ORIGINAL ARTICLE

E-Government for improving healthcare service quality in hospitals around Central Java

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ABSTRACT

Digital technology has been developed in the healthcare industry. The Healthcare Management Information System (HMIS) is one example of a technology-driven healthcare solution. This study adopted a quantitative cross-sectional design with Partial Least Squares Structural Equation Modeling (PLS-SEM) for the data analysis. The subjects of this study included health workers using HMIS. The data were collected through quantitative questionnaires distributed offline and online via Google Forms. The sampling technique used was probability sampling, specifically a disproportional random sampling technique. This technique involved simple random selection across strata without proportional representation. The result indicated that Information Quality (IQ) has the greatest influence on Perceived Usefulness (PU), with an original sample of 0.193, while Service Quality (SQY) has the greatest influence on Perceived Ease of Use (PEU), with an original sample of 0.183. PU and PEU have a significant positive impact on Attitude toward Use (ATU). ATU strongly influences Behavioral Intention to use (BIU), which subsequently impacts Actual Use (AU). Through PU and PEU, HMIS users at hospitals in Central Java experience a positive influence on their attitudes toward using HMIS. The ATU positively influences BIU, impacting users' decisions to incorporate HMIS into their daily work.

Keywords:
E-government; healthcare service; hospital; quality

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INTRODUCTION

Public service involves a range of activities aimed at meeting the needs of all communities.[1,2] Improving the quality of public services is essential for building public trust in service providers.[3] Public service providers have implemented initiatives to enhance the standards of public services by introducing regular innovations.[4,5] One such innovation is the integration of Information and Communications Technology (ICT), which is now widely applied across various sectors, including administrative and bureaucratic services within government, industry, economy, and healthcare.[6] Government services based on electronics are known as Electronic Government (e-Government), which is designed to enhance government efficiency and effectiveness at both central and regional levels.[7] The effectiveness and quality of government services provided to the community depend greatly on the operational efficiency of a well-functioning bureaucracy. Moreover, enhancing the performance of e-Government as a form of digital service supports sustainable development.[8]

The current development of digital technology is also applied in healthcare.[9] The Ministry of Health of the Republic of Indonesia has prioritized the transformation of health technology to promote technological advancement and digitalization within the healthcare sector.[10] It includes creating a unified health platform for digitally recording patient medical records. Digital technology has shifted the healthcare landscape to be more patient-centered, emphasizing patient empowerment, and active participation in their own healthcare.[11,12] According to data released by the Indonesian Hospital Association in 2020, in the digital era, 47% of consumers searched for information about doctors, 38% sought details on hospitals and healthcare facilities, and 77% scheduled health check-ups.[13]

One form of hospital service that uses information technology is the HMIS.[14] The integration of HMIS as a form of e-Government implementation in healthcare services serves to improve efficiency, effectiveness, transparency, and accountability in healthcare delivery.[15] The implementation of HMIS in healthcare services showcases how information technology can enhance public services and benefit the community.[16] By implementing information technology in hospitals, clinical errors can be reduced, and patient care quality can be significantly improved.[17] Furthermore, the integration of HIS can enhance healthcare efficiency, specifically reducing overall cost and time.[18,19] Improvements in accessing, managing, and exchanging health information with internal and external stakeholders are key benefits of the HIS. The utilization of HMIS contributes to increased revenue and improved service quality in hospitals. In Indonesia, HMIS development requires integration with other services.[20] The HMIS architecture consists of at least two main service activities: (1) Primary services (front office), which include the registration process, outpatient and inpatient care processes, and discharge process, and (2) Administrative services (back office), which cover planning, procurement/purchasing, inventory maintenance, asset management, human resources management, financial management (debts, receivables, cash, ledger, and others), as well as communication and collaboration.[21]

Several hospitals began implementing HMIS in 2013 following the Minister of Health Regulation No. 82 of 2013, which mandated that every hospital must adopt an HMIS within two years of the regulation's enactment. However, the utilization of HMIS in Indonesia remains suboptimal.[22] Data from the Directorate General of Health Services of the Ministry of Health of Indonesia in 2022 stated that only 56% of hospitals adopted HMIS optimally in both front-office and back-office functions. HMIS functions solely in the front office at 22%, while 3% of HMIS implementations are non-functional, and 19% of hospitals have not yet adopted it. The distribution of HMIS usage across Indonesian provinces shows that East Java province has the highest adoption, with 51 hospitals, followed by West Java and Central Java with 28 hospitals each. Banten province has 21 hospitals, and the Special Capital Region of Jakarta has 20 hospitals adopting HMIS. In Central Java province, HMIS utilization varies by hospital class: Class A hospitals have a maximum utilization rate of 90% in the front and back office; Class B hospitals at 82.9%, Class C hospitals at 75.3%, and Class D hospitals at 66%. Nevertheless, there are hospitals under Class C with a 6.5% adoption rate and some Class D hospitals have only 15% adoption of HMIS.[23]

Hospitals have experienced the impact of using HMIS. Many factors determine the benefits of successfully implementing HMIS.[24] The potential benefits of HMIS can provide maximum results for the organization if the human, organizational, and technology factors support each other.[25] The study conducted by Malik & Kazi (2021) explains that the success of implementing HIS in Pakistan using the Human, Organization, Technology (HOT) approach shows that the human aspect is the main and most influential barrier compared to technology and organizational aspects.[26]

In discussing the benefits, it is crucial to consider the obstacles associated with integrating information technology into healthcare.[27] These challenges frequently arise from non-technical factors, such as organizational culture, bureaucracy, and traditional governance, which are the primary contributors to these obstacles.[28] Moreover, alterations in work culture often hinder the integration of such systems, which poses challenges related to employee attitudes, organizational structure, and governance. Hence, the effective incorporation of information systems in hospitals necessitates strong organizational and managerial support to effectively overcome these barriers effectively.[29]

The adoption of HMIS is believed to raise the standard of healthcare services and address the community's need for excellent healthcare. Thus, the researchers assess the need for a study on why the utilization of HMIS to support the digitalization of healthcare services in Central Java hospitals is not yet optimal. Vantissha (2022) analyzed the application of HMIS from multiple aspects, including human factors such as system users, organizational support, technological infrastructure, and assessment of user attitudes, all of which play a role in the effective use of HMIS.[25] Aligned with that, Zhai (2022) discussed the effectiveness of information systems considering the facets of human, organizational, and technological factors (HOT-Fit). In this study, HOT-Fit and TAM theoretical approaches were integrated, along with e-Government implementation strategies using a quantitative approach.[30] The HMIS for hospitals faces a gap between user expectations and system capabilities. Users expect more in-depth data analysis, detailed reports, and integration with other systems. To improve management practices and achieve effective HMIS, the framework of health information system evaluation shall consider humans and organizations. Besides that, the health information system also needs to be supported and equipped with the technology. Organizations in the healthcare sector must prepare workers or staff to adapt to new technology or changes.

In addition, a thorough comprehension of e-Government strategies and user attitudes toward the system is crucial for the public and all parties involved in HMIS applications. The hypotheses are as follows:

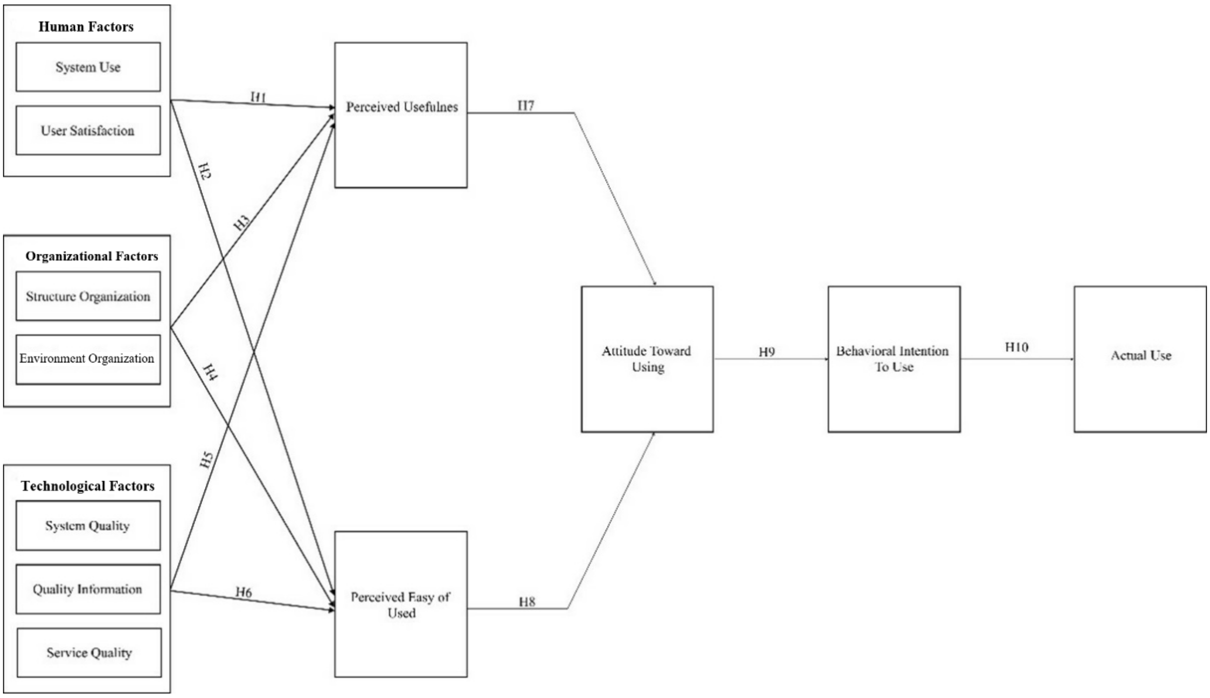

Figure 1. Integration of HOT-Fit and TAM

Hypothesis 1 (H1): Human factors (System Use and User Satisfaction) have a significant positive effect on Perceived Usefulness.
Hypothesis 2 (H2): Human factors (System Use and User Satisfaction) have a significant positive effect on Perceived Ease of Use.
Hypothesis 3 (H3): Organizational factors (Organizational Structure and Organizational Environment) have a significant positive effect on Perceived Usefulness.
Hypothesis 4 (H4): Organizational factors (Organizational Structure and Organizational Environment) have a significant positive effect on Perceived Ease of Use.
Hypothesis 5 (H5): Technological factors (Information Quality, System Quality, and Service Quality) have a significant positive effect on Perceived Usefulness.
Hypothesis 6 (H6): Technological factors (Information Quality, System Quality, and Service Quality) have a significant positive effect on Perceived Ease of Use.
Hypothesis 7 (H7): Perceived Usefulness has a significant positive effect on Behavioral Intention to Use.
Hypothesis 8 (H8): Perceived Ease of Use has a significant positive effect on Behavioral Intention to Use.
Hypothesis 9 (H9): Behavioral Intention to Use has a significant positive effect on Actual Use.
Hypothesis 10 (H10): Behavioral Intention to Use has a significant positive effect on Actual Use.

METHOD

Davis introduced the Technology Acceptance Model (TAM) in 1989. TAM is derived from the Theory of Reasoned

Action (TRA), which is designed to explain how users perceive and assess technology.

TAM explains individuals' decision to use or not to use new technology. It posits technology usage based on beliefs, attitudes, intentions, and user behavior. Two principles in TAM explain an individual's utilization of technology: (1) Perceived Usefulness, which signifies the belief that technology improves task performance, and (2) Perceived Ease of Use, which suggests that using technology is easy. These two elements jointly influence an individual's decision to use technology.

This study employed the Structural Equation Modeling (SEM) with Partial Least Squares (PLS) approach for data analysis. The analysis used the SmartPLS 3.2.9 application. SEM is a statistical method aimed at investigating relationships among latent variables and their observable indicators. It also explores the relationships between latent variables themselves, which reveals direct measurement error. SEM enables a direct analysis of the correlation between dependent and independent variables. PLS is one of the statistical methods in SEM that is variant-based and is developed to solve multiple regression problems with specific data.

The researcher used a quantitative approach to gather data by distributing survey questionnaires. In addition, the study included components from the HOT-Fit model, which included aspects related to human factors such as system usage and satisfaction, organizational factors such as structure and environment, and technological factors like system quality, information quality, and service quality. In addition, the researcher integrated components from the TAM theory, such as PEU, PU, AU, BI, and ATU. There are two main categories of questions: HOT-Fit and TAM. The first part (HOT-Fit) of the questionnaire inquires about system use, user satisfaction, organizational structure, organizational environment, system quality, information quality, service quality, and net benefits. The second part (TAM) included Perceived Ease of Use (PEU), Perceived Usefulness (PU), Attitude Toward Use (AU), Behavioral Intention to Use (BIU), and Actual Use (AU).

Lastly, this research utilized a Likert scale to assess the item questions related to the variables. This scale ranged from 1 to 4, with 1 denoting "strongly disagree" and 4 "strongly agree". Furthermore, the researcher adapted the questionnaire items from a previous study that had demonstrated strong validity (refer to the appendix for specific indicators).

Data Collection and Sample

In this study, the researcher collected quantitative data by distributing questionnaires that respondents could access online, such as Google Forms or manual completion. This study involved HMIS users in Central Java hospitals as the sample. Hospitals were selected based on specific criteria, including Class C classification, Public General status, government management (City/Regency and vertical), and prior utilization of HMIS, with functionality extending to at least the front office. The inclusion criteria were based on facilities and capabilities that provide at least four basic specialist medical services and four medical support specialist services, as well as the availability of health workers appropriately allocated according to the type and level of service. Exclusion criteria were hospitals that did not meet the minimum requirement for basic and supporting services and those lacking the workforce necessary to meet the hospital service demand.

Based on these inclusion criteria, there were six Class C Hospitals included in the study, Surakarta Central General

Hospital, Kayen Pati Regional Public Hospital, dr. Gondo Suwarno Regional Public Hospital in Ungaran, Kajen Regional Public Hospital in Pekalongan, Dr. M. Ashari Pemalang Regional Public Hospital, and Ibu Fatmawati Soekarno Regional Public Hospital in Surakarta. The sampling technique employed was probability sampling, specifically a disproportional random sampling technique. This technique employs simple random sampling, where the selection of samples is not proportional within each stratum. There were 345 hospitals in Central Java in total.

The inclusion criteria for this study were as follows: a) Respondents had a permanent employment status at the hospital and had been employed there for over two years, b) Respondents were active users of HMIS at the hospital. The exclusion criteria were: a) Respondents failed to complete the questionnaire, b) Respondents had resigned from their positions.

The HMIS users were selected using probability sampling with a disproportional sampling technique. Based on the established criteria, 213 respondents were selected. This sample size was determined following the sampling calculation method by Ferdinand (2006), where the number of study variable indicators (39) was multiplied by the value range of 5 to 10, resulting in a minimum sample size of 198 (39x5).

RESULTS

Table 1. Demographic Distribution

Variable	Description	Total	Percentage (%)
Sex	Male	56	26,29
	Female	157	73,71
Age	< 25	9	4,22
	25 – 35	75	35,21
	36 – 45	94	44,13
	> 45	35	16,44
Educational level	High school	16	7,51
	Diploma	85	39,91
	Bachelor's degree	92	43,19
	Professional degree	13	6,11
	Master's degree	7	3,28
Job position	Head of Installation	5	2,35
	Head of Ward/Head of Unit	14	6,67
	Doctor	11	5,15
	Head of Department/Team Leader/Coordinator	6	2,93
	Pharmacist/Professional/Assistant	14	6,67
	Nurse/Midwife	75	35,23
	Medical Physicist/Radiographer	6	2,93
	Physiotherapist/Nutritionist	5	2,35
	Medical Record Officer/Casemix	14	6,67
	Laboratory Technician	9	4,21
	Operational Staff	53	24,84

Measurement Model

There are three model tests in the measurement model in SEM-PLS: convergent validity, discriminant validity, and reliability. Assessing convergent validity involves evaluating the values of Average Variance Extracted (AVE) and outer loadings. Convergent validity is considered satisfactory when the outer loading surpasses 0.7, and the AVE is greater than 0.5 (Table 2). Meanwhile, the researcher assessed discriminant validity through the Fornell-Larcker criterion by comparing the square root of each construct's AVE with the correlations among other variables (Table 3).

The reliability test involved analyzing the values of composite reliability and Cronbach's alpha. Variables can be considered to meet the reliability test if their composite reliability value exceeds 0.70. Additionally, study variables with a Cronbach's alpha value above 0.6 have good reliability (Table 2).

Table 2. Validity and Reliability Test

Variable	Question Item	Outer Loadings	Average Variance Extracted (AVE)	Cronbach Alpha	CR
HOT-Fit					
System Use	SU1	0.811	0.686	0.772	0.868
	SU2	0.846			
	SU3	0.828			
User Satisfaction	US1	0.858	0.716	0.801	0.883
	US2	0.867			
	US3	0.817			
Organizational Structure	OS1	0.649	0.650	0.719	0.846
	OS2	0.853			
	OS3	0.895			
Organizational Environment	OE1	0.884	0.789	0.867	0.918
	OE2	0.886			
	OE3	0.894			
System Quality	SQ1	0.861	0.669	0.751	0.858
	SQ2	0.764			
	SQ3	0.826			
Information Quality	IQ1	0.875	0.632	0.705	0.837
	IQ2	0.784			
	IQ3	0.719			
Service Quality	SQY1	0.868	0.655	0.733	0.849
	SQY2	0.852			
	SQY3	0.697			
Net Benefits	NB1	0.915	0.821	0.891	0.932
	NB2	0.899			
	NB3	0.905			
TAM					
Perceived Ease of Use	PEU1	0.861	0.688	0.774	0.868
	PEU2	0.874			
	PEU3	0.746			
Perceived Usefulness	PU1	0.890	0.762	0.844	0.905
	PU2	0.838			

Variable	Question Item	Outer Loadings	Average Variance Extracted (AVE)	Cronbach Alpha	CR
	PU3	0.889			
Attitude Toward Use	ATU1	0.789	0.743	0.673	0.852
	ATU3	0.930			
Behavioral Intention to Use	BIU1	0.872	0.818	0.888	0.931
	BIU2	0.939			
	BIU3	0.901			
Actual Use	AU1	0.881	0.772	0.853	0.911
	AU2	0.903			
	AU3	0.852			

Table 3. Fornell-Larcker Criteria Values for Integrating HOT-Fit and TAM

TAM and HOT-Fit Indicators	ATU	AU	BIU	OE	PEU	PU	IQ	OS	SQ	SQY	SU	US
ATU	0.862											
AU	0.308	0.879										
BIU	0.312	0.816	0.904									
OE	0.441	0.612	0.599	0.888								
PEU	0.438	0.587	0.562	0.669	0.829							
PU	0.435	0.675	0.677	0.686	0.770	0.873						
IQ	0.431	0.621	0.594	0.739	0.763	0.796	0.795					
OS	0.615	0.568	0.654	0.729	0.742	0.760	0.733	0.928				
SQ	0.458	0.609	0.566	0.680	0.777	0.802	0.714	0.758	0.820			
SQY	0.471	0.556	0.553	0.644	0.761	0.752	0.755	0.715	0.756	0.905		
SU	0.417	0.645	0.593	0.646	0.703	0.726	0.709	0.654	0.702	0.680	0.828	
US	0.414	0.568	0.532	0.612	0.760	0.766	0.758	0.719	0.734	0.733	0.702	0.846

Model Equations

Path coefficient testing in SEM-PLS analysis serves to evaluate the level of the correlation between latent variables through bootstrapping. In this study, a one-tailed test was employed with a significance level set at 5% (0.05), and the number of observations was 213. The critical T-table value used in the calculation process was 1.65 (Table 4).

Table 4. Data Integration of HOT-Fit and TAM Model

Relationship	Original Sample (O)	T Statistics	P Values	Description
SU -> PU	0.066	1.230	0.110	Rejected
US -> PU	0.125	1.903	0.029	Accepted
SU -> PEU	0.059	0.949	0.172	Rejected
US -> PEU	0.193	2.265	0.012	Accepted
OS -> PU	0.220	1.973	0.025	Accepted
OE -> PU	0.020	0.307	0.379	Rejected
OS -> PEU	0.175	1.773	0.038	Accepted
OE -> PEU	0.047	0.714	0.238	Rejected
IQ -> PU	0.193	1.932	0.027	Accepted

Relationship	Original Sample (O)	T Statistics	P Values	Description
SQ -> PU	0.192	2.101	0.018	Accepted
SQY -> PU	0.178	1.742	0.041	Accepted
IQ -> PEU	0.135	1.698	0.045	Accepted
SQ -> PEU	0.177	1.846	0.033	Accepted
SQY -> PEU	0.183	1.782	0.038	Accepted
PU -> ATU	0.240	2.144	0.016	Accepted
PEU -> ATU	0.253	2.564	0.005	Accepted
ATU -> BIU	0.312	4.764	<0,001	Accepted
BIU -> AU	0.816	25.250	<0,001	Accepted

Table 4 shows that the human factors of SU and US have different effects on PU. The US has a positive significant influence on PU, while SU does not. Similarly, human factors, consisting of SU and US, also yield similar results regarding their influence on PEU. The US has a positive significant effect on PEU, while SU does not. These findings for the human factors are consistent with the organizational factors, which comprise OS and OE. Only OS has a significant positive effect on PU and PEU, while the OE does not. The technological factors which consist of IQ, SQ, and SQY have a significant positive impact on both PU and PEU. IQ has the greatest influence on PU, with an original sample of 0.193, while SQY has the greatest influence on PEU, with an original sample of 0.183. PU and PEU have a significant positive impact on ATU. ATU has a strong influence on BIU, which subsequently affects AU.

DISCUSSION

HOT-Fit model incorporates three factors: human, organizational, and technology.[31] This framework integrates the HOT-Fit model with the TAM theory to assess the implementation of HMIS in hospitals across Central Java. First, human factors, which encompass SU and US, significantly influence users' perceptions of technology usage and, ultimately, technology adoption. However, only US has a significant effect on PU and PEU in HMIS usage.

User Satisfaction (US) is defined as an overall evaluation of users' experiences in using the HMIS.[32] This definition relates to their knowledge of the system's utility and their attitude toward the system, which are shaped by user characteristics. When users are satisfied with the HMIS, they perceive it as beneficial and easy to use.[33]

On the other hand, users' familiarity with HMIS technology means that SU does not significantly affect PU and PEU. Therefore, the system's use no longer directly influences PU and EU. Instead, other factors, such as previous experience with the HMIS, work environment factors, and users' psychological situations at the time, come into play.[34]

In terms of organizational factors, only OS significantly and positively influences PU and PEU. This finding aligns with previous research by Saghafian (2021), which suggests that organizational factors affect perceptions of technology adoption. Within the OS, hospitals have provided policies and facilities that support the utilization of HMIS.[35] Therefore, HMIS is perceived as useful and easy to use by hospital staff.[36]

However, within OE, factors such as government policies mandating the use of HMIS in hospitals and the availability of a budget for HMIS development do not influence PEU and PU systems. For HMIS users, government regulations or organizational budgets during system development are not considered, as they are not directly involved in system development or budget decisions. The decision to adopt HMIS to support daily tasks is more influenced by the availability of HMIS used in the hospital.[37]

Three technological factors – IQ, SQ, and SQY – have a significant influence on PU and PEU.[38] These findings align with the results of Daghan (2016), which highlighted that IQ, SQ, and SQY are essential for technology users. In this study, the HMIS provides accurate, adequate, and up-to-date information, as well as timely information to the hospital staff. It leads them to perceive the information provided by the HMIS as more useful and accessible. Additionally, the responsive and reliable HMIS system and services make HMIS users more sensitive to SQ and SQY. It also leads them to perceive the HMIS as easier to use and more beneficial.[39]

Among these three factors, OS is the most dominant factor directly influencing the PU of HMIS. This outcome indicates that HMIS users rely on the role of hospital management in formulating internal policies and providing facility support for HMIS utilization. The better the policies and facility support for HMIS utilization, the more HMIS users will perceive it as highly beneficial in assisting their work. Meanwhile, SQY is the most critical factor in PEU regarding HMIS.[40] The results of this study demonstrate that technical and non-technical support services provided by the hospital for HMIS utilization enhance HMIS users' ease of use of the system. Conversely, inadequate services can cause difficulty for HMIS users in effectively using HMIS.[41]

In the TAM, variables include PU, PEU, ATU, BIU, and AU.[42] Firstly, PU and PEU have a significant positive influence on the attitude toward using HMIS. This result corresponds to the finding of Huang (2020), who reported that PU and PEU significantly impact technology adoption. In this study, participants perceive PU as the extent to which technology enhances their job performance. The higher the belief of HMIS users in the usefulness of HMIS in improving job performance, the more positive their attitude toward using HMIS becomes.[43] Similarly, participants in this study interpret PEU as the extent to which technology use requires minimum effort. The higher the belief of HMIS users in the ease of accessing HMIS, the more positive their attitude toward using it .

The difference between SIMRS in Indonesia and other countries is often shaped by varying needs in hospital information management. Globally, HMIS is implemented to increase service quality by providing good-quality data that can be used as a reliable information source for decision-making. In Indonesia, HMIS helps reduce medical errors caused by illegible prescriptions. In Malaysia, medical personnel confirmed that they can access significantly more information in one place compared to the conventional paper-based method. In India, HMIS offers system-generated appointment reminders, which can improve patient follow-up.[44]

Moreover, the attitude toward use (ATU) has a substantial positive impact on the behavioral intention to use HMIS. Users of HMIS who perceive it as beneficial, capable of enhancing their job performance, and hold a positive attitude toward its usage are more likely to exhibit a stronger behavioral intention to use HMIS. Finally, BIU has a significant positive influence on the AU of HMIS. BIU is an important factor in AU. The greater the behavioral intention to use HMIS, the greater their actual usage of HMIS will be. This study strengthens the quality and reach of HMIS. With access to more accurate, open, and relevant health data, citizens can also exert pressure on their governments for better delivery of health care services. However, this study focused on Class C hospitals, so the generalizability of these results to other hospital classes is limited.

CONCLUSION

HMIS users in hospitals in Central Java experience a positive influence on the attitude toward using HMIS through Perceived Ease of Use (PEU) and Perceived Usefulness (PU). Moreover, the positive influence of the Attitude toward Use (ATU) extends to the Behavioral Intention to Use (BIU), which leads to the decision to utilize HMIS in their daily work. Additionally, human factors, specifically User Satisfaction (US) and System Usage (SU), also contribute to users' decision to use the system in hospitals in Central Java. Furthermore, organizational factors, specifically Organizational Structure (OS), and technological factors, which include System Quality (SQ), Information Quality (IQ), and Service Quality (SQY), also influence the decision.

RECOMMENDATIONS

HMIS management in all classes of hospitals in Indonesia has the same system implementation. HMIS deployment requires a strong commitment from hospital management. Furthermore, the implementation of this new platform can exert a substantial effect on hospitals and entirely alter the way information systems operate. Thus, before implementing HMIS, careful consideration, thorough planning, and prudent decision-making are fundamental. Knowledge of the success factors for implementing HMIS is required to increase the success rate for efficient and successful implementation of HMIS.

ETHICAL APPROVAL

This study has been approved by the Health Research Ethics Committee of Politeknik Kesehatan Kemenkes Semarang (number 1190/EA/KEPK/2023).

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