ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26mar090

Data Driven Recommendation System for Improving Resource Allocation for Hospitals

Jessica Clarrise M. Salmos[1*]; Rolaida L. Sonza[2]

[1]Good Samaritan Colleges, Burgos Avenue, Brgy. Sangitan East, Cabanatuan City, Nueva Ecija, 3100, Philippines
[2]Graduate School, Nueva Ecija University of Science and Technology Cabanatuan City, Nueva Ecija, 3100, Philippines

Corresponding Author: Jessica Clarrise M. Salmos[*]

Publication Date: 2026/03/06

Abstract: This study developed a Data-Driven Recommendation System for Improving Resource Allocation for Hospitals, specifically designed for San Antonio District Hospital in San Antonio, Nueva Ecija. It employed a developmental research design using the Agile Development Model to design and implement a secure, web-based system that provides real-time monitoring of hospital equipment, supplies, room and bed availability, and maintenance schedules. The system also generates automated alerts and structured, data-driven recommendations to support administrative and operational decision-making without disrupting existing hospital workflows.

System evaluation was conducted using the ISO/IEC 25010 Software Quality Model. Ten (10) IT experts assessed the system across nine quality characteristics, yielding an overall mean rating within the Highly Acceptable range (overall means ranging from 3.70 to 3.80). Thirty (30) hospital staff evaluated the system in terms of functional suitability, performance efficiency, and interaction capability, with results likewise interpreted as Highly Acceptable (overall means ranging from 3.20 to 3.30). These findings indicate that the system meets both technical quality standards and practical operational requirements in a district hospital setting.

Overall, the results demonstrate that the developed system effectively addresses limitations associated with manual resource tracking by providing centralized visibility, timely notifications, and data-supported recommendations. The study concludes that the system is suitable for deployment in district hospitals and contributes a practical, scalable approach to data-driven decision support for hospital resource allocation in low-resource healthcare environments.

Keywords: *Data-Driven System; Hospital Resource Allocation; Equipment Management; ISO/IEC 25010; Web-Based System.*

How to Cite: Jessica Clarrise M. Salmos; Rolaida L. Sonza (2026) Data Driven Recommendation System for Improving Resource Allocation for Hospitals. *International Journal of Innovative Science and Research Technology*, 11(3), 32-36. https://doi.org/10.38124/ijisrt/26mar090

I. INTRODUCTION

Hospitals are required to provide timely and quality healthcare services while operating under limited resources. Effective management of critical assets such as medical equipment, hospital rooms, and bed capacity plays a vital role in sustaining daily hospital operations and ensuring uninterrupted patient care. However, in many district-level hospitals, resource management activities continue to rely on manual monitoring and fragmented record-keeping, which often results in delayed decision-making and operational inefficiencies (Bautista et al., 2022; De Guzman et al., 2022).

Previous studies have emphasized that the absence of integrated information systems limits the ability of healthcare institutions to accurately monitor resource availability and respond promptly to operational demands. Laudon and Laudon (2020) noted that fragmented and decentralized information processes reduce accountability and increase the likelihood of data inconsistency. Similarly, Buntin et al. (2011) highlighted that decision-support and hospital information systems improve managerial effectiveness by transforming operational data into actionable information, particularly in resource-constrained healthcare environments.

Despite these documented benefits, the adoption of data-driven and decision-support systems remains limited in district hospitals. Mohan et al. (2020) emphasized that many existing hospital information systems are designed for large healthcare institutions and are often unsuitable for smaller

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26mar090

hospitals due to cost, system complexity, and misalignment with actual workflows. Gonzales et al. (2021) further observed that system effectiveness depends not only on technical capability but also on usability and alignment with operational practices. As a result, district hospitals continue to face challenges in monitoring equipment availability, managing room and bed occupancy, and ensuring timely maintenance and calibration of medical devices.

In the case of district hospitals, these limitations directly affect operational efficiency. Delays in equipment maintenance, inefficient room assignments, and the lack of real-time visibility over hospital resources may hinder the ability of hospital personnel to respond effectively to patient needs, particularly during periods of increased patient volume.

This study addresses these challenges through the development of a Data-Driven Recommendation System for Improving Resource Allocation for Hospitals, designed specifically for a district hospital setting. The system focuses on real-time monitoring of medical equipment, hospital supplies, and room and bed availability, as well as automated notifications for maintenance and calibration schedules. Using a developmental research approach guided by the Agile Development Model, the system was designed to align with existing hospital workflows while remaining simple, secure, and practical for daily use.

The objective of this study is to design, develop, and evaluate the proposed system using the ISO/IEC 25010 Software Quality Model, assessing its functional suitability, performance efficiency, interaction capability, reliability, security, and related quality characteristics. The originality of this work lies in its localized and context-aware design, which adapts data-driven decision-support concepts to the operational realities of a district hospital. By focusing on core resource management functions rather than complex clinical systems, the study contributes a practical and scalable solution that supports improved hospital resource utilization and operational decision-making.

II. METHODOLOGY

This study employed a developmental research design to design, develop, and evaluate a Data-Driven Recommendation System for Improving Resource Allocation for Hospitals. The developmental approach was used to systematically address identified operational issues related to hospital resource management through the creation of a functional and practical system. System development followed the Agile Development Model, which involved iterative phases of requirements analysis, system design, development, testing, and deployment. This approach allowed continuous refinement of system features based on feedback and ensured alignment with existing hospital workflows.

The developed system was implemented as a web-based platform that supports real-time monitoring of medical equipment, room and bed availability, and maintenance and calibration schedules. To assess system quality and acceptability, evaluation was conducted using the ISO/IEC 25010 Software Quality Model. IT experts evaluated the system across the full set of quality characteristics, while hospital staff assessed selected attributes relevant to actual system use. This evaluation approach ensured that both technical quality and operational usability were adequately examined within the context of the study.

- *Sampling Procedure*

The study employed purposive sampling in selecting respondents for the system evaluation. This sampling method was used to ensure that the participants possessed the appropriate background, experience, and involvement relevant to the objectives of the study and the evaluation of the developed system.

Respondents were deliberately chosen based on their roles and direct participation in either system evaluation or hospital operations. Only individuals who could provide informed and meaningful feedback were included. Through this approach, the study ensured that both technical and operational perspectives were represented in assessing the system's quality and level of acceptability.

- *Respondents*

The respondents of the study consisted of forty (40) individuals divided into two groups. Ten (10) IT experts were involved in the technical evaluation of the system using the complete set of ISO/IEC 25010 quality characteristics, while thirty (30) hospital staff members served as end users and assessed the system in terms of functional suitability, performance efficiency, and interaction capability. This number of respondents was considered sufficient to evaluate the system's quality and level of acceptability while remaining appropriate to the scope and context of the study.

Table 1 Distribution of Respondents

Set of Respondents	Sample	Percentage (%)
IT Experts	10	25%
Hospital Staff	30	75%
TOTAL	**40**	**100%**

Table 1 shows the distribution of respondents involved in the system evaluation. Most respondents were hospital staff members, ensuring that the assessment reflected actual operational use of the system, while the inclusion of IT experts provided technical evaluation based on the ISO/IEC 25010 quality characteristics.

- *Research Site*

The study was conducted at San Antonio District Hospital, located in Barangay San Mariano, San Antonio, Nueva Ecija. The hospital serves as a district-level healthcare facility providing essential medical services to the local community. It was selected as the research site due to its reliance on manual and fragmented processes for managing

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26mar090

medical equipment, room and bed allocation, and maintenance scheduling, making it suitable for the development and evaluation of the proposed data-driven recommendation system.

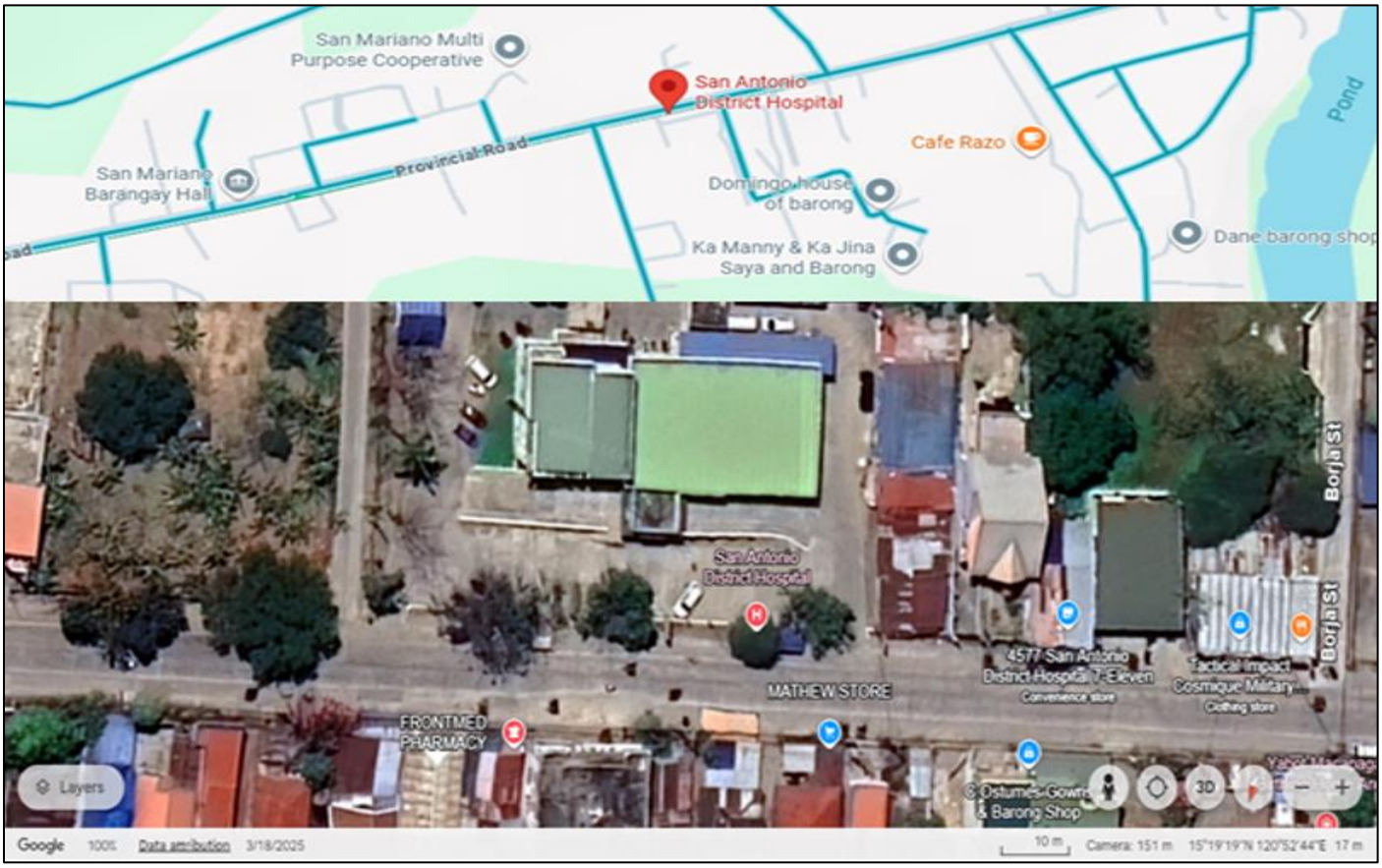

Fig 1 Research Locale

The hospital's administrative structure and the active involvement of personnel responsible for equipment management, room and bed allocation, and maintenance activities provided a suitable environment for the development and evaluation of the proposed system. This setting allowed the system to be assessed under actual operational conditions, ensuring that its functionality and recommendations were aligned with real hospital workflows and decision-making processes.

III. RESULTS AND DISCUSSION

➢ *System Performance Benchmark*

The evaluation of the Data-Driven Recommendation System for Improving Resource Allocation for Hospitals was conducted using the ISO/IEC 25010 Software Quality Model, yielding results that indicate a high level of system quality across all evaluated characteristics. The system achieved a Grand Mean of 3.73, interpreted as Highly Acceptable, demonstrating that it meets both technical and operational requirements in a district hospital setting. Among the assessed characteristics, Safety obtained the highest mean score (3.90), described as Very Safe, indicating minimal operational risk during use. Functional Suitability and Flexibility also received high ratings (3.80), showing that the system effectively supports its intended functions while remaining adaptable to operational needs.

Other quality characteristics, including Performance Efficiency, Compatibility, Interaction Capability, Reliability, and Security, each obtained a mean score of 3.70 and were described as Highly Efficient, Highly Compatible, Highly Interactive, Highly Reliable, and Highly Secured, respectively. These results indicate consistent system performance, effective user interaction, and adequate data protection. Maintainability received a mean score of 3.60, interpreted as Highly Maintainable, suggesting that the system can be updated and managed with relative ease.

Table 2 Evaluation Summary Results Based on ISO/IEC 25010

Data-Driven Recommendation System for Improving Resource Allocation for Hospitals	Overall Mean	Verbal Description
Functional Suitability	3.80	Highly Functional
Performance Efficiency	3.70	Highly Efficient
Compatibility	3.70	Highly Compatible
Interaction Capability	3.70	Highly Interactive

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26mar090

Reliability	3.70	Highly Reliable
Security	3.70	Highly Secured
Maintainability	3.60	Highly Maintainable
Flexibility	3.80	Highly Flexible
Safety	3.90	Very Safe
Grand Mean	3.73	Highly Acceptable

The evaluation results show that the developed system performs well across key software quality characteristics, particularly in safety, functional suitability, and flexibility. These strengths indicate that the system can operate reliably, protect data integrity, and support consistent use within a hospital environment without adding operational risk or unnecessary complexity.

The use of the ISO/IEC 25010 Software Quality Model provided a structured basis for assessing system quality and acceptability. The results confirm that the system meets established quality standards relevant to hospital operations and supports data-driven decision-making in resource allocation, while also identifying performance efficiency as an area to be maintained as system usage increases.

IV. CONCLUSIONS

This study focused on the design, development, and evaluation of a Data-Driven Recommendation System for Improving Resource Allocation for Hospitals to address challenges related to manual and fragmented resource management in a district hospital setting. The developed system provided a centralized platform for monitoring medical equipment, room and bed availability, and maintenance schedules, supporting more informed and timely operational decision-making.

Evaluation results based on the ISO/IEC 25010 Software Quality Model indicate that the system achieved a Highly Acceptable level of quality across all assessed characteristics. High ratings in safety, functional suitability, flexibility, and related quality attributes demonstrate that the system meets established software quality standards and performs reliably under expected hospital operating conditions.

The findings confirm that the developed system is technically sound and suitable for use in hospital operations. The study shows that the system can serve as a practical tool for supporting hospital resource management and data-driven decision-making, with opportunities for further refinement as operational requirements evolve.

ACKNOWLEDGMENT

The researcher would like to express her sincere and heartfelt gratitude to the following individuals and institutions whose support and contributions made the successful completion of this study possible.

Dr. Rolaida L. Sonza, her thesis adviser, for her expert guidance, patience, and unwavering support throughout the conduct of this research.

Dr. Alvin P. Dela Cruz, the statistician, for his valuable assistance and expertise in ensuring the accuracy and reliability of the data analysis.

Dr. Vlademir T. Turingan, the English editor, for his careful review and constructive suggestions that enhanced the clarity and quality of the manuscript.

Dr. Jocelyn B. Cruz, Dean of the Graduate School, for her support, encouragement, and leadership throughout the research process.

Dr. Maria Isidra P. Marcos, Dr. Allen Paul L. Esteban, and Dr. Jet C. Aquino, members of the evaluation panel, for their insightful comments, constructive criticisms, and recommendations that greatly improved the study.

The Administration and Staff of San Antonio District Hospital, for granting permission to conduct the study and for their cooperation throughout the requirements gathering, system development, evaluation, and testing phases. Their support made the development of a practical and context-aware system possible.

Ms. Aileen D. Delfin, Administrative Officer IV, and Ms. Clarize Y. Roxas, Administrative Aide, for their assistance during the system orientation and for providing valuable feedback that helped improve the system's functionality and relevance.

Ms. Laenelle Pantaleon, Nurse I, for her active participation during the initial data-gathering phase and for sharing insights from a clinical perspective, which greatly enriched the study.

The IT experts and hospital personnel who served as respondents in the system evaluation, for their professional assessments and honest feedback that were essential in validating the system's quality and effectiveness.

The researcher's family and friends, for their continued support, encouragement, and understanding throughout this academic endeavor.

Above all, the researcher offers her deepest gratitude to God Almighty for the wisdom, strength, and guidance bestowed throughout this academic journey. Without His grace, the completion of this study would not have been possible.

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26mar090

REFERENCES

[1]. Alpaydin, E. (2020). Introduction to machine learning (4th ed.). MIT Press.

[2]. Bautista, R. M., Ignacio, L. R., & Lim, A. S. (2022). An evaluation of hospital information systems in Philippine provincial hospitals: Challenges and prospects. Philippine Journal of Public Health, 67(1), 45–52.

[3]. Bekker, R., Koole, G., & Mandjes, M. (2021). Flexible capacity management for hospitals. European Journal of Operational Research, 288(3), 983–995. https://doi.org/10.1016/j.ejor.2020.06.015

[4]. Benton, W. C. (2013). Purchasing and supply chain management (2nd ed.). McGraw-Hill Education.

[5]. Buntin, M. B., Burke, M. F., Hoaglin, M. C., & Blumenthal, D. (2011). The benefits of health information technology: A review of the recent literature shows predominantly positive results. Health Affairs, 30(3), 464–471. https://doi.org/10.1377/hlthaff.2011.0178

[6]. Chan, C. W., Farias, V. F., Bambos, N., & Escobar, G. J. (2019). Optimizing intensive care unit discharge decisions with patient readmissions. Operations Research, 67(5), 1300–1318. https://doi.org/10.1287/opre.2019.1889

[7]. De Guzman, J. P., Santos, M. L., & Cruz, R. D. (2022). Hospital information systems in Philippine district hospitals: A systematic review. Philippine Journal of Health Research and Development, 26(2), 51–63.

[8]. Department of Health (DOH). (2022). Philippine eHealth strategic framework and plan 2023–2028. https://doh.gov.ph/ehealth

[9]. Gonzales, L. A., Ramos, E. R., & Dela Cruz, B. A. (2021). Implementing a modular inventory and bed tracking system in rural hospitals: Lessons from Mindoro. Philippine Journal of Healthcare Informatics, 12(1), 30–38.

[10]. Guerrero, E. S., & Santos, A. G. (2023). Factors influencing hospital staff's adoption of digital inventory systems in the Philippines. Journal of Health Informatics and Technology, 9(2), 23–31.

[11]. Investopedia. (2022). Resource allocation. https://www.investopedia.com/terms/r/resource-allocation.asp

[12]. Laudon, K. C., & Laudon, J. P. (2020). Management information systems: Managing the digital firm (16th ed.). Pearson.

[13]. Martinez, D. A., & Pines, J. M. (2020). Applying predictive analytics to hospital operations: A strategic framework. Health Systems, 9(4), 312–322. https://doi.org/10.1057/s41306-020-00086-z

[14]. Mohan, R., Sharma, S., & Jha, V. (2020). Feasibility of open-source hospital information systems in low-resource settings: A case from India. International Journal of Medical Informatics, 137, 104108. https://doi.org/10.1016/j.ijmedinf.2020.104108

[15]. Murdoch, T. B., & Detsky, A. S. (2013). The inevitable application of big data to health care. JAMA, 309(13), 1351–1352. https://doi.org/10.1001/jama.2013.393

[16]. Parimbelli, E., Bottalico, B., Losiouk, E., Tomasi, M., Santosuosso, A., Lanzola, G., & Quaglini, S. (2018). Trusting telemedicine: A discussion on risks, safety, legal implications, and regulatory needs. Telemedicine and e-Health, 24(11), 924–929. https://doi.org/10.1089/tmj.2017.0253

[17]. Parker, F., Martínez, D. A., Scheulen, J. J., & Ghobadi, K. (2024). An interactive decision-support dashboard for optimal hospital capacity management. Decision Support Systems, 182, 113500. https://doi.org/10.1016/j.dss.2024.113500

[18]. Ramos, R. M., & Del Rosario, J. C. (2023). Real-time systems and the operational efficiency of rural hospitals in the Philippines. Asian Journal of Health Systems Research, 8(2), 62–71.

[19]. Shelly, G. B., & Rosenblatt, H. J. (2011). Systems analysis and design (9th ed.). Course Technology.

[20]. Stallings, W. (2018). Data and computer communications (10th ed.). Pearson.

[21]. Toerper, M., Shermock, K. M., Martinez, D. A., & Pines, J. M. (2021). Capacity planning and optimization for hospital systems. Healthcare Management Review, 46(4), 288–297. https://doi.org/10.1097/HMR.0000000000000291

[22]. U.S. Food and Drug Administration. (2022). Calibration standards for medical devices. https://www.fda.gov/medical-devices/calibration-standards-medical-devices

[23]. Weissman, G. E., Crane-Droesch, A., Chivers, C., et al. (2020). Locally informed simulation to predict hospital capacity needs during the COVID-19 pandemic. Annals of Internal Medicine, 173(1), 21–28. https://doi.org/10.7326/M20-1260

[24]. World Health Organization. (2011). Medical device technical series: Medical equipment maintenance programme overview. https://apps.who.int/iris/handle/10665/44574

[25]. World Health Organization. (2020). Strengthening the health system response to COVID-19: Technical guidance. https://apps.who.int/iris/handle/10665/336240