Journal : *JMMR (Jurnal Medicoeticolegal dan Manajemen Rumah Sakit), 15 (1): 39-58, April 2026*
Website : https://jmmr.umy.ac.id/index.php/jmmr
DOI : https://doi.org/10.18196/jmmr.v15i1.683

Decision Criteria in Hospital Information System Sourcing Policies and Their Impact on Stakeholders' Satisfaction

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INDEXING

Keywords:
Hospital;
Information systems;
Sourcing policy;
System usability

ABSTRACT

This study investigated the decision criteria guiding hospitals in formulating policies on insourcing or outsourcing their Hospital Information Systems (HIS). It examined how these decisions affect stakeholders' satisfaction, using perceived system usability as a proxy. This study adopted a sequential mixed-methods design involving qualitative site visits to six hospitals, followed by a quantitative survey of 80 HIS stakeholders. Findings from site visits indicated that performance, reliability, and quality were common decision criteria across sourcing strategies. Hospitals that insourced their HIS emphasized security, access, and control over source code and data, whereas those that outsourced prioritized maintainability, adherence to standards, and implementation time efficiency. Interestingly, regardless of sourcing strategy, cost was consistently ranked among the least important decision criteria, suggesting that HIS stakeholders prioritize system performance over budgetary considerations. Regarding the impact of sourcing decisions, insourced HIS achieved significantly higher usability scores than outsourced HIS, indicating greater stakeholder satisfaction. Overall, this study presented an integrated view of the criteria driving HIS sourcing policies and their implications for HIS stakeholder satisfaction.

Kata kunci:
Rumah Sakit;
Sistem informasi;
Kebijakan pemilihan vendor;
Usabilitas sistem

Penelitian ini menginvestigasi kriteria pengambilan keputusan yang digunakan rumah sakit dalam merumuskan kebijakan insourcing atau outsourcing untuk Sistem Informasi Manajemen Rumah Sakit (SIMRS) dan menganalisis bagaimana keputusan tersebut berdampak pada kepuasan pengguna dengan mengukur persepsi usabilitas sistem oleh pengguna. Penelitian ini menggunakan desain sequential mixed-methods yang melibatkan kunjungan lapangan kualitatif ke enam rumah sakit, diikuti dengan survei kuantitatif kepada 80 responden lintas kelompok pemangku kepentingan SIMRS. Temuan dari kunjungan lapangan menunjukkan bahwa kinerja, keandalan, dan kualitas teridentifikasi sebagai kriteria yang umum dipertimbangkan oleh semua rumah sakit. Rumah sakit yang melakukan insourcing memprioritaskan aspek keamanan, akses, serta kendali terhadap source code dan data. Sebaliknya, rumah sakit yang melakukan outsourcing lebih memprioritaskan aspek kemudahan pemeliharaan, kepatuhan terhadap standar, dan efisiensi waktu. Menariknya, terlepas dari strategi insourcing atau outsourcing, biaya dianggap sebagai kriteria yang tidak penting yang menunjukkan bahwa pemangku kepentingan SIMRS cenderung memprioritaskan kinerja sistem dibandingkan anggaran implementasi sistem. Terkait dampak kebijakan insourcing atau outsourcing, SIMRS yang dikembangkan secara internal memperoleh skor usabilitas yang secara signifikan lebih baik dibandingkan SIMRS yang di-outsource, hal tersebut mengindikasikan tingkat kepuasan yang lebih baik. Penelitian ini menyajikan daftar kriteria yang mempengaruhi pengambilan kebijakan pemilihan penyedia SIMRS dan implikasinya terhadap kepuasan pengguna.

Article history: Received 2025-10-31; Revised 2026-03-01; Accepted 2026-03-31

INTRODUCTION

A Hospital Information System (HIS) is an integrated, computerized platform designed to manage hospital resources efficiently (Bostanci et al., 2022; Merotiwon et al., 2023). In Indonesia—the geographical focus of this study—the adoption of HIS is mandated by the Ministry of Health. In 2022, the Ministry issued regulations requiring all health facilities,

including hospitals, to implement secure, confidential, and interoperable electronic medical record systems that are integrated with the government's centralized health database.

The focus of this study was twofold. First, it examined the criteria hospitals use when selecting a provider for their Hospital Information System (HIS). Implementing a HIS is widely recognized as a complex, costly, and high-risk information system project, often associated with a low success rate (Sayyadi Tooranloo & Saghafi, 2021; Varajão et al., 2022). The selection of a HIS provider, therefore, represents a strategic decision with long-term implications for a hospital's operational and overall business performance (Bayyapu, 2022; Kitsios et al., 2019).

Previous studies have identified criteria for sourcing decisions in the broader information systems domain. However, empirical studies examining HIS sourcing strategies remain limited. This study investigates whether the criteria used in the broader information systems domain remain relevant for HIS implementation. Accordingly, we sought to answer RQ1. What criteria guide hospitals in formulating policies to insource or outsource their Hospital Information System (HIS)?

The second focus of this study investigates the level of satisfaction among HIS stakeholders with their system as influenced by their own sourcing decisions. To assess this, we used perceived usability as an indicator of stakeholder satisfaction. In general, users interact with information systems to accomplish their tasks. Consequently, user satisfaction is closely related to how easily and reliably the systems support their daily activities, minimize cognitive and operational burden, and facilitate efficient administrative processes. Usability covers these dimensions by reflecting the extent to which a system enables users to achieve their goals effectively, efficiently, and with satisfaction (ISO, 2018). Therefore, higher perceived system usability can indicate higher stakeholder satisfaction with the system. Moreover, usability is a fundamental factor that positively affects system acceptance and continued use (Chang & Almaghalsah, 2020; Maramba et al., 2019). Accordingly, we sought to answer RQ2. How do stakeholders perceive the usability of their Hospital Information System (HIS) as an indicator of overall satisfaction?

We further examined whether different HIS sourcing strategies lead to variations in stakeholder satisfaction, as reflected by the perceived usability. Currently, empirical studies examining the impact of HIS sourcing strategies on stakeholder satisfaction are limited. This examination led to our third research question, RQ3: How does the sourcing policy of a Hospital Information System (HIS)—insourced or outsourced—influence its perceived usability?

Our findings offer important policy implications for hospital management in determining the most appropriate sourcing strategy for HIS implementation. By empirically examining the relationship between HIS sourcing policy and perceived usability, this study contributes evidence-based insights to inform strategic decision-making in HIS provisioning and long-term system management. It also contributes to the health informatics literature by providing empirical evidence on how HIS sourcing strategies are determined and how they impact stakeholders' satisfaction with the HIS.

RESEARCH METHOD

This study adopted a sequential mixed-methods design to investigate how hospitals determine whether to insource or outsource their Hospital Information Systems (HIS). In the first phase, a qualitative approach was employed through site visits and semi-structured

interviews with representatives from six hospitals to explore their decision-making processes and underlying rationales. The qualitative findings were used to refine and contextualize the sourcing decision criteria derived from the literature by confirming which criteria were relevant in real hospital settings and by identifying how practitioners expressed these considerations. These insights were used to structure the questionnaire items for the subsequent survey, ensuring the survey instrument reflected the decision rationales observed during the site visits. In the second phase, a quantitative survey was distributed to a broader group of HIS stakeholders to capture their perceptions and assess patterns across institutions. Together, these two approaches provided depth and breadth in understanding the considerations influencing HIS sourcing policies in hospital settings.

Literature Review

To understand how hospitals determine their HIS providers—through insourcing or outsourcing—we first synthesized the existing literature on organizational sourcing decisions for information systems. Prior studies specifically addressing HIS sourcing policy were limited, so we drew on broader information system sourcing literature to gain insights relevant to sourcing policy that could inform decision-making criteria in the healthcare context.

In general, there are four possible options to source an information system: (1) to build the HIS internally (in-house), (2) to outsource the HIS development externally (outsource), (3) to buy an off-the-shelf HIS (commercial off the shelf - COTS), or (4) to use open-source software (OSS) (Chatzipetrou et al., 2018; Petersen et al., 2018). Each of these methods has its own features. Each feature can be an advantage or a disadvantage depending on the context of the information system's implementation. Table 1 briefly describes features of the four sourcing options.

For clarity, this study categorized the four identified sourcing options into two principal categories: insourcing and outsourcing, with the latter including both Commercial Off-The-Shelf (COTS) and Open-Source Software (OSS) solutions (Angst et al., 2017; Schniederjans et al., 2015). Based on this classification, we examined the literature to identify the policy and decision-making criteria commonly used by organizations when determining the most appropriate sourcing approach for their information systems shown in Table 1.

Selecting the source or provider of a Hospital Information System (HIS) requires careful consideration of various system sourcing decision criteria (Ananthu et al., 2024; Bali et al., 2023; Borg et al., 2019; Chatzipetrou et al., 2020; Gorgun et al., 2022; Petersen et al., 2018). To identify sourcing decision criteria, we first analyzed factors reported as influencing information system sourcing decisions. These factors were then compared across studies using an iterative coding process to identify similarities and overlaps in meaning (Lungu, 2022). Conceptually related factors were grouped into broader categories, resulting in 17 consolidated sourcing decision criteria (see Table 2). We used these criteria as the analytical foundation for both our site visits and quantitative survey, enabling a structured and policy-relevant investigation of hospitals' sourcing strategies for HIS.

Table 1. Features of the Four Information System Sourcing Options

	In-House	COTS	OSS	Outsourcing
Developer	Internal within the user institution	External to the user institution.	External to the user institution.	External to the user institution.
Solution	Tailor-made. The solution is made to the user's specification.	Generic. The solution is made based on the developer's "best practice".	Generic. The solution is made based on the developer's "best practice".	Tailor-made. The solution is made to the user's specification.
Source code Proprietary	The user institution owns the source code.	The solution vendor owns the source code. Typically, the user institution has no access to the source code.	The vendor owns the source code. However, the vendor makes the source code publicly available, so the user institution can access it and develop custom modifications.	The source code proprietary arrangement depends on the outsourcing contract. The user institution typically holds the solution's proprietary source code.
Database Access	The user institution has full access to the database.	Typically, the user institution has no access to the database.	The user institution has direct and full access to the information system database.	Typically, the user institution has full access to the database.
Acquisition Cost	Salary and benefits of the information system team.	Price as determined by the vendor and may include warranty and support.	OSS is typically available for free with limitations. The solution is provided "as is" with no warranty or support.	Price as determined by the vendor and may include warranty and support.

Site Visits

We selected hospitals for site visits using purposive sampling to ensure representation of institutions adopting both insourcing and outsourcing strategies for their Hospital Information Systems (HIS). Hospitals were invited to participate based on their relevance to the study and their willingness to provide access for site visits and interviews. Six hospitals agreed to participate and granted the research team the necessary organizational permissions to conduct interviews with their HIS stakeholders. We interviewed the representatives of the six hospitals between June and October 2022. Within each hospital, participants were drawn from multiple stakeholder groups, including management representatives, IT personnel, and end users, to capture diverse perspectives on sourcing decisions and system use.

We interviewed the participants face-to-face, with an average duration of two hours. To improve the validity, we conducted the interviews ourselves using a set of open-ended questions. The questions focused on understanding their HIS sourcing policy and the reasons for their decision. All respondents were promised that publication of this study would disclose any identity that might refer to the corresponding hospital. Therefore, to maintain confidentiality, the participating hospitals were anonymized and labeled alphabetically from Hospital A to Hospital F. Furthermore, the number of hospital beds was reported in hundreds to prevent disclosure of each hospital's identity.

The six hospitals were classified as class B. According to the Ministry of Health, Republic of Indonesia (2010), a hospital must have at least 200 beds, among other requirements, to be classified as a class B hospital. Table 3 summarizes the six hospitals we interviewed in this study.

It is important to note that Hospitals C and D, and Hospital E, are managed by the same Hospital Group Z.

The interview data collected during the site visits were analyzed using thematic analysis (Ahmed et al., 2025). First, we reviewed the interview notes to become more familiar with the data and identify statements related to HIS sourcing decisions. Second, we assigned initial codes to the identified statements to capture the rationale underlying hospitals' sourcing policy decisions. Third, the codes were iteratively compared and grouped into broader themes based on conceptual similarity, representing common decision considerations such as system performance, reliability, security, and control. Finally, the identified themes were mapped to the 17 sourcing decision criteria derived from the literature. This mapping allowed us to validate whether the decision considerations expressed by the hospitals aligned with the criteria identified in prior information systems sourcing studies. It ensured that the subsequent survey instrument reflected real-world decision rationales observed during the site visits.

Table 2. Policy and Decision-Making Criteria for Selecting the Source of an Information System

Criteria	Description	(Petersen et al., 2018)	(Chatzipetrou et al., 2020)	(Shahzad et al., 2017)	(Borg et al., 2019)	(Daneshgar et al., 2013)	(Gorgun et al., 2022)	(Bali et al., 2023)
Performance	How effectively does the system support the company's strategy and requirements?	√	√	√	√	√	√	√
Maintainability	How easy is it to fix and update the system?	√	√	√	√	√	√	
Reliability	How resilient is the system?	√		√	√			√
Security	How secure is the data in the system?	√			√			
Quality	How good (quality) is the system as perceived by users?	√	√	√	√		√	
Time	How much time is needed to develop and deliver the system?	√		√		√	√	√
Cost	How much does it cost to acquire the system?	√	√	√		√	√	√
Support and Community	How easy is it to get support for the system?	√	√	√		√	√	√
Access and Control	Who owns the intellectual property, the source code, and the user controls over system use?	√		√		√	√	
Component usage	The implication of the components used in the system.	√		√			√	√
Component history	The maturity of components used in the system.	√	√	√				
Size	How big is the system in terms of storage and memory?		√					
Complexity	Source code complexity		√	√		√	√	
Documentation	How good is the system documentation		√	√				
Adherence to standards	How does the system enforce industry standards?		√		√			
Usability	How easy is the system to use?			√	√			
Portability	Can the system be available on multiple platforms?				√		√	

Table 3. Profile of the Six Hospitals

	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Hospital F
Owner	Private	Private	Private	Private	Private	Public
Teaching Hospital	Yes	No	No	No	Yes	Yes
Bed Counts	300-400	200-300	200-300	200-300	200-300	400-500
HIS Source	Insource	Outsource, COTS	Outsource, COTS	Insource	Outsource, COTS	Insource
Server location	On Premises	On Premises	On-Cloud	On Premises	On-Cloud	On Premises
IT Staffs	10	4	2	3	1	16
Interviewees	Head of IT	Hospital Director, Head of IT	Head of IT, IT Staffs, End Users	Head of IT, IT Staffs, End Users	Head of IT, Board of Directors	Head of IT

Quantitative Survey

The second phase of this research adopted a quantitative approach, using a questionnaire administered to HIS stakeholders across hospitals in Indonesia. This phase aimed to achieve two main objectives. The first objective was to examine stakeholders' perceptions of the importance of various sourcing decision criteria identified from the literature (see Table 2). The second objective was to assess stakeholders' perceptions of the usability of their existing HIS. Respondents comprised key personnel involved in the planning, implementation, and operation of HIS, including hospital administrators, IT managers, medical staff, and end-users. The survey complemented the qualitative insights from the earlier site visits, offering broader empirical evidence to inform policy formulation and HIS sourcing policy making.

Questionnaire Items

The questionnaire items were designed to collect information on three main aspects: (1) demographic characteristics, (2) perceptions of the importance of various sourcing decision criteria, and (3) perceptions of the usability of their current HIS. To ensure the reliability of the instruments, we evaluated the questionnaire items' internal consistency using Cronbach's alpha.

1. Demographic Questionnaire Items

Before requesting participants' demographic data, we introduced the research team and the research objectives and explained how data would be collected and used. After consenting to participate, each participant was asked to provide information about their personal profile, including age group and gender.

We then asked participants to provide information on their hospital's profile. The profile included the type of hospital (i.e., private vs. public), the participant's location (i.e., province), the participant's primary role in the hospital, and the participant's years of employment group.

Lastly, we asked about the HIS profile used at their hospital. The HIS profile items included questions about the participant's role(s) related to the HIS (i.e., decision-making, user, and/or developer), the HIS sourcing policy (i.e., insourcing vs. outsourcing), and the length of time the current HIS has been in use.

2. The HIS Provider Selection

The second section of our survey focused on assessing stakeholders' perceptions of the importance of the 17 sourcing decision criteria identified in the literature (see Table 2).

Respondents were asked to rate each criterion using a five-point Likert scale, ranging from 1 (very unimportant) to 5 (very important). This section aims to capture how HIS stakeholders prioritize factors when making sourcing decisions, providing quantitative insights into the relative importance of each criterion from both user and managerial perspectives.

3. The Perceived Usability of HIS

Lastly, we investigated the level of perceived usability among HIS users as a proxy for stakeholders' satisfaction with their HIS. To measure the perceived usability of a HIS, we used the System Usability Scale (SUS), known for its simplicity and ease of use (Brooke, 1996; Kaya et al., 2019; Suria, 2024).

SUS used a 10-item questionnaire (see Table 4) to assess user agreement on a Likert scale from 1 (strongly disagree) to 5 (strongly agree) (Brooke, 1996). As shown in Table 4, the SUS questionnaire included five positive statements (odd-numbered questions) and five negative statements (even-numbered questions). Equation 1 shows how to compute the SUS score. In the equation, x_i is the 5-level Likert scale score for item i.

Table 4. SUS Questionnaire Items

No.	Item
1.	I would like to use this system frequently.
2.	I found the system unnecessarily complex.
3.	I thought the system was easy to use.
4.	I think I would need technical support to use this system.
5.	I found the various functions in this system were well integrated.
6.	I thought there was too much inconsistency in this system.
7.	I imagine that most people will learn to use this system very quickly.
8.	I found the system very cumbersome to use.
9.	I felt very confident using the system.
10.	I needed to learn many things before I could get going with this system.

Source: *(Brooke, 1996)*

$$SUS\ Score = \left(\sum_{i=1,3,5,7,9} x_i - 1 + \sum_{i=2,4,6,8,10} 5 - x_i\right) 2.5 \qquad \text{Equation. 1}$$

The SUS score ranges from 0 (worst) to 100 (best) (Bangor et al., 2009). The average SUS score across all participants indicates the system's usability level. The average SUS score can then be used to determine the usability adjective ratings from worst to best (Figure 1).

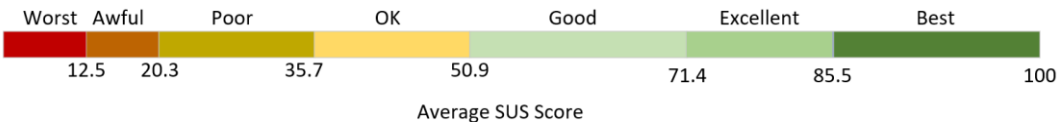

Figure 1. The Adjective Ratings for the Average SUS Score

Source: *(Bangor et al., 2009)*

Data Collection

A self-administered questionnaire in Google Forms was developed to include the questionnaire items. The target participants were hospital staff in Indonesia. Invitations for this research were distributed primarily through WhatsApp (the most popular messaging application in Indonesia) groups of various hospital-related communities. To be eligible,

respondents had to be involved in the use, management, or development of HIS within their hospital, including hospital management, IT personnel, medical staff, and other operational users who regularly interact with the HIS.

Data collection was performed in December 2023. We did not offer any incentives to the participants, so their participation was purely voluntary. We promised not to record their private profile or the profiles of the hospitals where they work. There were no risks associated with participating in our survey. Ethics approval was not required as this survey study did not involve any intervention, did not record any private data, and did not expose human participants to any foreseeable risk.

The collected data were analyzed using descriptive and inferential statistical techniques. SUS scores were calculated following the standard scoring procedure (see Equation 1), and descriptive statistics were computed to summarize respondents' perceptions of sourcing decision criteria and system usability. To examine statistical significance differences, we employed Welch's two-sample unpaired t-test (Ergin & Koskan, 2023). Statistical significance was evaluated at the 5% level. All analyses were conducted using R statistical software.

RESULTS AND DISCUSSION

Findings from the site visits and quantitative survey collectively provide a comprehensive understanding of how hospitals decide whether to insource or outsource their Hospital Information Systems (HIS). The qualitative results reveal key considerations, rationales, and contextual factors shaping hospitals' sourcing policies, while the quantitative findings capture broader stakeholder perspectives on the relative importance of these factors. Together, they offer both contextual depth and generalizable evidence to inform policy formulation on HIS sourcing decisions. The following subsections present the qualitative and quantitative results sequentially, followed by a discussion of their implications for HIS sourcing policies.

Results from Site Visits

Across the six hospitals studied, both insourcing and outsourcing strategies were observed. Despite these differences, performance, reliability, and system quality were consistently identified as important factors in HIS sourcing decisions. Hospitals adopting insourcing strategies emphasized control over system source code, data access, and the flexibility to modify the system according to evolving operational needs. In contrast, hospitals adopting outsourcing strategies emphasized maintainability, adherence to standards, and implementation time efficiency. These findings provide contextual insights into the criteria guiding HIS sourcing decisions and serve as qualitative evidence addressing RQ1.

HIS Sourcing Policy in Hospital A

Hospital A initially provisioned HIS from an outsourcing vendor. The initial HIS was developed as a web-based system using open-source technology. It has been many years since Hospital A decided to maintain and further develop its initial HIS internally.

The IT manager of Hospital A stated that insourcing enables them to quickly deliver information system updates mandated by the hospital's board and external entities, such as the Indonesian government. HIS at Hospital A was made based on their expertise in running their hospital for over two decades. Their current HIS has fully enabled electronic medical record systems, reducing the need to archive many paper records as was typically done in traditional

medical record systems. In addition, their HIS enabled them to establish strategic relationships with external partners conveniently.

HIS Sourcing Policy in Hospital B

Hospital B is a privately owned hospital within a global hospital network, where the holding company standardizes management practices. Their HIS is a web-based COTS solution sourced from a global vendor and hosted on-premises. While individual hospitals can customize certain features, major modifications require approval from the holding company before being implemented by the vendor. Over time, the system has undergone multiple updates to align with the network's evolving requirements. Accordingly, we categorized Hospital B's HIS strategy as COTS-based outsourcing.

According to the director, outsourcing HIS enables the hospital to focus on its core mission of delivering healthcare services while leveraging best practices from both the vendor and the broader hospital network. This approach allows the hospital to prioritize capital investment and transfer operational IT responsibilities to external providers. Such practice is considered a positive reinforcement to improve hospital performance (Rahimi et al., 2017).

HIS Sourcing Policy in Hospital C

Hospital C is part of a private national Hospital Network Z that initially developed its HIS internally as a desktop-based system. However, as the technology reached the end of its life and became incompatible with evolving requirements, the board decided to replace it with a more scalable solution sourced from a global HIS vendor.

Hospital C adopted a cloud-hosted COTS HIS. The vendor specializes in multinational hospital networks, enabling the integration of management data across hospitals and supporting strategic functions, such as centralized procurement, to achieve economies of scale. Due to its co-location with the network's headquarters, Hospital C led the implementation of the new system.

The new cloud-based HIS is not open source, and the holding company does not have direct access to the source code or databases. Custom reports can be developed locally, while major modifications require approval from the holding company and coordination with the vendor. The system primarily manages medical records and integrates with separate COTS cloud solutions for accounting and financial transactions.

HIS Sourcing Policy in Hospital D

Hospital D is also a part of Hospital Network Z, the same private national hospital network as Hospital C. However, unlike Hospital C, at the time of our study, Hospital D still used the legacy desktop-based HIS developed internally by Hospital Network Z. In total, Hospital D employed three IT staff. They were mainly responsible for supporting users and maintaining the computer hardware and network in two shifts.

Hospital D will eventually migrate to the new cloud-based HIS, as Hospital C did. The board of hospital networks scheduled that the new HIS will be implemented in every hospital owned by the network within a year after the pilot implementation at Hospital C.

HIS Sourcing Policy in Hospital E

Hospital E is owned by private Institution X and managed by Hospital Network Z (i.e., the private hospital network that owned Hospitals C and D). At the time of our study, Hospital E was considering its HIS source. Two options were considered: (1) the legacy desktop-based HIS, and (2) the new cloud-based HIS. Table 5 summarizes the characteristics and differences

of the two options. After months of careful consideration, Hospital E decided to adopt the Cloud-Based HIS.

HIS Sourcing Policy in Hospital F

Hospital F is a public teaching hospital. Their IT sourcing policy is mainly insourcing. They developed their own web-based HIS using an open-source technology to fit their specific requirements. Their HIS is hosted on-premises. As in Hospital A, the number of IT staff at Hospital F is high compared to other hospitals that have outsourced their HIS. Also similar to Hospital A, Hospital F decided to insource as it gives them the agility to develop and/or modify their HIS to fit their rapidly changing requirements.

The IT manager at Hospital F suggested that they had evaluated sourcing HIS from other vendors. At the time of the study, Hospital F management confirmed that they would continue to source their HIS requirements internally rather than migrate to alternative HIS sources.

Discussion on Results from Site Visits

Hospital Information Systems (HIS) are complex and involve a vast array of domain expertise beyond medical and health, including, but not limited to, supply chain management, inventory management, human resources, finance, and customer relationship management. Our study confirmed Angst et al.'s (2017) finding that a HIS consists of multiple modules, which may be provisioned from multiple internal and external sources.

Due to the hospital's complex and continuously changing requirements, no vanilla COTS HIS implementation was identified. Therefore, the use of COTS should be regarded as a long-term outsourcing engagement with the HIS vendor rather than a simple off-the-shelf purchase.

There was no single correct approach to source HIS. Hospitals that outsource their HIS were willing to accept that their HIS was not fully designed to meet their specific needs. They considered such "sacrifice" negligible since outsourcing HIS enabled them to transfer risks and resources associated with HIS development and maintenance to external entities. By outsourcing HIS, they could fully focus on their primary business strategy in health services.

Table 5. Differences in Requirements between Desktop-based and Cloud-based HIS Systems within the Hospital Network Z

Requirements	Desktop-Based HIS	Cloud-Based HIS
Computer Servers	Database Server, and Backup Server	Not Required
Network	Focus on the Local Area Network. An Internet connection for hospital staff is not mandatory.	A stable internet connection is critical, as HIS is cloud-based. Therefore, this option requires redundant internet connections to ensure service availability.
Medical Record Archive Room	The desktop-based HIS does not have an electronic medical record system. This option requires the hospital to build a physical medical records archive.	Not Required
Training	Staff training using the desktop-based HIS.	Staff training using the cloud-based HIS
HIS Cost	Not Applicable (Free)	Cost per Invoice, Annual license cost

On the other hand, hospitals that decided to insource their HIS considered ownership of the source code and database access to be critical. These hospitals ensured that their years

of experience managing hospitals were reflected in and consistently applied through their custom HIS. By insourcing HIS, they ensured that a solution that meets their exact specifications is available when needed and on time.

Results related to RQ1. What criteria guide hospitals in formulating policies to insource or outsource their Hospital Information System (HIS)?

We organized and mapped findings from our site visits against the sourcing decision-making criteria identified in the literature (see Table 2). In this analysis, Hospitals C and D were treated as a single case, as their HIS sourcing decisions are determined by the same governing entity—the parent organization of Hospital Network Z.

In this analysis, we focused on identifying the key criteria that strongly influenced hospitals' HIS sourcing decisions. While all criteria listed in Table 2 were relevant and considered by all participating hospitals, only a subset emerged as decisive in shaping the final sourcing policy. For instance, although the total cost of ownership of the legacy desktop-based HIS in Hospitals C and D was significantly cheaper than that of the new cloud-based HIS, both hospitals nonetheless decided to adopt the latter. In this case, cost differences were acknowledged but not determinative. The new cloud-based HIS was preferred not because of its higher cost, but because it provided superior performance, reliability, and quality compared to the desktop legacy system. Thus, performance, reliability, and quality were identified as the decisive criteria guiding the sourcing policy of Hospitals C and D.

Table 6 shows that all participating hospitals identified performance, reliability, and quality as common factors influencing their HIS sourcing decisions. This finding is consistent with prior studies on information system sourcing, which found that performance, reliability, and quality were determinants of IT sourcing selection (Borg et al., 2019; Petersen et al., 2018).

Table 6. The Decisive Criteria used by Participating Hospitals when Determining the Sourcing Approach for their Hospital Information Systems (HIS). Columns Shaded in Blue Represent Hospitals that insourced their Primary HIS, while Columns Shaded in Orange Represent Hospitals that outsourced their Primary HIS.

Criteria	Hospital				
	A	B	C, D	E	F
Performance	✓	✓	✓	✓	✓
Maintainability	✓		✓		✓
Reliability	✓	✓	✓	✓	✓
Security	✓				
Quality	✓	✓	✓	✓	✓
Time				✓	
Cost					
Support and Community					
Access and Control	✓				✓
Component usage in the system					
Component history					
Size					
Complexity					
Documentation					
Adherence to standards		✓			
Usability					
Portability					

The presence of these common factors is particularly interesting, as not all hospitals adopted the same sourcing policies. Hospitals may encounter multiple sourcing options offering comparable levels of performance, reliability, and quality, in which case other criteria become the decisive factors. For instance, Hospital B emphasized the importance of compliance with standards. By outsourcing their HIS, Hospital B effectively transferred the risk of non-compliance to their HIS vendor, enabling hospital management to focus more on their core mission of delivering health services.

Another noteworthy observation concerns cost and time, which are widely recognized as key determinants of information system project success (Kandengwa & Khoza, 2021; Tam et al., 2020; Varajão et al., 2022). In contrast, we found that these factors were not regarded as decisive criteria by all hospitals (except Hospital E, which considered time a decisive criterion). The cost of HIS implementation may be considered insignificant compared to other major hospital expenditures. Similarly, time was likely perceived as less consequential, since all HIS sourcing options required a comparable implementation duration.

As expected, hospitals that insourced their primary HIS emphasized that having complete access and control over the system's source code and data was a non-negotiable requirement. Both Hospital A and Hospital F reported prior adverse experiences when outsourcing their HIS, which led to their current stance on system ownership. Drawing from these experiences, both hospitals concluded that ownership of the source code and database should remain with the hospital. Such access enables the flexibility to determine the direction of their HIS.

Overall, the site visits revealed that performance, reliability, and quality were the most consistently cited decision criteria across hospitals, regardless of sourcing strategy.

Discussion on Results from Quantitative Survey

Building on insights from the site visits, this subsection presents the quantitative survey results gathered from HIS stakeholders across hospitals in Indonesia. While the site visits revealed contextual and managerial considerations in HIS sourcing policy making, the survey provides broader empirical evidence to inform policy formulation. Specifically, it examines stakeholders' perceptions of the importance of sourcing decision criteria and their assessments of HIS usability. These findings complement the qualitative results, offering a stronger evidence base for developing effective and context-appropriate HIS sourcing policies.

We collected data from 80 participants from 13 distinct provinces in Indonesia. The majority of participants were female (62.5%). Regarding age group, half of our participants were between 20 and 40 years old, while the other half were between 40 and 60 years old. Table 7 shows the distribution of the gender and age group of our participants.

Table 7. The Participant's Gender and Age Group Distribution

	Age Group		
	20 – 40	40 – 60	Total
Female	22	28	50 (62.5%)
Male	18	12	30 (37.5%)
Total	40 (50%)	40 (50%)	80 (100%)

Regarding participants' hospitals, 71.25% worked in public hospitals, and the remainder worked in private hospitals. 45% of participants were senior staff who had worked at their

current hospital for more than 10 years. Table 8 shows the distribution of our participants' years of employment and the hospital type where they currently work.

Table 8. The Participant's Years of Employment and Hospital-type Distribution

	Years of employment				
	< 2	2 – 5	5 – 10	> 10	Total
Private	5	4	7	7	23 (28.75%)
Public	5	4	19	29	57 (71.25%)
Total	10 (12.5%)	8 (10%)	26 (32.5%)	36 (45%)	80 (100%)

We grouped participants by primary position into administration staff (e.g., front office, cashier), healthcare staff (excluding doctors), doctors, and management. Table 9 shows that all participants used HIS daily, except 2 of 80, who reported using it less than once a week. Most participants are familiar with their HIS and, therefore, were considered suitable respondents.

Regarding the HIS used at the participants' hospitals, 62.5% of our participants reported that their hospital developed its HIS internally, and the remaining 37.5% reported sourcing it from external providers (i.e., outsourcing). The majority of outsourced HISs were relatively new to the participant's hospital (i.e., less than five years old). In contrast, most insourced HISs had been in use for more than 5 years.

Table 9. The Participant's Primary Position and HIS usage Frequency

	Daily	Weekly	< Weekly
Administration Staff	33	1	2
Healthcare staff	25	3	0
Doctor	3	0	0
Management	13	0	0
Total	74 (92.5%)	4 (5%)	2(2.5%)

Results Related to RQ1. What criteria guide hospitals' decisions in formulating policies to insource or outsource their Hospital Information System (HIS)?

For this, we clustered responses into four respondents' roles: Hospital Management, HIS Decision makers, HIS Developers, and HIS End Users. Note that each participant can have multiple roles, so their responses were considered across multiple response groups.

Table 10 presents the average importance of HIS sourcing decision-making criteria as perceived by each stakeholder group. Among the 17 HIS sourcing decision-making criteria, performance and usability were considered the two most important by management and HIS decision-makers. On the other end, cost, support, and community were considered the two least important criteria by management, HIS decision makers, and HIS developers. While there were no statistical differences in results across these stakeholder groups, these findings indicated that management, decision makers, and developers were willing to accept the costs and public support to obtain a HIS with the expected performance and usability.

Table 10. The Average Importance of HIS Sourcing Decision-Making Criteria as Perceived by Various Stakeholders. The Superscripts Indicate Statistical Significance (Welch Two-Sample Unpaired T-Test ≤ 0.05). The Best and Worst Results Were Bolded and Underlined, Respectively.

	End Users (*n=56*)	Management *(n=13)*	HIS Decision Makers *(n=15)*	HIS Developers *(n=13)*
Performance[a]	4.714[h]	**4.846**	**4.800**	**4.846**
Maintainability[b]	4.714[h]	4.615	4.733	4.538
Reliability[c]	4.714[dghj]	4.615	4.667	4.615
Security[d]	**4.821**[cfghijklmnoq]	4.538	4.667	<u>4.461</u>
Quality[e]	4.750[gjhm]	4.769	**4.800**	4.615
Time[f]	4.714[dghm]	4.615	4.600	4.692
Cost[g]	4.589[cdefnp]	4.461	<u>4.467</u>	<u>4.461</u>
Support & Community[h]	<u>4.464</u>[abcdefijklmnopq]	<u>4.384</u>	<u>4.467</u>	4.615
Access Control[i]	4.679[dhjp]	4.538	4.600	4.615
Component Usage[j]	4.607[cdehip]	4.615	4.733	4.692
Component History[k]	4.661[dhp]	4.615	4.733	4.538
Size[l]	4.661[dhp]	4.692	4.667	4.615
Complexity[m]	4.607[defhp]	<u>4.384</u>	4.600	4.692
Documentation[n]	4.696[dghp]	4.615	4.733	4.692
Adherence[o]	4.696[dhp]	4.769	4.733	4.769
Usability[p]	4.804[ghijklmnoq]	**4.846**	**4.800**	4.692
Portability[q]	4.661[dhp]	4.769	**4.800**	4.769

The internal consistency reliability of the 17 sourcing decision criteria items was evaluated using Cronbach's alpha. The results indicated excellent reliability (Cronbach's α = 0.979), suggesting that the questionnaire items consistently captured respondents' perceptions of the importance of sourcing decision criteria.

Table 11 shows that the perceived importance of HIS sourcing criteria differs between stakeholders using insourced and outsourced HIS. Insourced HIS stakeholders considered security the most important criterion, indicating the importance of maintaining control over data and source code. In contrast, Outsourced HIS stakeholders prioritized system usability as the most important criterion. Support and community were rated as the least important criterion by both groups, suggesting that external community support was not generally considered a decisive factor in HIS sourcing decisions.

Results Related to RQ2: How do stakeholders perceive the usability of their Hospital Information System (HIS) as an indicator of overall satisfaction?

The average SUS score across all respondents was 65, indicating good perceived usability according to standard SUS interpretation scales (see Figure 1). This finding is consistent with prior studies assessing the usability of Hospital Information Systems, which similarly report good usability levels in healthcare settings (Behnam et al., 2023; Østervang et al., 2024). The agreement of findings suggests that, despite differences in sourcing strategies and organizational contexts, HIS implementations tend to achieve comparable usability standards, although room for improvement remains.

Table 11. The Average Importance of HIS Sourcing Decision-Making Criteria as Perceived By Stakeholders. The Superscripts Indicate Statistical Significance (Welch Two-Sample Unpaired T-Test, P ≤ 0.05) Between The Results and Those from Another Criterion. The Best and The Worst Results Were Bolded and Underlined, Respectively.

	Insourced *(n=50)*	Outsourced *(n=30)*
Performance[a]	4.820[hj]	4.633[h]
Maintainability[b]	4.820[h]	4.500
Reliability[c]	4.760[dh]	4.600[h]
Security[d]	**4.900**[efghijklmnoq]	4.533
Quality[e]	4.820[gh]	4.600[h]
Time[f]	4.800[dgh]	4.533
Cost[g]	4.680[defopq]	4.400
Support & Community[h]	<u>4.560</u>[abcdefijklnopq]	<u>4.366</u>[acenp]
Access Control[i]	4.740[dh]	4.500
Component Usage[j]	4.700[adhp]	4.530
Component History[k]	4.760[dh]	4.500
Size[l]	4.740[dhp]	4.567
Complexity[m]	4.680[dp]	4.433
Documentation[n]	4.780[dh]	4.567[h]
Adherence[o]	4.800[dgh]	4.567
Usability[p]	4.860[ghjlm]	**4.667**[h]
Portability[q]	4.800[dgh]	4.533

We also investigated the influence of HIS use frequency on perceived usability. We found that participants who used their HIS daily perceived their HIS as having a higher usability level (i.e., average SUS score of 65.743 ± 14.000) than those who used it less frequently (i.e., average SUS score of 55.833 ± 10.801). Nevertheless, the difference was not statistically significant.

The System Usability Scale (SUS) is a widely validated instrument for measuring system usability. In this study, we additionally assessed the internal consistency reliability of the SUS responses using Cronbach's alpha. The results indicated acceptable reliability (Cronbach's α = 0.73), demonstrating adequate consistency among the usability measurement items.

Results Related to RQ3: How does the sourcing policy of a Hospital Information System (HIS)—insourced or outsourced—influence its perceived usability?

The analysis revealed that insourced HIS achieved significantly higher usability scores than outsourced systems, indicating greater stakeholder satisfaction with internally developed systems, and the difference was statistically significant (see Table 12). This finding is consistent with the results reported by Brand et al. 2025), who found that users perceived outsourced HIS solutions as less usable and less satisfying than their customized HIS.

Table 12. The Average SUS Score as Perceived by Their Users. The Asterisks Indicate Statistical Significance (Welch Two-Sample Unpaired T-Test, P ≤ 0.05) Between Results for Participants using Insourced HIS and Outsourced HIS.

	n	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Total
Insource	50	9.15	6.30	8.55	4.00	8.00	4.85	8.35*	7.60	7.90	2.80	67.50*
Outsource	30	8.50	4.75	7.92	3.25	7.41	5.01	7.25*	6.83	7.67	2.17	60.83*

Interestingly, as shown in Table 12, usability was the most important criterion among the factors considered by hospitals that used outsourced HIS systems. With this in mind, the lower SUS index observed among outsourced HIS stakeholders suggests that they were, on average, less satisfied with their systems than stakeholders of insourced HIS systems.

Several organizational and system factors may explain the higher usability scores observed in insourced HIS systems. First, insourcing allows hospitals to retain direct control over system design, customization, and feature prioritization, enabling better alignment between the HIS and the hospital's requirements. Second, insourced environments often foster closer collaboration between IT staff and end users, facilitating iterative improvements and better communication regarding system requirements and acceptance. Third, hospitals that insource their HIS accumulate institutional knowledge over time, as internal IT teams develop a deeper understanding of local processes and requirements. This accumulated knowledge supports ongoing refinement of HIS functionality. In contrast, outsourced systems may involve standardized architectures, vendor-controlled update cycles, and formalized change request procedures, which may limit flexibility and delay user-requested customization.

In terms of results from individual SUS items, insourced HIS performed statistically better than outsourced HIS on the duration-of-use scale (S_7). Insourced HIS was perceived as easier to learn, and users required less time to become proficient. Insourced HIS also outperformed outsourced HIS across all other SUS statements, except for S_6. However, apart from S_7, the responses to the remaining statements did not differ significantly. This finding suggests that hospitals opting for an outsourced HIS may need to allocate additional resources and time to user training and change management to achieve comparable levels of usability and user acceptance.

Practical Implication

Decision-makers in HIS sourcing should recognize that sourcing decisions extend beyond cost and time considerations. Hospitals with strong internal IT capabilities and highly specific requirements may benefit from insourcing, particularly when agility and system customization are strategic priorities. While insourcing can enable greater flexibility, rapid system modification, and close alignment with stakeholders' requirements — potentially leading to higher HIS user satisfaction — it also requires substantial IT resources and organizational capacity. However, IT development is often not the primary capability hospitals prioritize. The case of Hospital Group Z (i.e., the owner of Hospitals C and D) illustrates this situation, in which the hospital decided to transition from insourcing to outsourcing to access a more standardized, scalable HIS solution. Therefore, the decision to insource HIS should be considered not only an operational but also a strategic decision, reflecting the HIS's critical role in the hospital's competitiveness.

On the other hand, hospitals seeking standardized best practices, risk transfer, and reduced internal IT burden may find outsourcing more suitable. Although outsourcing is often considered a strategy for transferring operational and technological risks, outsourcing HIS is neither risk-free nor necessarily less complex than insourcing HIS. Hospitals that outsource their HIS must possess sufficient organizational capacity to manage contractual relationships with vendors effectively, ensuring that they do not become dependent on a single provider without a viable exit strategy. Furthermore, clear and well-defined service level agreements (SLAs) are essential to ensure that the expected level of system performance and support

services is delivered. The experiences of Hospital A and Hospital F illustrate this risk: an outsourcing arrangement that did not perform as expected eventually led the hospitals to transition from outsourcing to insourcing their HIS. Therefore, hospitals considering outsourcing HIS should ensure that they have appropriate vendor governance mechanisms, contractual safeguards, and internal oversight capabilities to manage outsourcing risks effectively.

Our study demonstrates that multiple factors influence HIS sourcing decisions. This finding suggests that selecting the source of HIS is not a trivial choice but a long-term strategic decision that requires balancing operational flexibility, internal resource capacity, risk management considerations, and stakeholder satisfaction.

Limitations

This study has several limitations. First, the qualitative phase involved a limited number of hospitals, which may restrict the generalizability of contextual findings. Although the hospitals were purposively selected to represent both insourcing and outsourcing strategies, they may not capture the full diversity of HIS practices across Indonesia. Second, the quantitative survey was voluntary and distributed broadly within hospital stakeholder communities. At the same time, this approach enabled access to diverse participants, the non-probability sampling method may introduce self-selection bias and limit representativeness.

The findings should be interpreted as indicative rather than fully representative of all hospitals. While the results provide useful insights into HIS sourcing decision-making, caution should be exercised when generalizing these findings across different healthcare systems, organizational contexts, or countries. Future research involving larger samples and more systematic sampling approaches would help validate and extend these findings.

CONCLUSION

This study examined the decision criteria underlying Hospital Information System (HIS) sourcing policies and their relationship with stakeholder satisfaction using a sequential mixed-methods approach. We found that performance, reliability, and quality were commonly considered decisive by all hospitals, regardless of their HIS sourcing policy. Beyond these shared factors, differences emerged in other decision criteria. Hospitals that insourced their HIS valued security, control, and access to the system's source code and database as essential for maintaining autonomy, whereas those that outsourced prioritized maintainability, implementation time, and adherence to standards over direct system control. These distinctions highlight how institutional priorities and governance orientations shape HIS's sourcing policy.

Interestingly, cost was consistently ranked among the least important criteria across all stakeholder groups. This finding suggests that hospitals tend to prioritize system performance over budgetary considerations.

Overall, stakeholders rated the usability of their HIS as Good, regardless of the sourcing policy. However, the usability scores reported by stakeholders of outsourced HIS were statistically significantly lower than those of stakeholders in insourced HIS. This finding suggests that outsourced HIS stakeholders were, on average, less satisfied with the usability of their systems. Our findings also suggest the importance for hospitals using outsourced HIS to

invest adequate time and resources in user training to ensure that staff can fully leverage their outsourced HIS's capabilities.

In practice, our findings identify a set of decision criteria that hospital management can use as a structured framework for selecting the appropriate HIS sourcing strategy. Hospitals with strong internal IT capabilities and a need for workflow customization may benefit from insourcing, whereas hospitals prioritizing standardization, risk transfer, and reduced internal IT burden may consider outsourcing.

This study has limitations, including the limited number of hospitals involved in the qualitative phase and the voluntary, non-probability sampling approach used in the quantitative survey. Future research could employ larger, more diverse samples, longitudinal designs, or cross-country comparisons to examine further how sourcing strategies influence long-term HIS performance and stakeholder outcomes.

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Published by: UMY ADMMIRASI

Vol. 15 No. 1 (2026): April 2026

DOI: https://doi.org/10.18196/jmmr.v15i1

Published: 2026-04-22

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