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Original Research

The Effect of Health Information Technology Assets on the Sustainability of Health Management Information Systems Usage Moderated by Strategy in Kendari City

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Abstract

Background: Health policies in Indonesia facilitate public access to healthcare information in efforts to improve public health. These policies rely on the support of electronic healthcare information systems to provide health data and information. However, the usage of these systems faces various challenges that affect their sustainability.
Objective: To determine the effect of healthcare information technology assets on the sustainability of healthcare management information systems and the role of healthcare information technology strategies as a moderating variable.
Methods: This is a quantitative and explanatory research study. The sample consisted of 350 respondents, with a significance level of 0.05. Latent variables included the sustainability of healthcare management information system usage, healthcare information technology assets, and information system strategies, which also served as an intervening variable.
Results: The direct effect test yielded a p-value of 0.000 (<0.05), leading to the rejection of the null hypothesis. Thus, healthcare information technology assets and healthcare information technology strategies have a positive and significant effect on the sustainability of healthcare management information system usage. The indirect effect test yielded a p-value of 0.003 (<0.05), also leading to the rejection of the null hypothesis. These results indicate that the healthcare information technology strategies variable moderates the effect of healthcare information technology assets on the sustainability of healthcare management information system usage.
Conclusion: Healthcare information technology strategies strengthen the effect of healthcare information technology assets on the sustainability of healthcare management information system usage.

Keywords: Health policy; health information systems; information technology; Indonesia

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Background

Health policies in Indonesia regulate health information. The government facilitates public access to health information in efforts to improve public health. The government is responsible for providing access to information, education, and healthcare services to improve and maintain the highest possible level of health (Law Number 36 of 2009 concerning Health, 2009). Therefore, sufficient health data and information are necessary.

Both data and information are closely related. Without data, information cannot be created, and without information, data becomes useless (Hidayat, 2019). Therefore, a sufficient information system is needed to process data according to needs (Ahmad & Munawir, 2018). To improve information quality and managerial performance, computerized and up-to-date information technology can be applied (Hakim, 2016). This applies to all fields, including healthcare.

Electronic recording and reporting systems are essential elements in healthcare digital transformation (Agarwal et al., 2010). Using technology interfaces in healthcare recording and reporting system allows digital data, information, and various knowledge to support independent and collaborative healthcare work from different entities (e.g., patients, healthcare providers, and public health professionals). Using this technology may have many positive effects, such as increased patient engagement and better health outcomes (Reynolds, 2021).

The healthcare sector is an important context for research in Information Systems (IS). Healthcare information technology research has grown rapidly over the past two decades and has become a strong specialized field of information system research (Davidson et al., 2018). Research related to healthcare information systems is also inseparable from healthcare workers (medical professionals). Medical professionals play a crucial role in clinical patient care and are also users of electronic recording and reporting systems. Furthermore, in the past, there were many healthcare workers refused the implementation of electronic recording and reporting systems. However, there is also evidence of other influencing factors of the use of electronic recording and reporting systems (Venkatesh et al., 2011).

Considering the importance of public health and concerns about the implementation and use of electronic recording and reporting systems in healthcare units, there is a need to conduct a research and have an understanding built upon existing healthcare unit information system literature as well as to take into account specific contextual issues for electronic recording and reporting systems (Kohli & Tan, 2016).

Sustainability concepts should be incorporated into the development of information system projects (Marnewick, 2017). The sustainability of healthcare management information system usage faces many challenges, which can be overcome through technical system design, stakeholder coordination, and organizational capacity building to maintain and improve the system. All of this requires time and attention but is likely to improve long-term outcomes (Moucheraud et al., 2017).

Sustainable usage is also affected by the availability of adequate healthcare information technology assets, one of which is trained human resources using technology-based healthcare information systems, where increasing human resource capacity in developing countries is an urgent issue for the sustainability of technology-based healthcare information system utilization (Kimaro, 2017). This also requires innovative designs to protect the sustainability of healthcare service systems (Lehoux et al., 2016).

Healthcare information system research is based on the theory gap about the effect of healthcare information technology assets on the sustainability of healthcare information system usage. Among them, there is a theory stating that using this technology may have many positive effects, such as increased patient engagement and better health outcomes (Reynolds, 2021). However, on the other hand, it can cause side effects not only for hospitals but also for patients, such as medication errors (Berger & Kichak, 2004), decreased appointment availability (Bishop et al., 2015), and no improvement in the quality of care (Yanamadala et al., 2016).

The utilization of electronic disease recording and reporting systems in Kendari City found electronic information-based systems that are not fully utilized, even not continued. The information system that must be run by healthcare workers is quite extensive, leading to fatigue, lack of focus, and confusion about which application to prioritize for work, leading to data entry errors in applications. This is partly due to the implementation of inappropriate strategies, as well as the lack of integration between applications/disconnection between applications, even though using the same data, re-entering data into

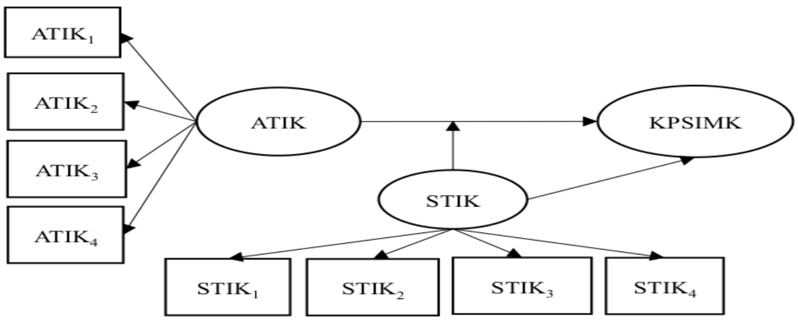
other applications is still done. The above phenomenon can be a barrier to the sustainability of technology-based healthcare management information system usage in healthcare units in Kendari City.
Therefore, this study aims to Describe the sustainable use of health management information systems and describe the role of health information technology strategies in supporting the continued use of health management information systems moderated by health information technology strategies

Method

Research Design

This study is classified asa quantitative and explanatory research that attempts to explain existing phenomena. Explanatory research is a research method aimed at explaining the position of the variables studied and the effect between variables (Sugiyono, 2017). This study used an analytical survey method. Analytical survey is a study that analyzes the dynamics of relationships between phenomena. Analytical survey study can determine the extent of involvement of a factor in the occurrence of an event from correlation analysis (Notoatmodjo, 2018). The research model is as follows:

Figure 1 Research Model



Information:
KPSIMK= Sustainability of Healthcare Management Information System Usage
ATIK = Healthcare Information Technology Assets consist of 4 dimensions:
ATIK 1 = Healthcare Workers
ATIK 2 = Health Data
ATIK 3 = Electronic Health Record Application
ATIK 4 = Healthcare service infrastructures
STIK = Healthcare Information Technology Strategies consist of the followings:
STIK 1 = Complementary strategy
STIK 2 = Competitive strategy
STIK 3 = Evolution of strategy
STIK 4 = Governance concept

Samples/Participants

The minimum sample size is determined based on the formula proposed by Slovin. The sample in this study was healthcare workers who use health electronic records, with a total of 350 healthcare workers with a significance level of 0.05 from a population of 2,783 healthcare workers. Respondents were selected using purposive sampling techniques, meaning anyone who met the inclusion criteria encountered was included as a respondent.

Based on the predetermined sample size, samples were taken by inventorying all health centers and hospitals in Kendari City, assigning enumerators to each health center and hospital. The enumerators visited the research locations starting from medical record departments, outpatient services, and met the healthcare workers to ask about compliance with inclusion criteria. If compliant, anyone who was met first and met the inclusion criteria was included as a respondent.

Instrument

The main instrument used in this study was a structured questionnaire containing variables to be studied. Measurement was carried out on answers to questions concerning indicators of the variables under study. The questionnaire consisted of four main parts: a part facilitating answer classification containing the questionnaire data collection start date, enumerator name, respondent name, department, supervisor verification, healthcare unit name, and respondent gender. Screening was done to ensure that the questionnaire was answered by respondents who met the previously established criteria, while also containing general information about the respondent, questions about the respondent's assessment of research variables, data collected from respondent answers, and was used to test research hypotheses.

In conducting validity tests, two tests were done; one with convergent validity and another with discriminant validity. Convergent validity testing was done using either the Average Variance Extracted (AVE) value or the outer loading value, or using both values. The expected AVE value in convergent validity testing was greater than 0.5. If there were AVE values that did not meet the criteria, latent variables also had to be removed from the model. Meanwhile, in convergent validity testing with outer loading, the expected value was greater than 0.7 in confirmatory research and greater than 0.5 in developmental research, and could use a scale of 0.5 – 0.6 (Chin, 1998; Ghozali & Latan, 2014), where if there were outer loading values less than 0.4, they had to be removed from the model (Sarwono & Narimawati, 2015).

Data Analysis

The inferential analysis used to test the hypotheses in this study was using SEM (Structural Equation Modeling) with a PLS (Partial Least Square) approach (Ghozali & Latan, 2014). In this study, two testing stages were conducted: outer model testing followed by inner model testing. Outer model testing was done to determine the validity and reliability of the data used in the study.

After all variables and indicators met the minimum test criteria, the next step was inner model testing. Inner model testing was used to see the relationship between latent variables. In inner model testing, three tests had to be done: R-Square, F-Square, and hypothesis tests, which included the P-Value, T-Statistic, and Original Sample tests. There were three categories of R-Square values: substantial, moderate, and weak. R-Square values higher than 0.67 were categorized as strong, values of 0.33 were moderate, and 0.19 were weak (Chin, 1998). In this study, both direct effect and indirect effect hypothesis tests were conducted.

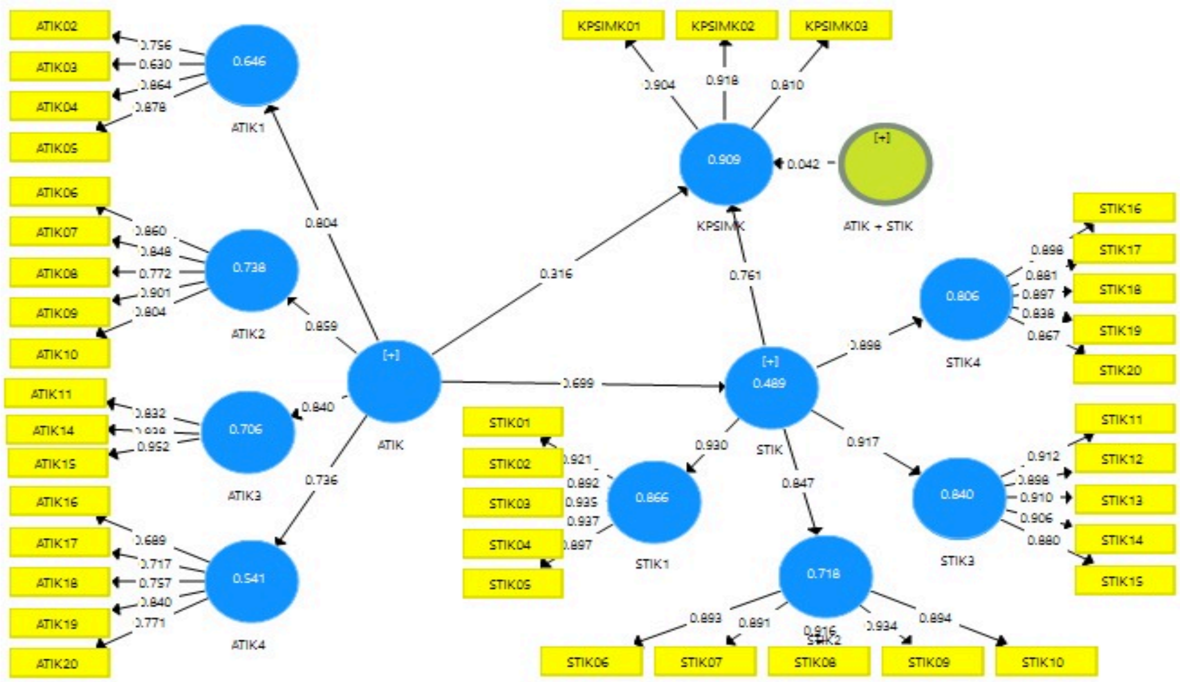
Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Commission (KEPK) of the Regional Management of the Indonesian Public Health Association (IAKMI) of Southeast Sulawesi Province, number 146/KEPK-IAKMI/X/2023.

Results

Model design describes how the latent variables are related to the hypothesis, problem formulation and theoretical study. The inner model design resulting from SmartPLS software processing before being given numbers where the blue circles represent the research variables is presented in the following chart:

Figure 2 Outer Model Design



Descriptive Statistical Test

Each indicator was tested for descriptive statistics. The latent variables tested were the sustainability of healthcare management information system usage, information system, information technology assets, and information technology strategies.

Descriptive Statistics of the Sustainability of Healthcare Management Information System Usage

Descriptive statistics of the sustainability of healthcare management information system usage are presented in Table 1 below:

Table 1 Descriptive Statistics of the Sustainability of Healthcare Management Information System Usage

Indicators	***Min***	***Max***	***Mean***	***Median***	***Standard Deviation***
KPSIMK01	1.000	5.000	3.946	4.000	0.763
KPSIMK02	1.000	4.000	3.303	3.000	0.623
KPSIMK03	1.000	5.000	3.437	3.000	0.778
Average	**1.000**	**4.667**	**3.562**	**3.333**	**0.721**

Table 1 shows that the average value of each indicator in the sustainability of healthcare management information system usage is 3.562 with a standard deviation of 0.721. The highest mean is found in indicator KPSIMK01 with a value of 3.946, and the lowest mean is in indicator KPSIMK02 with a value of 3.303.

Descriptive Statistics of Healthcare Information Technology Assets.

The healthcare information technology assets variable consists of four dimensions: workers, data, applications, and infrastructure. Each dimension is measured using five indicators. The descriptive statistics of the Information Technology Assets variable are presented in Table 2.

Table 2 Descriptive Statistics of Healthcare Information Technology Assets.

Dimension	Indicator	Min	Max	Mean	Median	Standard Deviation
Healthcare Workers	ATIK01	1.000	5.000	3.417	4.000	1.192
	ATIK02	1.000	5.000	3.880	4.000	1.032
	ATIK03	1.000	5.000	3.337	4.000	1.279
	ATIK04	1.000	5.000	3.886	4.000	1.113
	ATIK05	1.000	5.000	4.094	4.000	1.108
Health Data	ATIK06	1.000	5.000	4.206	4.000	1.046
	ATIK07	1.000	5.000	4.106	4.000	1.076
	ATIK08	1.000	5.000	3.897	4.000	1.188
	ATIK09	1.000	5.000	4.029	4.000	1.052
	ATIK10	1.000	5.000	4.329	5.000	0,979
Electronic Health Record (EHR) Application	ATIK11	1.000	5.000	3.866	4.000	1.319
	ATIK12	1.000	5.000	3.463	4.000	1.380
	ATIK13	1.000	5.000	3.171	3.000	1.192
	ATIK14	1.000	5.000	4.269	5.000	1.012
	ATIK15	1.000	5.000	4.211	4.000	1.017
Healthcare service infrastructures	ATIK16	1.000	5.000	3.649	4.000	1.151
	ATIK17	1.000	5.000	3.903	4.000	1.040
	ATIK18	1.000	5.000	4.137	4.000	0.999
	ATIK19	1.000	5.000	3.869	4.000	1.159
	ATIK20	1.000	5.000	3.651	4.000	1.153
Average		**1.000**	**5.000**	**3.869**	**4.050**	**1.026**

Table 2 shows that the average value of each indicator in the healthcare information technology assets variable is 3.869 with a standard deviation of 1.026. The highest mean is found in indicator ATIK10 with a value of 4.329, and the lowest mean is in indicator ATIK03 with a value of 3.337.

Outer Model

Outer model testing was conducted to determine the validity and reliability of the data used in the study. Measurement of indicators and constructs used validity and reliability tests to assess the ability of indicators to measure each construct.

In conducting validity tests, two tests were performed: convergent validity and discriminant validity tests. Convergent validity test was performed using the Average Variance Extracted (AVE). The expected AVE value in convergent validity testing is greater than 0.6.

Descriptive Statistics of Healthcare Information Technology Strategies

The healthcare information technology strategies variable consists of four dimensions: complementary strategy, competitive strategy, evolution of strategy, and governance concept. Each dimension is measured using five indicators. The descriptive statistics of the information technology strategies variable are presented in Table 3.

Table 3 shows that the average value of each indicator in the healthcare information technology strategies variable is 4.293 with a standard deviation of 0.788. The highest mean is in indicator STIK12 with a value of 4.426, and the lowest mean is in indicator STIK07 with a value of 4.063.

Table 3 Descriptive Statistics of Healthcare Information Technology Strategies

Dimension	Indicator	Min	Max	Mean	Median	Standard Deviation
Complementary Strategy	STIK01	1.000	5.000	4.186	4.000	0.840
	STIK02	1.000	5.000	4.266	4.000	0.779
	STIK03	1.000	5.000	4.254	4.000	0.839
	STIK04	1.000	5.000	4.246	4.000	0.735
Competitive Strategy	STIK05	1.000	5.000	4.203	4.000	0.794
	STIK06	1.000	5.000	4.157	4.000	0.901
	STIK07	1.000	5.000	4.063	4.000	0.921
	STIK08	1.000	5.000	4.186	4.000	0.893
	STIK09	1.000	5.000	4.300	4.000	0.799
	STIK10	1.000	5.000	4.226	4.000	0.880
Evolution of Strategy	STIK11	1.000	5.000	4.411	5.000	0.750
	STIK12	1.000	5.000	4.426	5.000	0.763
	STIK13	1.000	5.000	4.369	4.000	0.736
	STIK14	1.000	5.000	4.374	4.000	0.709
	STIK15	1.000	5.000	4.329	4.000	0.758
Governance concept in Healthcare Units	STIK16	1.000	5.000	4.491	5.000	0.636
	STIK17	1.000	5.000	4.400	4.000	0.705
	STIK18	1.000	5.000	4.409	5.000	0.714
	STIK19	1.000	5.000	4.251	4.000	0.835
	STIK20	1.000	5.000	4.317	4.000	0.774
Average		1.000	5.000	4.293	4.200	0.788

Convergent Validity Test with Outer Loading

Convergent validity value is the loading value of the factor on latent variables with their indicators. The expected value exceeds > 0.6 as the minimum limit of the loading value of the factor.

Table 4. Outer Loading Value of Healthcare Management Information System Usage Sustainability Variable

Indicator	***Outer Loading***	**Information**
KPSIMK01	0.904	Accepted
KPSIMK02	0.918	Accepted
KPSIMK03	0.810	Accepted

Tabel 4 shows that the smallest outer loading value is 0.810, owned by indicator KPSIMK03, and the largest value is in indicator KPSIMK02 with a value of 0.918.

Table 5 shows that the lowest outer loading value is 0.630, owned by indicator ATIK03, and the highest value is in indicator ATIK15 with a value of 0.952.

Table 5. Outer Loading Value of Information Technology Assets Variable

Dimension	Indicator	*Outer Loading*	Information
Healthcare Workers	ATIK02	0.756	Accepted
	ATIK03	0.630	Accepted
	ATIK04	0.864	Accepted
	ATIK05	0.878	Accepted
Health Data	ATIK06	0.860	Accepted
	ATIK07	0.848	Accepted
	ATIK08	0.772	Accepted
	ATIK09	0.901	Accepted
	ATIK10	0.805	Accepted
HER Application	ATIK11	0.832	Accepted
	ATIK14	0.939	Accepted
	ATIK15	0.952	Accepted
Healthcare service infrastructures	ATIK16	0.688	Accepted
	ATIK17	0.717	Accepted
	ATIK18	0.757	Accepted
	ATIK19	0.840	Accepted
	ATIK20	0.771	Accepted

Table 6 Outer Loading Value of Information Technology Strategies Variable

Dimension	Indicator	*Outer Loading*	Information
Complementary Strategy	STIK01	0.921	Accepted
	STIK02	0.892	Accepted
	STIK03	0.935	Accepted
	STIK04	0.937	Accepted
	STIK05	0.897	Accepted
Competitive Strategy	STIK06	0.893	Accepted
	STIK07	0.891	Accepted
	STIK08	0.916	Accepted
	STIK09	0.934	Accepted
	STIK10	0.894	Accepted
Evolution of Strategy	STIK11	0.912	Accepted
	STIK12	0.898	Accepted
	STIK13	0.910	Accepted
	STIK14	0.906	Accepted
	STIK15	0.880	Accepted
Governance Concept	STIK16	0.898	Accepted
	STIK17	0.881	Accepted
	STIK18	0.897	Accepted
	STIK19	0.838	Accepted
	STIK20	0.867	Accepted

Table 6 shows that the lowest outer loading value is 0.838, in indicator STIK19, and the highest value is in indicator STIK04 with a value of 0.937.

The results of the convergent validity test with Outer Loading show that all indicators displayed are above 0.6, thus proceeding to the next testing phase.

Convergent Validity Test with Average Variance Extracted (AVE)

Table 7 Convergent Validity Test with Average Variance Extracted

Variable/ Dimension	*Average Variance Extracted (AVE)*	Information
KPSIMK	0.772	Valid
ATIK	0.544	Valid
Healthcare Workers	0.622	Valid
Health Data	0.703	Valid
HER Application	0.826	Valid
Healthcare service infrastructures	0.572	Valid
STIK	0.654	Valid
Complementary Strategy	0.840	Valid
Competitive Strategy	0.820	Valid
Evolution of Strategy	0.812	Valid
Governance Concept	0.768	Valid
ATIK + STIK	1.000	Valid

Based on the table above, the AVE values for all indicators are above 0.55, indicating that the used indicators are accepted and considered valid.

Reliability Test dengan Cronbach's Alpha

The reliability test aims to see the Cronbach's alpha and composite reliability values for all variables and indicators, where the criteria for Cronbach's alpha and composite reliability are greater than 0.7 (Ghozali, 2018). If the final results for Cronbach's alpha and composite reliability reach a value of 0.7, then the testing for the inner model or the second stage testing of all research variables can proceed (Ghozali, 2018). The results of the Cronbach's alpha testing are presented as follows:

Table 8. The Results of Cronbach's Alpha Test

Variable and Dimension	Cronbach's Alpha	Information
KPSIMK	0.851	*Reliable*
ATIK	0.916	*Reliable*
Healthcare Workers	0.798	*Reliable*
Health Data	0.894	*Reliable*
HER Application	0.893	*Reliable*
Healthcare service infrastructures	0.883	*Reliable*
STIK	0.972	*Reliable*
Complementary Strategy	0.952	*Reliable*
Competitive Strategy	0.945	*Reliable*
Evolution of Strategy	0.942	*Reliable*
Governance Concept	0.924	*Reliable*
ATIK + STIK	1.000	*Reliable*

Table 8 shows that the research model has achieved a Cronbach's alpha value. From the model, it can be inferred that the model meets the Cronbach's alpha criteria because the testing meets the reliability criteria and is a reliable and trustworthy instrument.

Reliability Test with Composite Reliability

The reliability test with composite reliability is an indicator to measure a construct seen in the latent variable coefficients view. The results of the reliability test with composite reliability are presented in the following table:

Table 9 Reliability Test with Composite Reliability

Variable/Dimension	Composite Reliability	Information
KPSIMK	0.910	*Reliable*
ATIK	0.929	*Reliable*
STIK	0.974	*Reliable*
ATIK + STIK	1.000	*Reliable*
Healthcare Workers	0.866	*Reliable*
Health Data	0.922	*Reliable*
HER Application	0.934	*Reliable*
Healthcare service infrastructures	0.869	*Reliable*
STIK	0.963	*Reliable*
Complementary Strategy	0.958	*Reliable*
Competitive Strategy	0.956	*Reliable*
Evolution of Strategy	0.972	*Reliable*
Governance Concept	0.943	*Reliable*

Table 9 shows that the composite reliability values for all indicators are above 0.7. Thus, the used indicators are accepted and considered reliable for further analysis.

Inner Model

Results of Path Coefficients/Direct Effect Hypothesis Test

The significance of direct effect hypotheses can be observed in the path coefficients table, which is the estimation output value (Ghozali, 2018). The required significance quality is 5% if P-values are less than 0.050 (Ghozali, 2018). As an alpha (α) number. According to the applicable provisions. If the p-value < α, it indicates that the requirements are met, thus Ho is rejected or Ha can be accepted

Table 10 Results of Direct Effect Hypothesis Test

Hypothesis	*Original Sample (O)*	*Sample Mean (M)*	*Standard Deviation (STDEV)*	*T Statistics (|O/STDEV|)*	*P Values*	Information
ATIK -> KPSIMK	0.302	0.302	0.020	14.948	0.000	Accepted
STIK -> KPSIMK	0.734	0.733	0.029	25.558	0.000	Accepted

Based on the analysis results presented in table 10, the alternative hypothesis of this research is accepted with a p-value of 0.000<0.05 and the null hypothesis is rejected. Thus, the healthcare Information Technology Assets variable affects the sustainability of healthcare management information system usage, and healthcare information technology strategies affect the sustainability of healthcare management information system usage.

Result of Hipotesis Indirect Effect Test

Indirect effect aims to analyze the strength of the effect of one variable on another, both between exogenous and endogenous variables. The variable referred to here is the moderating intervening variable. The test results are presented in the following table:

Table 11 Results of Indirect Effect Hypothesis Test

Hypothesis	*Original Sample (O)*	*Sample Mean (M)*	*Standard Deviation (STDEV)*	*T Statistics (O/STDEV)*	*P Values*	Information
ATIK + STIK -> KPSIMK	0.054	0.054	0.018	3.022	0.003	Accepted

Based on the analysis results presented in table 11, the alternative hypothesis of this research is accepted with a p-value of 0.003<0.05 and the null hypothesis is rejected. This result indicates that the healthcare information technology strategies variable is a moderating variable for the influence of healthcare information technology assets on the sustainability of healthcare management information system usage.

Results of Coefficient of Determination (R^2) Test

R square, also known as the coefficient of determination, explains how far dependent data can be explained by independent data. R square values range from 0 to 1, with the closer it is to one, the stronger it is. The values of R square and Adjusted R square are presented in the following table:

Table 12 Nilai R square dan Adjusted R square

Variable	*R Square*	*R Square Adjusted*	Information
Healthcare Information Technology Assets	0.714	0.713	Strong
Healthcare Information Technology Strategies	0.490	0.489	Strong

Table 12 shows that healthcare information technology assets and information technology strategies have significant effect on the sustainability on the healthcare management information system usage. Information technology strategies as the moderating effect of the information technology assets on the sustainability of the healthcare management information system usage.

Results of Effect Size Test

In addition to looking at R-square, testing with the effect of endogenous latent variables on exogenous latent variables with the effect size (F^2) value. The effect size values displayed are exogenous latent variables that have a significant effect on endogenous latent variables, as shown in the following table:

Table 13. Results of Effect Size Test

Variable	*F square*	Information
Healthcare Information Technology Assets	0.494	Great Effect
Healthcare Information Technology Strategies	1.574	Great Effect

Table 13 shows that healthcare information technology assets and strategies have a significant effect on the sustainability of healthcare management information system usage.

Results of Model Fit Test

Model fit test using standardized root mean square residual (SRMR) values. SRMR is a model fit measurement tool. The accepted SRMR value as a fit model is a value of less than 0.1 (Worthington & Whittaker, 2006). The model fit test results obtained an SRMR value of 0.091 <0.1. This value indicates that the model used is acceptable or fits.

Discussion

The implementation of health policies regarding the provision of data and information at healthcare units, such as health centers and hospitals, requires healthcare information technology assets such as healthcare workers, health data, EHR applications, and healthcare service infrastructure, which are fundamental dimensions possessed by a healthcare unit in implementing an adequate healthcare management information system, thus enabling the government to provide ease of access to health information in efforts to improve public health. Healthcare workers can support the implementation of healthcare management information systems. Good acceptance, suitability, feasibility, knowledge, and understanding of the application's usefulness will greatly assist in the implementation of healthcare management information systems (DeVylder et al., 2023).

In addition to healthcare workers, regarding data, security and privacy aspects are important for data reuse in care and highlight some challenges that need to be overcome to unlock the full potential of the data (Tummers et al., 2023). This significantly affects the sustainability of healthcare management information system usage.

Health information technology mostly supports some data information needs even in emergencies (Shagerdi et al., 2022). Health data and information generated from healthcare management information systems also depend on the EHR applications used. The EHR applications owned are tailored to the needs of healthcare units. The implemented applications support the sustainability of healthcare management information system usage, thus increasing trust in informative digital health applications from the patient's perspective (Hertling et al., 2022).

Healthcare service infrastructure is also crucial in supporting the implementation of healthcare management information systems. The goal of large-scale health information infrastructure is to integrate health data collected and managed by many different organizations that may use unique and incompatible terminologies. Efficient exchange of health information between these heterogeneous systems requires infrastructure that meets several key technical requirements (Dixon et al., 2023).

Healthcare units in Kendari City mostly have adequate infrastructure, both hardware and software. Minimum computer units are already available in healthcare units, but there are still some lacking because they are only available at registration desks, while in other units, more smartphones are used to run healthcare management information system applications provided by those healthcare units. This is common in health centers. In contrast to hospitals, most units have been equipped with adequate computer units, so services using healthcare management information system applications run smoothly. Although healthcare information technology assets owned are already very adequate, it is not a standard that the healthcare management information system operated will be continuously used. Its sustainability is determined by the strategies that have been implemented by healthcare units.

Strategies, as an art, science, and practice, have been at the center of management and information technology (IT) literature and discussions for years and will remain a major management concern in the future. Effective strategies are the primary determinants of organizational performance, but developing effective strategies is difficult. A large number of issues and approaches to help shape strategies have been developed over the years (Collis & Rukstad, 2008).

In the IT field, we execute strategies, whether consciously or not, when we formulate a goal's definition and how we approach it, and when we determine the staff, technology, and decision-making structures needed to implement that goal. We can experience IT strategy failures both in formulation and implementation. Formulation failure is the most serious because it can mean that the implementation strategy, no matter how good the planning and execution, is on the wrong track (Glaser & Salzberg, 2011).

The IT investment strategy serves to improve organizational performance. This investment should enable hospitals to reduce costs, improve services, enhance service quality, and, overall, achieve its strategic goals. The goal of aligning IT with strategic planning is to ensure a strong and clear relationship between IT investment decisions and the overall strategy, goals, and objectives of healthcare organizations (Glaser & Salzberg, 2011).

There are several strategies implemented by healthcare units, both health centers and hospitals, which still utilize electronically-based healthcare management information systems. Firstly, competitive strategies, which are executed with the advantage of the information system used being connected to social health insurance administration body applications, meaning that the healthcare management information system application developed by healthcare units is integrated with social health insurance administration body applications.

Management of healthcare units in Kendari City prioritizes the advantages of the information systems they possess. These advantages are utilized for sustainable usage, leveraging the information system's advantages for service improvement, and attracting user interest in healthcare management information system services.

There are strategies for the possessed data and artificial intelligence, either stand-alone or as part of digital health/recording and reporting electronic health initiatives or other national digital health initiatives owned by the health ministry. National healthcare and/or research budgets include specific funds for big data and artificial intelligence actions.

Research strategies around big data and also artificial intelligence as well as data science that have encompassed applications for healthcare-related public interests. A clear set of ethical principles is implemented, aligned with existing policies and regulations. Minimum infrastructure requirements to be used can be explained/defined to facilitate their use and placement, computing capacity is also a concern, including storage capacity, network infrastructure, and adequate funding.

The application-related strategy implemented in Kendari includes developing a comprehensive EHR system, collecting all information related to individual patient care. This means that in addition to information about the health status/diagnosis of patients, the system stores health information, such as lab results, diagnostics, treatments (e.g., referral processes), interventions (e.g., surgeries), medication prescriptions, and billing/reimbursement. Furthermore, the developed system also includes professional standards and supporting tools that produce valid clinical decisions.

Another adoption strategy in the national HIS is the existence of an electronic system for birth registration in Kendari City, where the health office collaborates with the civil registry office. Kendari City has not been equipped with a specific death information system, and there is no electronic system for notification and registration of infectious diseases that must be reported. The healthcare information system in Kendari City has been available in the form of an electronic information system for quality control, pharmacovigilance/drug and medical device side effects, market access, and stock storage in the form of a pharmaceutical information system at health centers and hospitals.

Management also implements complementary strategies, including planning and providing sufficient funds for development, both management and staff have initiatives for service improvement, cooperation between management and staff for the sustainability of healthcare management information system usage, having strategies for improving the quality of information systems and their sustainability. Sustainable IT capabilities and primary guidelines for healthcare units to establish complementary strategies for sustainable assets (Kim et al., 2020), thus supporting sustainable healthcare management information system usage.

CEOs with predominantly administrative backgrounds appear to be more effective in setting strategies, due to their greater tendency to emphasize better information combined with the use of Management Information Systems for diagnostics. Implications for strategic hospital management are clearly outlined (Naranjo-Gil & Hartmann, 2007). Most respondents implementing strategies set by healthcare unit management, both health centers and hospitals, routinely use developed healthcare management information systems.

Conclusion

The use of health management information systems in health service units such as community health centers and hospitals must be supported by adequate health information technology assets and adapted to the needs of each health service unit. To maintain sustainable use, it is not enough to just have health information technology assets, but an appropriate health information technology strategy is needed, enabling health policies related to data and information provision to be fulfilled, executed well, providing convenience to the public in accessing health information in efforts to improve public health.

Declaration of Conflict of Interest

The authors declare having no conflict of interest.

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Author Contribution

JM was responsible for data collection, data analysis, data interpretation, and manuscript preparation. DTS was responsible for the study concept and design, MGJ was responsible for data interpretation, and NY was responsible for data analysis and data interpretation.

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