrative processes, including the implementation of an online registration system, self-service kiosks in registration areas, and automating data input to reduce reliance on manual processes. Second, improving service reliability through the development of clear standard operating procedures (SOPs), periodic and mandatory staff training, and implementing a performance monitoring system. Third, optimizing the

use of technology by adopting integrated digital platforms, such as digital queuing systems, e-prescriptions, and digital-based information exchange, to eliminate non-value-added manual activities.

Overall, this study proves that the application of the Time and Motion Study and Value Stream Mapping methods within the Quality Evaluation Framework is able to provide an accurate diagnosis of operational problems at the Promec Clinic. These findings and recommendations not only provide practical contributions to clinic management in improving efficiency and patient satisfaction, but also serve as a valuable reference for other clinics in Indonesia facing similar challenges. Thus, this study successfully answers all the proposed problem formulations and hypotheses, and demonstrates that business process improvements can be carried out systematically, based on data, and focused on perceived value by patients. provide a statement that what is expected, as stated in the "Introduction" chapter can ultimately produce the "Results and Discussion" chapter, so that there is a match. In addition, prospects for developing research results and prospects for further research implementation can also be added (based on the results and discussion).

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