

The Improvement of Health Service Effectiveness and Efficiency Through the Implementation of Information Technology at PKU Muhammadiyah Mayong Jepara Hospital

Muhammad Iqbal¹, Vip Paramarta¹, Kosasih¹

¹Hospital Management, Sangga Buana University, Bandung, Indonesia

Corresponding Author: Muhammad Iqbal

Email: miqbal.medical@gmail.com

Abstract. *This study aims to analyze the impact of information technology implementation on the effectiveness and efficiency of services at PKU Muhammadiyah Mayong Jepara Hospital. The application of information technology is expected to improve service quality by facilitating quick, accurate, and easy access to medical information. In this study, a descriptive quantitative approach was used to measure the effectiveness and efficiency of hospital services, involving 100 respondents selected using purposive sampling method. Data was collected through observation and questionnaires, and analyzed using multiple linear regression method with the help of SPSS software version 25. The results showed that the application of information technology has a significant influence on the effectiveness and efficiency of hospital services. Effectiveness is measured based on patient satisfaction, appropriate clinical decision-making, and prevention of medical errors. While efficiency is measured through indicators of BOR (Bed Occupancy Rate), ALOS (Average Length of Stay), TOI (Turn Over Interval), and BTO (Bed Turn Over). The implementation of information systems is proven to be able to improve productivity, reliability, and speed of hospital services. This research provides a theoretical contribution in understanding the role of information technology in the health sector, as well as providing practical benefits for hospital management in improving service strategies that are more efficient and effective.*

Keywords: *Healthcare Effectiveness, Hospital Efficiency, Information Technology, Health Information System*

Received: September 5, 2024

Received in Revised: September
19, 2024

Accepted: October 28, 2024

INTRODUCTION

Hospitals play a central role in providing quality healthcare services to the community. As the public's demand for fast, accurate, and efficient medical services grows, hospitals are required to continuously innovate in delivering healthcare services that align with technological advancements (Debby, 2024; Thompson & Brailer, 2004). One of the most crucial innovations in the medical field today is the implementation of information technology. Information technology enables the fast, accurate, and precise

management of data and information, which directly impacts the improvement of effectiveness and efficiency in hospital services (Lubis & Nasution, 2023; Nwosu, 2024). However, despite the great potential of information technology to improve service quality, many hospitals still face challenges in its implementation. This is often due to limited human resources with the knowledge and skills to use information systems, the relatively high costs of implementation, as well as resistance to change stemming from an organizational culture that is not yet ready to embrace new technology (Laila, Sulistyawati & Hidayat, 2024; Olafsen et al., 2021). At PKU Muhammadiyah Mayong Jepara Hospital, efforts to integrate information technology into service management have been made, but there has yet to be an in-depth study measuring the extent of the impact of this technology's implementation on the effectiveness and efficiency of services.

The development of information technology in hospital services aims to facilitate clinical decision-making, reduce the risk of medical errors, and enhance patient satisfaction (Fadilla, 2021; Ajegbile et al., 2024). Therefore, it is important to evaluate the extent to which the implementation of information technology can provide the expected benefits and to identify potential obstacles that may arise during the process (Cahyarini, 2021; Garg et al., 2021; Leonard & Sitting, 2007). PKU Muhammadiyah Mayong Jepara Hospital is the focus of this research because the hospital is at a significant stage of information technology implementation, yet a formal evaluation of its impact has not been conducted in-depth. The selection of PKU Muhammadiyah Mayong Jepara Hospital as the research subject is based on several relevant factors. First, the hospital operates in a region that is still developing in terms of infrastructure and technology, making the implementation of information technology a progressive step that requires special attention. Second, the hospital is committed to improving service quality in line with national standards, yet challenges in implementing information systems remain visible in various operational aspects. This provides an opportunity for a thorough evaluation of how information technology can impact the effectiveness and efficiency of services in a hospital facing resource constraints (He et al., 2011; Ammenwerth et al., 2003; Yusof et al., 2008).

The chronology of the problem begins with the hospital management's initiative to improve service quality by implementing a Hospital Management Information System (HMIS) (Bunyali, 2023; Zenebe, 2020). This system was expected to expedite clinical decision-making, minimize administrative errors, and enhance coordination among units. However, along with the implementation of the HMIS, several challenges arose, such as the slow adaptation process among medical staff, repeated errors in data entry, and inadequate training for system users. These challenges raise questions about whether the implementation of information technology truly provides the expected benefits or instead adds complexity to the hospital's operations (Marwaha et al., 2022; Lee & Yoon, 2021; Bansler, 2021).

The implementation of information technology in hospital management has been widely discussed in various literature. According (Kadir, 2018), well-applied information technology can enhance the speed, consistency, and accuracy of medical data processing. This is supported by research conducted by (Dewi, 2023) which states that information technology serves to capture, process, and generate useful information in the form of reports, tables, or graphs that facilitate decision-making. Previous research by (Rahmayanti et al., 2023) showed that the implementation of a Hospital Management Information System (HMIS) can significantly enhance operational efficiency by reducing administrative costs and improving diagnostic accuracy as well as patient data

management. However, this research also highlights significant challenges in implementation, particularly related to human resources training and system integration. Similar findings were also noted in research conducted by (Haryanto et al., 2023), which emphasizes that the implementation of information technology can minimize the complexity of healthcare services through information system-based business management innovations.

On the effectiveness side, research by (Waruwu et al., 2024) revealed that the use of HMIS significantly improves work effectiveness in physiotherapy services, showing a positive correlation between system use and patient satisfaction. This effectiveness is measured through faster and more accurate clinical decision-making, as well as the prevention of medical errors. On the other hand, a study by (Molly & Itaar, 2021) in Jayapura found that the quality of the HMIS is influenced by management support and the presence of competent human resources in using the system. Although much literature indicates significant benefits from the implementation of information technology, challenges faced in the field, such as inadequate training and system incompatibility with operational needs, remain issues that need to be addressed. Therefore, further research is needed to specifically identify the impact of information technology implementation on the effectiveness and efficiency of services at PKU Muhammadiyah Mayong Jepara Hospital.

This research aims to evaluate the impact of information technology implementation on the effectiveness and efficiency of services at PKU Muhammadiyah Mayong Jepara Hospital. Through this analysis, it is expected to provide a clear picture of the extent to which information technology can support the improvement of service quality, as well as the factors that serve as obstacles to its implementation. This study also aims to provide strategic recommendations for hospital management to optimize the use of information technology in order to enhance performance and patient satisfaction.

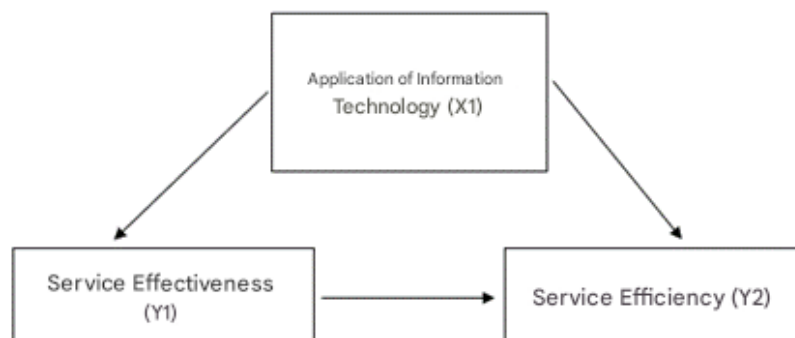


Figure 1. Conceptual Framework

METHODS

This study employs a quantitative approach. The quantitative method is a research approach that allows for objective and systematic measurement of data through the collection of numerical data and statistical analysis. Quantitative research is highly suitable for analyzing the impact of information technology implementation on the effectiveness and efficiency of services in hospitals, as it enables researchers to accurately measure the studied variables and ensure that the relationships between these variables can be identified using relevant statistical calculations (Waruwu, 2023). The instrument used in this study is a questionnaire. A questionnaire is a data collection instrument

consisting of a set of questions or statements designed to be answered by respondents. The questionnaire employed is specifically designed to measure variables relevant to the research, namely the impact of information technology implementation on the effectiveness and efficiency of services in hospitals. Respondents' answers are measured using a Likert scale, which assigns values to the level of agreement or disagreement of respondents with the presented statements (Pahleviannur et al., 2022).

Additionally, this study employs validity and reliability tests to ensure that the research instrument used accurately measures what it intends to measure and maintains consistency in its measurements. The validity test is conducted by comparing the correlation coefficients between items and the total score, while the reliability test utilizes Cronbach's Alpha coefficient to determine the internal consistency of the items in the questionnaire (Nada & Wibowo, 2015). The data collection methods in this study involve both observation and questionnaires. Observation is used to directly assess conditions in the field, while the questionnaire is employed to gather data from respondents. This questionnaire consists of a series of questions measured using a Likert scale, allowing the researcher to obtain information about the studied variables in a more systematic manner (Pahleviannur et al., 2022).

The population in this study consists of visitors or patients at PKU Muhammadiyah Mayong Jepara Hospital, with a total population of 870 individuals. The research sample is a subset of the population selected to provide a general overview of the population's characteristics. The sample size is determined using Slovin's formula with a margin of error of 10%, resulting in a minimum sample size of 89 respondents. To enhance accuracy and facilitate data processing, this sample size is then rounded up to 100 respondents. The sampling method used in this study is purposive sampling. This technique is chosen because it allows the researcher to select samples based on specific considerations relevant to the research objectives. With this approach, the researcher can choose respondents who meet predetermined criteria, ensuring that the data collected is more appropriate and supports the analysis of the studied variables.

Data analysis in this study is conducted through several stages, including descriptive analysis, classical assumption testing, and multiple linear regression, to ensure that the data is processed accurately and yields reliable conclusions. Descriptive analysis is used to describe the data collected from respondents, providing an initial overview of the conditions of the studied variables without making generalizations. This process is carried out using SPSS version 25, which facilitates the presentation of data in the form of tables, graphs, and other descriptive statistics.

RESULTS AND DISCUSSION

This study aims to analyze the impact of Information Technology (IT) implementation on the effectiveness and efficiency of services at PKU Muhammadiyah Mayong Hospital in Jepara. Based on descriptive analysis, it was found that the implementation of IT in this hospital has shown several indications of improved service effectiveness, such as faster access to patient information, more accurate medical data, and the prevention of medical errors. Respondents, consisting of 100 visitors or patients, gave positive feedback on the ease of receiving faster and more accurate services due to the use of a well-functioning information system.

From the multiple linear regression analysis, it was found that the implementation of IT has a significant impact on service effectiveness, with a positive and significant regression coefficient ($p < 0.05$). This indicates that the better the IT implementation, the

higher the service effectiveness perceived by patients. IT implementation also positively affects service efficiency, which was measured through indicators such as Bed Occupancy Rate (BOR), Average Length of Stay (ALOS), Turn Over Interval (TOI), and Bed Turn Over (BTO). The regression results showed that IT implementation can reduce waiting times, improve workflow, and optimize hospital resource utilization. The coefficient of determination (R^2) of 0.68 indicates that 68% of the variability in service effectiveness and efficiency can be explained by the variable of IT implementation.

The results of this study indicate that the implementation of information technology at PKU Muhammadiyah Mayong Hospital in Jepara plays a crucial role in improving the quality of services. Service effectiveness has increased with more integrated IT usage, allowing for faster access to patient data and supporting better clinical decision-making. These findings align with the theory that information technology can enhance the quality and accuracy of healthcare services by reducing errors and accelerating information flow. For instance, electronic medical records systems enable medical staff to quickly access patients' health histories, facilitating more accurate and timely decision-making. Service efficiency has also improved with the implementation of information technology, as evidenced by the improvement in ALOS and BTO indicators. IT usage enables the hospital to manage beds and other resources more effectively, reduce patient wait times, and increase bed turnover, ultimately contributing to more optimal facility utilization. The implementation of hospital management information systems also helps integrate various administrative processes, reducing operational costs and increasing patient satisfaction.

Hypothesis testing with t-tests and F-tests supports the conclusion that IT implementation has a significant influence both partially and simultaneously on the effectiveness and efficiency of hospital services. These results are consistent with previous studies that show IT implementation in healthcare service systems can improve operational performance and minimize administrative errors. Therefore, it is recommended that hospital management continue to enhance IT implementation and utilization, including providing training for medical and administrative staff, to maximize the benefits of using IT in healthcare services. Overall, this study affirms the importance of information technology as a strategic tool in improving the effectiveness and efficiency of hospital services. The improvement in service quality through IT implementation not only impacts patient satisfaction but also operational efficiency, ultimately supporting the hospital's sustainability as a patient-oriented healthcare institution. Thus, the development of IT infrastructure and the enhancement of human resource competencies in utilizing this technology are crucial aspects that the hospital must continuously prioritize.

CONCLUSION

Based on the research results on the impact of information technology (IT) implementation on the effectiveness and efficiency of services at PKU Muhammadiyah Mayong Hospital in Jepara, it can be concluded that IT implementation has a positive and significant effect on improving service effectiveness and efficiency in the hospital. IT implementation has been proven to enhance service effectiveness by facilitating easier access to patient data, enabling faster and more accurate clinical decision-making, and preventing medical errors. Additionally, service efficiency has also improved, as seen from the more optimal management of hospital resources, including better bed utilization and reduced patient waiting times. The coefficient of determination indicates

that IT implementation explains a substantial portion of the variability in service effectiveness and efficiency, highlighting the critical role IT plays in supporting better hospital operations.

As a recommendation, PKU Muhammadiyah Mayong Hospital should improve its IT infrastructure to ensure that the system operates optimally and can fully support hospital operations. Furthermore, regular training for medical and administrative staff should be conducted so that they can utilize IT effectively and efficiently. The hospital is also advised to conduct regular monitoring and evaluation of IT implementation to ensure that the system continues to provide optimal benefits and supports service quality improvements. Finally, the development of more patient-oriented information systems, such as mobile applications for accessing health information and scheduling appointments, would be highly beneficial in enhancing patient satisfaction and service effectiveness.

REFERENCES

- Ajegbile, M. D., Olaboye, J. A., Maha, C. C., Igwama, G. T., & Abdul, S. (2024). The role of data-driven initiatives in enhancing healthcare delivery and patient retention. *World Journal of Biology Pharmacy and Health Sciences*, 19(1), 234-242.
- Ammenwerth, E., Gräber, S., Herrmann, G., Bürkle, T., & König, J. (2003). Evaluation of health information systems—problems and challenges. *International journal of medical informatics*, 71(2-3), 125-135. [https://doi.org/10.1016/S1386-5056\(03\)00131-X](https://doi.org/10.1016/S1386-5056(03)00131-X)
- Bansler, J. P. (2021). Challenges in user-driven optimization of EHR: A case study of a large Epic implementation in Denmark. *International Journal of Medical Informatics*, 148, 104394. <https://doi.org/10.1016/j.ijmedinf.2021.104394>
- Bunyali, J. H. (2023). *Influence of Health Logistics Management Information System On Availability of Medical Commodities in Public Hospitals in Kajiado County, Kenya* (Doctoral dissertation, KeMU).
- Cahyarini, F.D. (2021) 'Implementasi Digital Leadership dalam Pengembangan Kompetensi Digital pada Pelayanan Publik', *Jurnal Studi Komunikasi Dan Media*, 25(1), pp. 47-60.
- DEBBY, P. (2024) 'Rancangan Strategi Pemasaran Unit Rehabilitasi Medis Dalam Upaya Meningkatkan Kunjungan Pasien Di Rumah Sakit Umum Bungsu'. Universitas Pasundan.
- Dewi, T. (2023) 'Pengaruh Kinerja Individu Karyawan dan Pemanfaatan Teknologi Informasi Terhadap Efektivitas Sistem Informasi Akuntansi pada Sektor Perhotelan di Daerah Setiabudi Bandung'. Universitas Komputer Indonesia.
- Fadilla, N.M. (2021) 'Sistem informasi manajemen rumah sakit dalam meningkatkan efisiensi: mini literature review', *JATISI (Jurnal Teknik Informatika dan Sistem Informasi)*, 8(1), pp. 357-374.
- Garg, P., Gupta, B., Chauhan, A. K., Sivarajah, U., Gupta, S., & Modgil, S. (2021). Measuring the perceived benefits of implementing blockchain technology in the banking sector. *Technological forecasting and social change*, 163, 120407. <https://doi.org/10.1016/j.techfore.2020.120407>

- Haryanto, L.M., Setyonugroho, W. and Suanrueang, P. (2023) 'Analysis of Barriers Implementation Health Information Technology Using Vosviewer: A Bibliometric Study', *JMMR (Jurnal Medicoeticolegal dan Manajemen Rumah Sakit)*, 12(3), pp. 312–323. <https://doi.org/10.18196/jmmr.v12i3.11>
- He, W., Zhang, Z. J., & Li, W. (2021). Information technology solutions, challenges, and suggestions for tackling the COVID-19 pandemic. *International journal of information management*, 57, 102287. <https://doi.org/10.1016/j.ijinfomgt.2020.102287>
- Kadir, N.K. (2018) 'Survey Aplikasi Pemodelan Dan Simulasi Proses Bisnis Open Source', *MATICS: Jurnal Ilmu Komputer dan Teknologi Informasi (Journal of Computer Science and Information Technology)*, 10(2), pp. 59–64. <https://doi.org/10.18860/mat.v10i2.5164>
- Laila, L., Sulistyawati, S. and Hidayat, M.S. (2024) 'Evaluasi Penerapan Sistem Informasi Manajemen Rumah Sakit (SIMRS): Studi Literatur', *Jurnal Promotif Preventif*, 7(4), pp. 710–723. <https://doi.org/10.47650/jpp.v7i4.1424>
- Lee, D., & Yoon, S. N. (2021). Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges. *International journal of environmental research and public health*, 18(1), 271. <https://doi.org/10.3390/ijerph18010271>
- Leonard, K., & Sittig, D. (2007). Improving information technology adoption and implementation through the identification of appropriate benefits: creating IMPROVE-IT. *Journal of medical Internet research*, 9(2), e618. <https://doi.org/10.2196/jmir.9.2.e9>
- Lubis, N. S., & Nasution, M. I. P. (2023). Perkembangan Teknologi Informasi Dan Dampaknya Pada Masyarakat. *Kohesi: Jurnal Sains dan Teknologi*, 1(12), 41-50.
- Marwaha, J. S., Landman, A. B., Brat, G. A., Dunn, T., & Gordon, W. J. (2022). Deploying digital health tools within large, complex health systems: key considerations for adoption and implementation. *NPJ digital medicine*, 5(1), 13. <https://doi.org/10.1038/s41746-022-00557-1>
- Molly, R., & Itaar, M. (2021). Analisis Pemanfaatan Sistem Informasi Manajemen Rumah Sakit (SIMRS) Pada RRSUD DOK II Jayapura. *Journal of Software Engineering Ampera*, 2(2), 95-101. <https://doi.org/10.51519/journalsea.v2i2.127>
- Nada, N. Q., & Wibowo, S. (2015). Pengukuran kualitas layanan sistem informasi akademik menggunakan metode webqual 4.0. *Jurnal Informatika UPGRIS*, 1(2 Desember). <https://doi.org/10.26877/jiu.v1i2%20Desember.870>
- Nwosu, N. T. (2024). Reducing operational costs in healthcare through advanced BI tools and data integration. *World Journal of Advanced Research and Reviews*, 22(3), 1144-1156.
- Olafsen, A. H., Nilsen, E. R., Smedsrud, S., & Kamaric, D. (2021). Sustainable development through commitment to organizational change: the implications of organizational culture and individual readiness for change. *Journal of Workplace Learning*, 33(3), 180-196. <https://doi.org/10.1108/JWL-05-2020-0093>
- Pahleviannur, M. R., De Grave, A., Saputra, D. N., Mardianto, D., Hafrida, L., Bano, V. O., ... & Lisya, M. (2022). *Metodologi Penelitian Kualitatif*. Pradina Pustaka.

- Rahmayanti, N., Sa'diyah, U. H., Sudjud, R. W., & Paramarta, V. (2023). Penerapan Sistem Informasi Rumah Sakit dalam Meningkatkan Efisiensi Pelayanan di Rumah Sakit. *COMSERVA: Jurnal Penelitian dan Pengabdian Masyarakat*, 3(08), 3094-3101. <https://doi.org/10.59141/comserva.v3i08.1094>
- Thompson, T. G., & Brailer, D. J. (2004). The decade of health information technology: delivering consumer-centric and information-rich health care. *Washington, DC: US Department of Health and Human Services*.
- Waruwu, M. (2023) 'Pendekatan penelitian pendidikan: metode penelitian kualitatif, metode penelitian kuantitatif dan metode penelitian kombinasi (Mixed Method)', *Jurnal Pendidikan Tambusai*, 7(1), pp. 2896-2910. <https://doi.org/10.31004/jptam.v7i1.6187>
- Waruwu, M. D., Lase, D., Zega, Y., & Halawa, O. (2024). Pengaruh Pelatihan Terhadap Efisiensi Penggunaan Sistem Informasi Manajemen Rumah Sakit (SIMRS) di Klinik Pratama Tabita Gunungsitoli. *YUME: Journal of Management*, 7(3), 883-890. <https://doi.org/10.37531/yum.v7i3.7346>
- Yusof, M. M., Kuljis, J., Papazafeiropoulou, A., & Stergioulas, L. K. (2008). An evaluation framework for Health Information Systems: human, organization and technology-fit factors (HOT-fit). *International journal of medical informatics*, 77(6), 386-398. <https://doi.org/10.1016/j.ijmedinf.2007.08.011>
- Zenebe, D. (2020). *Challenges and Opportunities in Implementing Integrated Civil Service Management Information System (ICMIS) Project: The Case of Ethiopian National Quality Infrastructure Institutions* (Doctoral dissertation, ST. MARY'S UNIVERSITY).