INDONESIAN JOURNAL OF DENTISTRY
Faculty of Dentistry Universitas Muhammadiyah Semarang

A COMPREHENSIVE EVALUATION OF HOSPITAL INFORMATION SYSTEMS BASED ON THE HOT-FIT FRAMEWORK

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Received July 7th, 2025; 1st Revision July 16th, 2025; Accepted July 18th, 2025; Published online August 4th, 2025.

Keywords:

Hospital, HOT-FIT, Information System, Net Benefit

Indonesian Journal of Dentistry
Volume 5 No 2 Issue 1 Year 2025 Pages 89-99
URL: https://jurnal.unimus.ac.id/index.php/IJD
DOI: https://doi.org/10.26714/ijd.v5i1.18256

ABSTRACT

Background: The advancement of information technology requires hospitals to manage information systems efficiently. However, RSIGM Sultan Agung Semarang still encounters difficulties in optimizing its Hospital Management Information System (HMIS) to support daily operations and strategic decisions. This study aims to examine the influence of human, organizational, and technological factors on the net benefits of HMIS, both individually and collectively.

Method: A mixed-methods design with convergent triangulation was employed, integrating qualitative and quantitative data. Qualitative insights were obtained through in-depth interviews with key stakeholders, while quantitative data were gathered via a structured, validated questionnaire distributed using total and stratified random sampling.

Outcome: The results showed that organizational and technological factors had a significant positive effect on the perceived net benefit of HMIS, with organizational support identified as the most influential. In contrast, the human factor was found to have a significant negative impact, suggesting user-related barriers to system use. Collectively, the three factors explained a considerable portion of the variance in net benefit.

Conclusion: The study concluded that strengthening organizational systems and advancing technological components were essential for enhancing HMIS performance; these findings provided essential input for hospital policymakers to enhance HMIS implementation in similar settings. Addressing human factors through targeted training and simplifying system interfaces was also necessary to improve user experience and satisfaction.

INTRODUCTION

The rapid advancement of information technology has profoundly transformed various sectors, including healthcare services Hospitals are increasingly required to adopt fast, integrated, and reliable health information systems. These systems aim to improve service quality and support timely, data-driven decision-making. Effective utilization of these systems is no longer optional but a fundamental requirement to meet public expectations and comply with regulatory standards.[1,2]

Hospital Management Information Systems (HMIS) play a strategic role in streamlining clinical and administrative processes. These systems support healthcare operations, assist decision-makers with accurate data, and serve as tools for achieving competitive advantage in service delivery. In Indonesia, the importance of HMIS is emphasized in various national regulations, including Law No. 17 of 2023 on Health, which mandates that all hospitals implement a system integrated with the National Health Information System. To ensure compliance and system effectiveness, the Indonesian Ministry of Health has issued technical standards through several ministerial regulations, such as Permenkes No. 1171/2011 and Permenkes No. 82/2013. These regulations outline the minimum requirements for HMIS development and the mandatory integration at regional and national levels. Hospitals are expected to adjust and comply within a stipulated time frame, thus necessitating an in-depth and ongoing evaluation of system performance and user alignment.[3,4]

Evaluating an HMIS requires a multidimensional approach that considers not only technical performance but also the human and organizational context in which the system operates. The Human, Organization, and Technology-Fit (HOT-Fit) framework is widely recognized for its comprehensive perspective in assessing health information systems. It examines system quality, information quality, service quality, user satisfaction, and the overall net benefit, along with the fit among human, organizational, and technological components. Previous research applying the HOT-Fit model has shown inconsistent findings across settings. While some studies found significant relationships between system quality and user satisfaction or net benefits, others reported minimal or no influence. Similarly, results concerning information quality, organizational structure, and leadership support have varied. These differences highlight the importance of context-specific analysis to capture the real-world performance of HMIS.[5,6]

At RSIGM Sultan Agung Semarang, a dental and oral hospital affiliated with Sultan Agung Islamic University (UNISSULA), a new HMIS has recently been introduced. Despite its strategic role, the system's implementation has been met with several challenges. These include slow user adaptation due to insufficient training, frequent technical errors, limited system functionality, and lack of timely support from the vendor. Additionally, some hospital units, especially the finance department, reported unrecorded services that resulted in financial losses, while decision-makers lacked timely reports to evaluate performance. In response to these challenges, a systematic evaluation of the HMIS at RSIGM Sultan Agung is essential. Using the HOT-Fit framework in conjunction with the Net Benefit model, this study aims to assess how human, organizational, and technological factors influence the perceived effectiveness of the system.[7,8] The findings are expected to offer valuable insights for improving system alignment with user needs and ensuring that HMIS implementation supports both service delivery and institutional goals.

RESEARCH METHOD

This study utilized a mixed-methods approach with a convergent parallel design, combining qualitative and quantitative data collection and analysis conducted simultaneously. This design allowed the researchers to gain a comprehensive understanding of the effectiveness of the Hospital Management Information System (HMIS) at RSIGM Sultan Agung Semarang by integrating multiple forms of evidence. This integration allowed for data triangulation, increased internal validity, and enabled deeper interpretation of system performance. Qualitative data was collected through semi-structured interviews with key stakeholders and system users who were directly involved in the implementation and daily use of the HMIS. These informants included directors, department heads, unit managers, administrative personnel, dentists, nurses, and other clinical staff. The interview guidelines explored ten key aspects relevant to HMIS evaluation: system quality, information quality, service quality, top management support, project management, vendor support, IT staff capabilities, system use, user satisfaction, and net benefit.[9]

The quantitative component involved the distribution of structured questionnaires to a defined sample of HMIS users. The study population was divided into two groups: key participants (n = 11), who held strategic and managerial roles, and triangulation participants (n = 56), consisting of operational users such as administrative staff, dental practitioners, nurses, and allied health workers. Total sampling was applied to key participants, while sample size for triangulation participants (n = 49) was determined using Slovin's formula with a 95% confidence level and 5% margin of error. Proportional stratified random sampling was used to ensure proportional representation across subgroups. Two primary instruments were used for data collection, an interview guide for qualitative data and a structured questionnaire for quantitative data. The questionnaire contained Likert-scale items (ranging from 1 = strongly disagree to 5 = strongly agree) that assessed users' perceptions across the ten key dimensions of HMIS performance. Prior to distribution, the instrument underwent validity testing using a sample of 30 respondents. The results indicated that all items in the human, organizational, and net benefit variables were valid (r-count > r-table), while three invalid items in the technology variable were revised for clarity. The instrument's reliability was confirmed through a Cronbach's Alpha test, which yielded a value of 0.941, indicating a very high level of internal consistency and reliability across 84 questionnaire items. This suggests that the instrument was appropriate for measuring the variables under investigation.

Data analysis was conducted through a combination of descriptive, bivariate, and multivariate techniques. Descriptive statistics were used to present the characteristics of respondents and summarize response distributions. Pearson correlation analysis was used to examine the partial relationship between each independent variable and the dependent variable (net benefit), with

statistical significance set at $p < 0.05$. Multiple linear regression analysis was conducted to assess the combined influence of human, organizational, and technology variables on net benefit, with interpretation based on R-squared values, ANOVA tests, significance levels, and standardized beta coefficients. For qualitative data, thematic analysis was conducted to identify patterns, themes, and explanatory narratives. Observational data from site visits and real-time system interactions were used to support and contextualize the findings from both qualitative interviews and quantitative surveys.

RESEARCH FINDINGS

This study aimed to analyze the influence of human, organizational, and technological factors on the net benefit of the Hospital Management Information System (HMIS) at Sultan Agung Islamic Dental and Oral Hospital in Semarang. A mixed-methods approach was employed, utilizing a convergent design that integrates both quantitative and qualitative methods simultaneously. Table 1 presents the demographic characteristics of the respondents, including gender, age, education level, job position, and length of service. These characteristics are crucial for understanding the background of respondents in forming their perceptions of the HMIS implementation.

Table 1. Respondent Characteristics

Variable	N	%
Gender		
Male	25	41.7 %
Female	35	58.3 %
Age		
17 – 25 years	12	20.0 %
26 – 34 years	25	41.7 %
35 – 43 years	23	38.3 %
Education Level		
Doctoral (Ph.D.)	5	8.3 %
Master/Professional	25	41.7 %
Bachelor's Degree (S1)	20	33.3 %
Diploma	8	13.3 %
High School/Vocational	2	3.3 %
Current Position		
Board of Directors	2	3.3 %
Medical Committee	1	1.6 %
Head of Installation	3	5.0 %
Medical Service Manager	1	1.6 %
Education & Research Manager	1	1.6 %
Public Relations & Marketing Manager	1	1.6 %
Finance Manager	1	1.6 %

Head of Medical Records	1	1.6 %
Registration Admin	2	3.3 %
General Practitioners, Dentists, Dental Specialists	31	51.6 %
Nurses and Dental Therapists	12	20.0 %
Other Medical Personnel	4	6.7 %
Years of Service		
< 1 year	8	13.3 %
1 – 5 years	15	25.0 %

Table 2 provides information on respondents' exposure to and intensity of HMIS use, including their experience with system orientation, learning methods, and daily usage duration. Descriptive analysis showed that most respondents had received HMIS orientation (83.3%) and used the system for 1–3 hours per day (41.7%). Further analysis of the questionnaire responses indicated varied perceptions of system quality and IT support. Only 21.7% of respondents believed that HMIS aided their decision-making process, while 45% reported low motivation to use the system, as it did not fully support their daily work activities.

Table 2. HMIS Usage Among Respondents

HMIS Usage Aspects	Number of Respondents	Percentage (%)
Participated in socialization	50	83.3%
Learned through socialization	25	41.7%
Duration of use (1–3 hours/day)	25	41.7%

Table 3 presents the results of the Pearson correlation test between the independent variables—human, organization, and technology—and the dependent variable, net benefit. The bivariate analysis demonstrated that all three factors were positively and significantly correlated with net benefit, with correlation coefficients of 0.388, 0.865, and 0.593 respectively ($p < 0.05$). These findings indicate that the greater the support from each factor, the higher the perceived net benefit of the system.

Table 3. Pearson Correlation Analysis

Variable Relationship	r	Sig. (p)
Human – Net Benefit	0.388	0.002
Organization – Net Benefit	0.865	0.000
Technology – Net Benefit	0.593	0.000

Table 4 summarizes the results of the multiple linear regression analysis, which examined the simultaneous effect of the human, organizational, and technological factors on net benefit. The regression model yielded an R^2 value of 0.803, indicating that 80.3% of the variation in net benefit could be explained by the three independent variables. Among these, the organizational factor had the strongest positive influence ($\beta = 0.748$; $p = 0.000$), followed by the technological factor ($\beta = 0.439$; p

= 0.000). Interestingly, the human factor showed a significant negative effect (β = -0.270; p = 0.015), suggesting potential issues in user adoption or readiness related to human resources.

Table 4. Multiple Linear Regression Model

Variable	B	β (Beta)	Sig. (p)
Human (X1)	-0.148	-0.270	0.015
Organization (X2)	0.474	0.748	0.000
Technology (X3)	0.421	0.439	0.000
Constant	-6.392	—	0.007

The qualitative component of this study provided deeper insights into the challenges encountered during the implementation and daily use of the Hospital Management Information System (HMIS) at RSIGM Sultan Agung Semarang. Data were obtained through interviews with key informants, including clinicians, managers, and administrative staff, and were analyzed thematically to support the quantitative results. One of the most prominent issues reported by the respondents was the limited availability of IT support outside standard working hours. Clinical staff, especially those working evening and night shifts, stated that they often faced system disruptions without immediate technical assistance. This situation not only delayed service delivery but also created frustration among users. As expressed by a nurse, "When the system crashes during night shifts, there is no IT staff on standby. We often have to wait until morning to get assistance." This finding highlights the need for round-the-clock technical support to ensure continuity of care and system reliability.

Another important concern was the misalignment between the SIMRS features and the clinical needs of specialized users. While the system generally accommodated administrative functions, some clinical users, particularly specialists, felt that it lacked flexibility and specificity. A dental specialist remarked, "While the system works fine for general practitioners, it lacks flexibility for specialists. The interface does not support detailed recording for diagnoses and follow-up treatments." This indicates that the system design may not fully consider the complexity and variability of clinical workflows in a specialized dental setting.

Finally, the interviews revealed a perceptual barrier among some users who regarded SIMRS more as a compliance tool than a functional asset. A manager explained, "Most of our staff still view the system more as an administrative requirement rather than something that genuinely supports their work." This perception potentially reduces user engagement and limits the effective utilization of the system in enhancing service quality. These qualitative findings reinforce the results from the quantitative data, particularly the significant influence of organizational and technological factors on the system's perceived benefits, while also underlining persistent human-related challenges that require strategic attention.

DISCUSSION

The implementation of a Hospital Management Information System (HMIS) is a strategic initiative aimed at enhancing the efficiency and effectiveness of healthcare services. Sultan Agung Islamic Dental and Oral Hospital in Semarang has adopted HMIS to streamline patient data management, administrative operations, and clinical services in an integrated manner. However, the success of HMIS is not solely determined by a single factor; it is significantly influenced by human, organizational, and technological components.[10] This study, therefore, sought to examine the impact of these three dimensions on the net benefit of HMIS implementation at the hospital. The Human-Organization-Technology (HOT-Fit) model provides a relevant theoretical framework for evaluating the success of health information systems. The model emphasizes the importance of alignment among human, organizational, and technological factors to maximize the benefits of information systems. Alhaq successfully applied the HOT-Fit model to assess HMIS and found that all three factors significantly affect net benefit outcomes.[11,12]

Human factors play a critical role in the success of HMIS implementation. These include the IT capabilities of staff, system usage, and user satisfaction, which collectively determine the operational efficiency and effectiveness of HMIS. In the context of Sultan Agung Islamic Dental and Oral Hospital, the study identified several key aspects of human factors affecting the net benefit. One major challenge was the limited availability of IT personnel outside of standard working hours. Clinical staff often encountered technical issues during night shifts without immediate support, which hindered service delivery. Moreover, the responsiveness and quality of IT services varied, with some users reporting delays in resolving technical problems.[13,14]

Communication between IT personnel and users was also identified as a concern. Difficulties in understanding technical guidance limited users' ability to resolve system-related issues independently. Previous research suggests that effective communication between IT staff and users enhances the utilization of health information systems.[15,16] User motivation to engage with HMIS was influenced by their perceptions of its usefulness and ease of use. Some staff viewed HMIS primarily as an administrative burden rather than a tool for enhancing productivity. Enhancing motivation requires proper training and continuous user support.[17] Furthermore, a lack of training led to low familiarity with system features, reducing system effectiveness.[18] User satisfaction depended on how well the system aligned with operational needs. Several features were deemed inadequate for daily clinical workflows, forcing manual data entry. A poorly designed user interface further hindered efficiency, with users describing it as non-intuitive. Prior studies affirm that user-friendly systems increase satisfaction and promote faster adoption.[19,20]

Organizational factors significantly influence the success of HMIS implementation. These include top management support, clear policies and guidelines, effective project management, vendor support, and organizational culture. Top management support is crucial for ensuring adequate resource allocation and conveying the strategic importance of system adoption.[21] While the hospital's leadership recognized HMIS as a long-term investment, some staff perceived it as a lower priority in practice. Clear policies and operational guidelines are necessary to standardize HMIS usage across departments. The absence of comprehensive documentation led some staff to rely on peers or self-learning, causing inconsistencies. Effective project management, including strategic planning and technical support, is essential but was hampered by limited IT staffing.[7,22]

Infrastructure limitations also emerged as barriers. Despite investments, server capacity and network stability issues were noted, especially during peak hours. Vendor responsiveness was another concern, with users reporting delays in system updates and insufficient alignment with hospital-specific needs. Inadequate training remained a critical issue, as not all staff received proper orientation, reducing their ability to operate the system efficiently. Periodic evaluations of HMIS focused more on technical performance than user experience, highlighting a gap in feedback integration. Organizational integration and inter-unit collaboration were found to be suboptimal. Communication gaps and lack of coordination reduced system utilization. Additionally, a resistant organizational culture among certain staff particularly those accustomed to manual workflows hindered full system adoption.[23,24]

Technological factors encompass system quality, performance, and information accuracy. Respondents acknowledged that HMIS was generally user-friendly, especially for digitally literate users. However, system delays occurred during high patient volume, and some specialized functions lacked necessary flexibility. Users noted that record entry could be time-consuming in emergency situations. Financial modules were not fully integrated, complicating data synchronization across departments. Optimal systems should handle high workloads and support interdepartmental integration.[25,26] System performance issues such as unexpected logouts and slow data retrieval were reported, along with a need for broader staff training. Internet connectivity was another limiting factor; while generally stable, some areas within the hospital experienced weak signals that impeded access.[27,28]

Regarding data accuracy, most respondents trusted HMIS for patient record reliability. However, occasional mismatches between input and display data were noted, suggesting the need for stronger validation mechanisms. Duplicate patient entries due to input errors and financial discrepancies further underscored the importance of data quality controls. Although the system produced comprehensive patient information, certain reports lacked automation or full alignment with user needs. Continuous system development is needed to improve completeness and accuracy.[19,23]

The study's findings indicate that organizational and technological factors positively and significantly influence net benefit, whereas the human factor shows a negative relationship. This suggests that while user competence and acceptance are critical, barriers such as resistance to change or system complexity may hinder effective use. These results are consistent with the HOT-Fit model, which underscores the need for alignment among human, organizational, and technological domains. The negative impact of human factors signals the necessity for further evaluation, particularly in user training and system usability.[29,30]

While most of the net benefit was explained by the three primary factors, other unmeasured variables may also contribute. Organizational elements such as management support and policy clarity, along with technological quality, were shown to significantly enhance system benefits. Conversely, the negative coefficient for the human factor suggests gaps in system adoption, often stemming from inadequate training or unfamiliarity with digital systems.[31–33] Continuous investment in human resource development and usability improvement is essential to maximize HMIS benefits.

CONCLUSION

The results of this study indicate that the successful implementation of the Hospital Management Information System (HMIS) at Sultan Agung Islamic Dental and Oral Hospital is influenced by three key factors: human, organizational, and technological. Among these, the organizational factor had the strongest positive effect on the perceived net benefit, emphasizing the importance of management support, clear policies, and structured implementation in maximizing system effectiveness. The technological factor also contributed positively, indicating that improvements in system quality, reliability, and usability significantly enhance user satisfaction and overall system performance. Conversely, the human factor had a significant negative influence, revealing that limited user skills, understanding, and acceptance can hinder optimal system use. These findings highlight the need for a balanced investment in technological infrastructure, organizational readiness, and human resource development. Hospital leaders are encouraged to integrate user-focused training programs, simplify system interfaces, and collaborate closely with system vendors to improve usability and user adoption. Strengthening these three dimensions is essential to fully realize the benefits of HMIS and to improve the quality and efficiency of healthcare service delivery.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to Universitas Adhirajasa Reswara Sanjaya (ARS University) for the academic support and research facilitation provided throughout the study. Special thanks are also extended to the management and staff of Sultan Agung Islamic Dental

Hospital (RSGM Sultan Agung Semarang) for granting access to the research site and for their valuable assistance during data collection.

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