



Towards Improved Hospital Services: IS/IT Strategic Recommendations for Muhammadiyah Hospital Based on Cost and Prioritization Analysis

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This mixed-method study looks into the strategic priorities of information systems and technology (IS/IT) at Muhammadiyah Hospital in Sidoarjo, with a focus on long-term goals and alternative tactics. Using the Ward and Peppard approach, the research seeks to develop strategic suggestions and identify potential future application portfolios. The data was examined using cost-benefit analysis (CBA) and ranked using the Analytical Hierarchy Process. Furthermore, professional viewpoints were acquired through focus group discussions to evaluate IS/IT portfolio recommendations. The findings show that cost parameters play an important role in selecting developmental systems. The study emphasizes the need of using a multi-method approach in IS/IT strategic planning within healthcare, as well as the value of expert input in making good decisions. The findings provide a framework for Muhammadiyah Hospital to improve future services and go forward with key IS/IT projects.

Keywords: *Hospital Service; Information and Technology Systems; Multi-Method Approach; Strategic Planning; Muhammadiyah Hospital*

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1. INTRODUCTION

The hospital is among the health service institutions that play a crucial role in enhancing the public's health, providing inpatient, outpatient, and emergency services. Many hospitals have shifted to profit-oriented, requiring the public to change their perspective on hospitals (Gonzalez, 2019; Shao, 2019). The transition from a comparative to a competitive advantage paradigm, driven by the challenges of free market competition and the advent of the Industrial Era 4.0, has intensified the battle for market share among hospitals. Hospital competition is more challenging due to free market competition in Indonesia, which has changed the paradigm of hospitals from comparative advantage to competitive advantage. Because of the growing number of hospitals, each one competes for customers. In addition to this growth, hospitals face fierce competition for market share in the hospital industry. The Industrial Era 4.0, with its free market competition, requires every hospital to obtain and maintain a competitive advantage for long-term success. Achieving a competitive advantage can drive success, but for a certain period, other hospitals will soon imitate that advantage (Douglas & Ryman, 2003). A hospital must strive to achieve a sustainable competitive advantage by continuing to innovate (Agwunobi & Osborne, 2016). As a result, excellent hospital strategic planning is critical for survival and growth in a rapidly changing environment (Abusalma, 2021; Douglas & Ryman, 2003; Elrod & Fortenberry, 2018; Girinata & Suryani, 2019). The environmental hospital organization is, among others, influenced by government policies such as the Ministry of Health, Local Government, and the Social Security Administration Agency, both regulations directly or indirectly related to hospital services. Muhammadiyah Hospitals, integral to Indonesia's extensive healthcare network, face challenges like accessibility, human resource availability, and equipment modernization. To navigate these challenges, Muhammadiyah Hospitals have adopted a business strategy emphasizing its identity as a social Islamic organization, holistic services, infrastructure and technology investment, and health worker education and training. The strategy includes integrating a management information system (SIM RS) across service units and introducing superior service products to improve service quality. The hospital's business strategy entails integrating the management information system into all service units and introducing several superior service products to enhance the quality of its services (Douglas & Ryman, 2003; Girinata & Suryani, 2019; Nabelsi & Gagnon, 2016). SIM RS is a data processing procedure that employs integrated data technology to produce precise and sufficient information results. Creativity and innovation are required for the hospital to gain a competitive advantage. Meanwhile, today's competitive advantage is inseparable from IS and IT because hospitals must create and develop new products, services, and systems. The information system (IS) defines the hospital's needs (Carvalho, Rocha, Vasconcelos, & Abreu, 2019; Keesara, Jonas, & Schulman, 2020; Rehman, Naz, & Razzak, 2021; Sousa, Pesqueira, Lemos, Sousa, & Rocha, 2019).

The previous research employs the Ward and Peppard technique to produce a strategic plan that can be put into a portfolio and used to plan information systems at STKIP Muhammadiyah Kotabumi (Sigit Gunanto, Nisar, & Irianto, 2019). Another research gave recommendations in the form of new applications such as ERP, CRM modules, financial systems, and third-party data collection applications to support the IS business strategy (Febriyanti, Samopa, & Ambarwati, 2019). Then, suggestions for the IT strategy include using cloud computing, IPTV, and adding infrastructure coverage. The other result findings are that the SAM is essential in building an organization, building cooperation, and increasing competitiveness to achieve the goal of alignment (AlKhalidi, Kaloti, Shella, Al Basuoni, & Meghari, 2020; Lv & Qiao, 2020; Tallon, Queiroz, Coltman, & Sharma, 2019). The organization must have IS/IT that supports business processes and provides the correct management information at the right time (Douglas & Ryman, 2003; Ismanto, Harisno, Kusumawardhana, & Warnars, 2018). Most research for strategic planning is limited to producing a portfolio recommendation without considering the company's or organization's financial side; therefore, this study will focus on IS/IT strategic planning to enhance the hospital's strategic advantage. In analyzing strategic planning, the method used is Ward and Peppard, which includes internal and external business analysis, as well as to produce IS/IT portfolios, IT/IT plans, hospital business plans, cost estimates, and benefits from this method's portfolio recommendations.

2. LITERATURE REVIEW

The Relationship between Information Systems Strategy, Information Technology Strategy, and Business Strategy

It is essential to understand the organization's business strategy to determine the Information Systems (IS) / Information Technology (IT) strategy that can support the achievement of an organization's vision and mission. This understanding should encompass various aspects, such as the rationale behind the business, its goals and direction, the timeline for achieving these goals, the methods for goal achievement, and any necessary adjustments (Budiyanto, 2017). Business strategy is paramount, serving as the core and guiding force for the company or organization's objectives and direction. It lays the foundational basis for formulating the IS strategy, which is demand-oriented and identifies all applications or information needed to support the business strategy. Following the development of the IS strategy, a technology requirement and priority list are generated, forming the basis of the IT strategy. This strategy encompasses all technical needs, including networks, hardware, and other supporting technologies. Ultimately, the IT strategy facilitates the creation of infrastructure and services to bolster all applications within the IS strategy (Ambarwati, Lieharyni, & Multazam, 2020).

Strategic Planning of Information Systems and Information Technology

Before delving into the strategic design phase of IS/IT, it is crucial to comprehend the concept of IS/IT strategic planning. IS/IT strategic planning is a process that identifies a portfolio of computer-based IS applications to aid the organization in executing its business plan and achieving its objectives (Ward & Peppard, 2002). Strategy pertains to the overarching consideration of the organization's Information Systems and their integration with the business at large. It must be coherent, consistent, and directed: coherent in its clarity to both the business and IS organization, consistent in its alignment, and directed in steering change (Cassidy, 2006). Strategic planning serves as a detailed framework for policy formulation, encompassing goal setting, strategy development, program implementation, activity focusing, and specifying the actions required by each organizational unit. IT strategy revolves around decisions related to implementing and using technology-based information systems in an organization. It is derived from the organizational strategy and includes content links (the consistency between business and IT plans), temporal links (the timing of IT plan development relative to business planning), and personnel links (the extent of participant involvement in business and IT planning) (Ward & Peppard, 2002). As outlined, the IT strategy identifies needs including hardware, networks, and other supporting technologies, while the IS strategy determines all necessary applications and information.

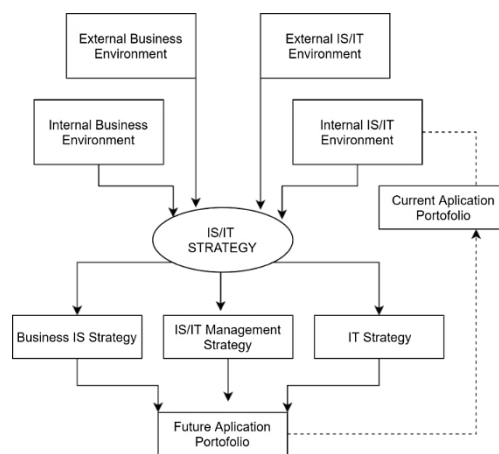


Figure 1. IS/IT Strategy Model

The internal business environment analysis encompasses aspects of the current business strategy, goals, resources, processes, and the organization's cultural business values. This analysis serves to ascertain the organization's existing business strategy, vision, mission, operational activities, business processes, available resources, and necessary information. In contrast, the

external business environment analysis includes economic factors, industry specifics, and the competitive landscape that the company faces. This external environment can either propel the company towards progress and competitiveness or pose challenges and threats to its sustainability. Furthermore, the internal IS/IT environment analysis sheds light on the company's current SI/IT state from a business perspective, focusing on its maturity level, business contribution, human resource skills, resources, and technology infrastructure, including the existing IS/IT portfolio. The external SI/IT environment analysis explores technology trends, potential utilization opportunities, and the IS/IT usage by competitors, customers, and suppliers. This external analysis is crucial for understanding developments in IS/IT outside the company that could impact its longevity. The outputs of strategic planning include the Business IS Strategy, which delineates how each business unit or function will leverage IS/IT to fulfill its business objectives, along with an overview of the application portfolio and information architecture. The IT Strategy outlines the policies and strategies for managing the technology and human resources of IS/IT. The IS/IT Management Strategy encapsulates the common elements to be applied throughout the company, ensuring consistency in IS/IT policy application.

Strategy Formulation

Strategy Formulation is a comprehensive process that defines the IS business strategy, IT strategy, IS/IT management strategy, and the future application portfolio. It specifies how each business unit or function can utilize SI/IT to achieve its business goals, fundamentally linking information systems and technology with the company's business strategy. This alignment involves tailoring the application and service needs of management and end-users to the business plans and activities, prioritizing the development of the company's infrastructure or application systems. The IT strategy is designed to delineate the acquisition, organization, and development of resources and technology to support the Business IS Strategy while also being adaptable to the evolving landscape of information technology that presents opportunities and challenges. According to Ward & Peppard (2002), IT Strategy support factors include application portfolio management, organization of SI/IT, resource and administrative issue management, information resource management, achievement of information service objectives, application development management, and technology management (Rehman et al., 2021). These strategies encompass all elements applied within the company, ensuring that management policies related to information systems and technology are in place. These policies form an organizational structure that supports the company's information systems, investment decisions related to suppliers, human resource policies, and accounting policies (Kodama, 2021). The future application portfolio offers a set of recommendations stemming from the SI/IT planning process, encapsulating the SI strategy, IT strategy, and SI/IT management strategy, laying the groundwork for the company's strategic direction in information systems and technology.

3. RESEARCH METHOD

This research applied qualitative and quantitative research methods to meet the broad research goals and produce suggestions for strategic planning of SI/IT at Muhammadiyah Hospitals. SI/IT strategic planning in the research refers to the Ward and Peppard framework to obtain future portfolio applications. Furthermore, a cost-benefit analysis was carried out using Cost Benefit Analysis (CBA) and prioritization of future needs. This strategy formulation discusses the SI business strategy, IT strategy, SI/IT management strategy, and future portfolio applications. The future application portfolio lists the SI, IT, and SI/IT management strategies that emerged from SI/IT planning. Portfolio results for future application require a Cost Benefit Analysis (CBA), which is an analysis with a systematic procedure to compare the series of costs and benefits relevant to the project (Bağdatlı, Akbıyıklı, & Papageorgiou, 2017; Kouskousis & Botsaris, 2017; Yang, Zhu, & Guo, 2018). CBA determines the viability of a hospital's plan, program, or policy. CBA aids in decision-making and evaluating available alternatives in five key stages they are defining the problem and identifying alternatives, determining the inputs and outputs (impact) of each option, calculating the benefits and costs of each option, comparing the benefits of each alternative, and identifying the best choice from available portfolio recommendations (Bağdatlı et al., 2017).

The research framework begins with establishing the background, formulating the problem, defining its boundaries, and

identifying the research objectives and anticipated benefits. Subsequent data and information gathering occurred at Muhammadiyah Hospital through observation, interviews, and literature review. Observation entailed comprehensive and direct examination of the hospital's condition, focusing on business processes, information technology infrastructure, and existing information system implementations, without specialized equipment. Interviews with Muhammadiyah Hospital management aimed to clarify data related to hospital business processes. This stage leveraged direct interactions to gather pertinent information from informants on the aspects warranting discussion. A literature review at the hospital facilitated the analysis of documents such as hospital profiles, modules, and products, offering supplementary data and information crucial for this research.

The subsequent phase involves analyzing and understanding the current state and business requirements. This encompasses analyzing internal and external business environments, as well as external and internal IS/IT environments. Analyzing the internal business environment is crucial to comprehending, identifying, and scrutinizing the internal conditions of Muhammadiyah Hospital, including its vision, mission, goals, and objectives. Business strategy analysis, derived from interview insights and literature observations, ascertains business priorities and IS needs. This analysis integrates activities and processes through value chain analysis, which elucidates how the business delivers added value to customers, leading to information system solutions aligned with business activities. Furthermore, external business environment analysis identifies factors that influence organizational direction, actions, structure, and processes, using PEST and Porter's Five Forces analyses to discern macro and micro external opportunities and threats. These analyses guide the formulation of the business strategy for Muhammadiyah Hospital.

The internal IS/IT environment analysis compares current IS/IT conditions with future goals, evaluating hospital resources like application portfolios, infrastructure, and services. Human resources, networks, IT infrastructure, and IS applications are analyzed to determine their adequacy and alignment with strategic goals. McFarlan's strategic grid analysis categorizes IS/IT applications based on their significance to the hospital, while external IS/IT analysis leverages technology trend analysis to identify potential future applications. Subsequent stages include determining future needs through SWOT analysis, Balanced Scorecard, Critical Success Factors (CSF), and Gap Analysis to elucidate IS/IT requirements. The outcome of IS/IT planning comprises three elements: IS/IT strategic management, IS business strategy, and IT strategy, leading to portfolio recommendations for enhancing Muhammadiyah Hospital's business activities.

Cost-Benefit Analysis (CBA) evaluates the feasibility of these recommendations, encompassing problem definition, alternative identification, input and output determination, benefit and cost calculation, and alternative comparison to ascertain the optimal choice. Following CBA, prioritization occurs through methods like the Analytic Hierarchy Process (AHP), culminating in a Focus Group Discussion (FGD) with hospital management, particularly in the IT sector and financial, to review and provide feedback on the IS/IT portfolio recommendations.

4. RESULTS AND DISCUSSION

4.1 RESULTS

4.1.1 Strategy Formulation

Previous research includes examining the company's internal and external environment and the use of systems and information technology (IS/IT) by companies and the general public, followed by SWOT analysis, IT Balanced Scorecard Analysis, and Critical Success Factor Analysis. Gap analysis makes it easier for hospitals to know which performance should be improved or improved. After knowing the results of Critical Success Factors, the results of mapping the current SI/TI gap conditions with SI/TI needs are obtained. The information obtained will be processed towards several recommendations at the hospital's formulation stage of SI/TI strategic planning.

4.1.2 IS Business Strategy

The information system gap shows the gap between potential business needs and Information System (IS) needs so that it can provide the right decision to determine development priorities later. The previous stage in the IS gap has determined the

mapping of IS needs, then the application users are determined. The results of mapping the conditions of the IS/IT gap using interviews show that the IS/IT needs in the hospital include 1) Upgrade, Update from the old or current version to the new version; 2) Optimized, Optimize the existing system, this system already exists and is actually needed but has never been or rarely used; 3) Replaced, the system needs massive changes; 4) New System, Create a new system; 5) Continue as-is and retained, Continue and maintain the current system; 6) Retired, delete the existing system because it is no longer needed. Appendix I shows the description of the IS business requirements.

4.1.3 IT Strategy

The previous stage determined the information technology (IT) gap based on potential needs and current conditions. After analyzing gaps in IT, the next step is mapping IT needs and providing IT recommendations following the analysis that was completed previously (Table 1).

TABLE 1 / Elaboration of IT Requirements

Information Technology Requirements	Analysis
Adding 2 database servers to optimize the performance of SI applications	<i>Upgrade</i>
Increased internet access capacity	<i>Upgrade</i>
Use of Big Data and virtual reality (VR) for research, management, and education needs	<i>New System</i>
Having a Command Center	<i>New System</i>
Infrastructure and Network Replacement	<i>Replace</i>
SIMRS server update	<i>Upgrade</i>
Having faceprint and fingerprint devices for attendance	<i>Continue as-is and retained</i>
Integrating all CCTV in the hospital centrally	<i>Optimized</i>
Complete Medscape Access	<i>New System</i>
Having a Data Center	<i>Upgrade</i>
Use Artificial Intelligence (AI) Technology to assist research, education, and management.	<i>New System</i>
Fulfilments of internet network distribution, either LAN or wifi, throughout the hospital area for both patients and employees.	<i>Optimized</i>
Fulfillments PC needs and reliable supporting devices for all work units as needed.	<i>Optimized</i>
Having a smartboard	<i>New System</i>
Addition of 40'-60' LED TV	<i>Optimized</i>

Source: Data Processed (2024)

4.1.4 Management Strategy for IS and IT

In addition, recommendations for IS/IT management strategies will be made in line with the previous analysis, where the scope of the discussion is about future IS/IT management in hospitals. This is done by adapting previous research findings (shown in Table 2).

TABLE 2 / Mapping The Requirements For SI/TI Management

IS/IT Requirements	Analysis
There is a need for planning the installation of Wireless LAN in user-intensive locations	<i>Upgrade</i>
Routine network security checks by IPTI	<i>Optimized</i>
Gradually updating supporting PC needs, and supporting devices such as ms.office, windows 10 and anti-virus by IPTI	<i>Upgrade</i>
Pay attention to network availability in network infrastructure improvements, network backbone overhaul, and backbone design must pay attention to network availability.	<i>Upgrade</i>
Continue to develop SIMRS	<i>Upgrade</i>
Request for replacement of hospital network backbone to Fiber Optics	<i>Upgrade</i>
Scheduling to upgrade the SQL database version so that the performance of the SI application is more optimal	<i>Upgrade</i>

Scheduling for Database Server Upgrade so that the performance of the SI application is more optimal	<i>Upgrade</i>
Continue to optimize the application program code	<i>Upgrade</i>
There is a need for a WMS (Warehouse Management System) system that integrates incoming goods, outgoing goods, moving between warehouses, storage, and picking.	<i>New System</i>
Increase the competence and number of human resources in each department related to SIMRS	<i>Upgrade</i>
Compliance with system operational SOPs	<i>Upgrade</i>
Strengthening SOPs and internal policies in the implementation of SIMRS	<i>Optimized</i>
Equal distribution of programmer competence in IPTI	<i>New System</i>
Need for additional system analysts in developing SIMRS	<i>New System</i>
Need for performance appraisal	<i>New System</i>

Source: Data Processed (2024)

4.1.5 Future Application Portfolio Recommendations

Recommendations for new application portfolios are made after finishing the previous stages (Table 3).

TABLE 3 / Future Application Portfolio

Strategic	High Potential
- Payroll	- Bridging SIMRS - LIS - GDA ONLINE
- Script Management	- Bridging LIS - PK
- Bed Management	- Bridging E-CLAIM INA-CBG
- Bridging SIMRS Inventory - BPKAD Goods Inventory	- Applicares
- Clinical Pathology Lab	- Medical Device Calibration
- E-Prescription	- PPI
- Public Relations*	- Maternity Room*
- Equipment*	- BLUD Accounting*
- Receiving Treasurer*	
- Storage of Goods and Services Procurement Documents	- Ambulance Module
- Goods and Services Procurement Document Template Processor	- SPPD
- Numbering of Goods/Services Procurement	- SI-SIRANAP Bridging
- SISROUTE Bridging	- Single ID Module
- Mobile Presence	- LIS-MIKRO Bridging
- Patient Satisfaction	- Cathlab Data and Medical Equipment Storage
- System Administration*	- Dashboard Management
	- Centralized Cashier*
Key Operational	Support

Symbol descriptions:

* = Applications that need to be upgraded

Table 3 shows recommendations for future application portfolios divided into four quadrants according to information systems based on hospital business processes. Briefly, these future app categories are a) strategic, which are applications that are critical to future business success. Strategic applications create or support a change in the way the hospital conducts its business to provide a competitive advantage; b) Key Operational are applications that sustain the hospital's existing business operations and help avoid losses; c) Support, which can improve business efficiency and management effectiveness, but applications in the Support category do not sustain the core business or provide a competitive advantage; d) High Potential, which can create opportunities for future profits but is not yet proven.

4.1.6 Cost Benefit Analysis Information System (CBA-IS)

The calculations were carried out using several evaluation techniques to determine the software and hardware development feasibility based on CBA. Five economic criteria were calculated: Return on Investment (ROI), Benefit Cost Ratio, Internal Rate of Return, Net Present Value, and Payback Period. They are calculated after identifying investment costs,

operational costs, and operational cost reductions. An example of IS is Payroll identification cases. All identification results are entered into a simple ROI table. The annual calculation of net cash flow was then derived by subtracting the decrease in operational costs from the increase in running costs. Then, the net cash flow per year is added up to obtain the total value of net cash flow in the five years. According to the B/C ratio calculation, the benefit-to-cost ratio value was 1.63. Using the IS, the B/C Ratio Payroll can determine the best option in the development plan, particularly regarding enhancing the margin of benefits to costs, where the benefits exceed the costs (Maravas and Pantouvakis, 2018). This result indicates that the benefits generated are greater than the investment incurred, so this investment is considered feasible based on the B/C Ratio criteria. The NPV of the net benefit is Rp 25,379,850, which is positive because it is more than zero. The second criterion used to choose the ideal alternatives in the feasibility analysis was met by this option. It was considered feasible since the NPV of net benefits was maximized. If the net benefit value exceeds the initial investment, then the investment might be called viable. Researchers get an internal rate of return of 16.72 percent after doing the calculations. Since the accuracy level is more than 4% (the interest rate applicable based on the BI-7 day (reverse) Repo Rate issued by Bank Indonesia), the third criterion used to identify the best solution in the feasibility study, maximizing the IRR, is satisfied or viable. IS Payroll's initial investment value is known to be Rp 40,000,000, and the payback period is estimated to be three years and six months based on the computed value of PP. Given the hospital's economic age of 5 years, this suggests that the return time is faster than the time established by the hospital (Table 4).

TABLE 4/ Justification of Eligibility in Payroll Information Systems

Method	Results	Standard	Information
ROI	39%	ROI > 0%	Feasible
NPV	Rp 25.379.850	NPV > 0	Feasible
IRR	16,72%	DF 4%	Feasible
PP	Three years six months	PP max five years	Feasible
B/C ratio	1,63	B/C ratio > 1	Feasible

Source: Data Processed (2024)

4.1.7 Cost Benefit Analysis Information Technology (CBA-IT)

After identifying investment costs, operational costs, and operational cost reductions and then taking one example of the case of identifying additional servers to optimize the performance of IS applications, all identification results are entered into the simple ROI table. The gap between the decline in operating and total costs is then utilized to determine net cash flow per year. Then, the net cash flow per year is added up to obtain the total value of net cash flow in the five years. One of the criteria in determining the feasibility of software development is choosing an alternative with a greater benefit ratio than the costs or investment incurred. B/C Ratio is the present value of benefits divided by the present value of costs. The benefit ratio can be calculated by dividing benefits' present value by costs' present value. Present value (PV) is the value of future cash flows discounted at the appropriate investment interest rate, commonly called the discount rate. After obtaining the present value of the costs and benefits of the investment, the next step is to calculate the B/C ratio. In this calculation, several values are needed, including the PV value obtained from the division between the PV value of benefits and the PV value of investment costs (Bağdatlı et al., 2017; Kouskoukis & Botsaris, 2017; Yang et al., 2018). Take one example of the case of adding servers to optimize the performance of IS applications; the PV value of the benefits is Rp 1,144,770,474, while for the PV value of the investment cost of Rp 920,000,000, both of which were obtained from previous calculations. Based on the calculation of the B/C ratio, the value of the benefit-to-cost ratio is 1.244315733. Based on the example, adding servers to optimize application performance IS B/C Ratio can be used to determine the best choice in the feasibility study by maximizing the benefit to cost ratio. This result indicates that the benefits generated are greater than the investment incurred, so this investment is considered feasible based on the B/C Ratio criteria. The computation of net present value (NPV) reveals an NPV of Rp.224,770,474 for the net benefits, demonstrating that the NPV is positive and greater than 0. As a result, the second criterion used to pick the optimal alternative in the feasibility

analysis has been met, particularly, that the alternative is feasible since it maximizes the NPV of net benefits. The internal rate of return that is calculated is 9.42%. The third criterion used to select the optimal option in the feasibility study, in this case maximizing the internal rate of return (IRR), has been met or is feasible as the value obtained is higher than 4% (interest rate appears to apply relying on the BI-7 day (reverse) Repo Rate approved by Bank Indonesia). The initial investment value for installing servers is assessed to be Rp 920,000,000, with a payback period of three years and 10 months based on the present value. Given the hospital's economic age of five years, this suggests that the return period is less than the term established by the hospital (Table 5).

TABLE 5 / Justification of Eligibility for Server Additions

Method	Results	Standard	Information
ROI	29%	ROI > 0%	Feasible
NPV	Rp 224.770.474	NPV > 0	Feasible
IRR	9,42%	DF 4%	Feasible
PP	3 years 10 months	PP max 5 years	Feasible
B/C ratio	1,244315733	B/C ratio > 1	Feasible

Source: Data Processed (2024)

4.1.8 Application Portfolio Recommendation Using AHP Method

At this stage, an AHP calculation will be carried out to determine the priority of all applications (Zhou, 2019). The first thing in the AHP calculation is to include all the criteria in the pairwise comparison matrix. There are five criteria that will be included in the pairwise comparisons matrix for the goal. Criterion 1 is ROI, criterion 2 is NPV, criterion 3 is IRR, criterion 4 is B/C Ratio and criterion 5 is PP After compiling the pairwise matrix, then do the synthesis to get the total priority value (TPV). The final stage is to measure consistency using the Consistency Ratio (CR) (Table 6).

TABLE 6 / AHP calculation

	ROI	NPV	IRR	B/C Ratio	PP	Eigen Value					Total	Average	Rating
ROI	1,00	2,00	3,00	0,33	0,50	0,15	0,25	0,38	0,10	0,13	1,00	0,199	3
NPV	0,50	1,00	1,00	0,50	0,50	0,07	0,13	0,13	0,15	0,13	0,60	0,120	5
IRR	0,33	1,00	1,00	0,50	1,00	0,05	0,13	0,13	0,15	0,25	0,70	0,140	4
B/C ratio	3,00	2,00	2,00	1,00	1,00	0,44	0,25	0,25	0,30	0,25	1,49	0,298	1
PP	2,00	2,00	1,00	1,00	1,00	0,29	0,25	0,13	0,30	0,25	1,22	0,244	2
Total	6,83	8,00	8,00	3,33	4,00						1,00		

Source: Data Processed (2024)

The results of the assessment can be accepted if it has a CR < (0.1), whereas from this calculation a consistency ratio (CR) is obtained of 0.09, as a result it can be said that the logical consistency or results of the assessment are acceptable. Then it can be seen from the table 4, the ranking of the criteria for the results of the AHP calculation. The first rank is B/C Ratio, followed by PP, ROI, IRR and the last is NPV. After calculating the AHP of all S.I. portfolio recommendations, they are then sorted by the highest rating as shown in table 7.

TABLE 7 / IS Portofolio Recommendations Based on AHP

No	B/C Ratio	PP	ROI	IRR	NPV	Applications
1	4,18	2 years	96%	60,04%	Rp22.281.699	IS Public Relations
2	4,08	1 year ten months	94%	59,42%	Rp30.750.921	Bridging LIS - PK
3	3,99	Two years	92%	57,93%	Rp29.906.578	IS Equipment

4	3,96	Two years	91%	57,44%	Rp29.625.130	IS Treasurer of Admissions
6	3,82	Two years, one month	88%	54,96%	Rp28.217.891	IS Numbering of Procurement of goods/services

Source: Data Processed (2024)

Formation of the management information system in the next five years is carried out in stages by focusing on improving internal and external services at the hospital:

- a. For the first year, namely in 2022, the hospital has a budgeting plan of IDR 121,000,000 for IS development and IDR 2,420,000,000 for IT procurement. In addition to IS development, supporting factors are needed in terms of IT. The hospital itself needs to replace the network backbone with Fiber Optics, therefore in the first year, the IT budget is used more in changing network infrastructure, adding P.C.s and supporting devices therefore it needs to be accompanied by an increase in competency and the number of human resources in each department related to SIMRS and network.
- b. For the second year, the hospital provided a budget plan of Rp. 133,100,000 for IS development and Rp. 2,662,000,000 for IT procurement. Therefore, regular scheduling is needed to upgrade the SQL database version and upgrade the database server so that application performance becomes more optimal.
- c. For the third year, the hospital gave a budget plan of Rp. 146,410,000 for IS development and Rp 732,050,000 for IT development and procurement. Adding PCs, servers, and network infrastructure changes were focused on in the first and second years. Inventory also needs to be supported by the WMS (Warehouse Management System) system that integrates incoming and outgoing goods, moving between warehouses, storage and picking.
- d. For the fourth year, the hospital provides a budget plan of Rp. 151,340,000 for IS development and Rp. 550,050,000 for IT procurement. In the fourth year, IT needs are focused on maintenance costs for this one year, both computers, networks and other IT operational costs. Then as a form of service provided by the hospital, it is necessary to install additional Wireless LANs in dense user locations.
- e. For the fifth year, the hospital provided a budget plan of Rp. 163,370,000 for IS development and Rp. 330,000,000 for IT procurement. This year, like the fourth year, is more about maintenance costs for this one year, both computers, network and other IT operational costs.

4.2 DISCUSSION

This research bolsters several prior studies that utilized the Ward and Peppard approach in IS/IT strategy development for ISP companies and utilized the Ward and Peppard method (Febriyanti et al., 2019). The research's investigation at Yogyakarta API Polytechnic used of IS/IT strategic planning (Budyanto & Setyohadi, 2017). Then, Hannesto's research used IS/IT strategic planning in a foundation (Hannesto & Surya, 2017). It's just that the advantages of the current research are strategic IS/IT planning that considers financial aspects using the Ward and Peppard method with CBA. Compared to previous research. The management implications of the hospital based on the results of the focus group discussion carried out in the hospital after the process of data analysis and discussion were carried out; this study used the strategic plan for 2019-2023 as one of the guidelines in aligning hospital IS/IT strategic planning.

The strategic plan used as a reference is suitable for implementation in hospitals during conditions before the covid-19 pandemic, whereas in 2020 there was a pandemic which caused the need for adjustments regarding the budget used. In 2022 the budget absorbed in the previous year is returned this year, this causes this year's budget to be bigger than the budget of other years. Not only the budget, the covid19 pandemic has delayed IT work in 2020 until 2022. Therefore, hospitals need additional human resources and competency development in the IT field in 2021 to carry out IS/IT. In addition, not all applications are carried out by the hospital's internal parties, there will be several applications that will be tendered to the relevant vendors (Earl,

2013; Gaol, Rahayu, & Matsuo, 2020; Lestari, Mahardika, Sujana, Adinda, & Lie, 2019). All recommendations were well received by the hospital and used by the hospital to improve public services, optimize the performance of human resources, and maximize business operational activities in the hospital.

5. CONCLUSION

In the study conducted at Muhammadiyah Hospital in Sidoarjo, the primary objective was to delineate the long-term goals of the hospital's Information Systems/Information Technology (IS/IT) strategy and to identify priority alternatives. The analysis positioned Muhammadiyah Hospital in the first quadrant, specifically at coordinates (3.039, 1.960), indicating a Strength-Opportunity (SO) strategic focus. This positioning necessitates leveraging inherent strengths to capitalize on external opportunities, enhancing service quality, and fostering collaborations to increase market share. At the heart of this strategic orientation is the advancement of IS/IT, advocating for adopting an integrated system equipped with advanced technology. The study revealed 32 strategic initiatives, comprising 25 innovative applications and seven significant updates, all designed to enhance competitiveness and achieve excellence. These initiatives are pivotal in transforming the hospital's strategic trajectory, intertwining its strengths with potential opportunities through these IS/IT endeavors. The study emphasizes the critical role of a robust IS/IT strategy in advancing Muhammadiyah Hospital towards its long-term goals, highlighting a strategic pathway that is both innovative and responsive to the dynamic healthcare landscape. Thus, the research substantiates the essential integration of IS/IT strategic planning in sustaining competitive advantage and pursuing operational excellence in the healthcare sector.

6. LIMITATION AND IMPLICATION

While comprehensive, the study on the IS/IT strategy at Muhammadiyah Hospital presents certain limitations that necessitate careful consideration in future research. Firstly, the scope of data may be restricted, potentially overlooking diverse IS/IT scenarios, which could affect the depth of strategic recommendations. Secondly, the fast-paced technological evolution could outdate the study's findings, limiting their long-term applicability. Additionally, the recommendations may not fully account for the hospital's resource constraints, including budget, staff capabilities, and infrastructure management, which are crucial for practical implementation. Moreover, external factors like regulatory changes, market dynamics, and economic conditions, which significantly impact the hospital's ability to execute the IS/IT strategy, might not have been fully integrated into the analysis. The stakeholder engagement level could also limit the strategy's alignment with actual needs and expectations. Methodologically, the reliance on Cost-Benefit Analysis (CBA) and the Analytical Hierarchy Process (AHP) could introduce biases or oversimplify complex decisions. The study's focus on planning and strategy formulation might overshadow the intricacies of strategy implementation and change management.

For future research, exploring alternative strategic planning frameworks such as The Open Group Architecture Framework (TOGAF), James Martin's Information Engineering (IE), Steven H. Spewak's Enterprise Architecture Planning, or the Zachman Framework could provide more diversified insights. A thorough analysis of the Cost-Benefit Ratio, alongside advanced decision support technologies like the Analytic Network Process (ANP), would enhance the strategic decision-making process. A deeper understanding of the complexities involved in IS/IT case studies is crucial before implementing methodologies like ANP. Addressing these limitations will contribute to a more robust and dynamic IS/IT strategic planning process capable of adapting to the evolving landscape of healthcare technology and organizational needs.

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REFERENCES

- Abusalma, A. (2021). Strategic agility and its impact on competitive capabilities in healthcare industry. *Management Science Letters, 11*(9), 2371–2376. <https://doi.org/10.5267/j.msl.2021.5.004>
- Agwunobi, A., & Osborne, P. (2016). Dynamic Capabilities and Healthcare: A Framework for Enhancing the Competitive Advantage of Hospitals. *California Management Review, 58*(4), 141–161. <https://doi.org/10.1525/cm.2016.58.4.141>
- AlKhaldi, M., Kaloti, R., Shella, D., Al Basuoni, A., & Meghari, H. (2020). Health system's response to the COVID-19 pandemic in conflict settings: Policy reflections from Palestine. *Global Public Health, 15*(8), 1244–1256. <https://doi.org/10.1080/17441692.2020.1781914>
- Ambarwati, R., Lieharyni, D. C. U., & Multazam, M. T. (2020). Transparency principle of GUG for audit it in higher education. *Talent Development and Excellence, 12*.
- Bağdatlı, M. E. C., Akbıyıklı, R., & Papageorgiou, E. I. (2017). A Fuzzy Cognitive Map Approach Applied in Cost–Benefit Analysis for Highway Projects. *International Journal of Fuzzy Systems, 19*(5), 1512–1527. <https://doi.org/10.1007/s40815-016-0252-3>
- Budiyanto, D., & Setyohadi, D. B. (2017). Strategic information system plan for the implementation of information technology at Polytechnic “API” Yogyakarta. In *5th International Conference on Cyber and IT Service Management (CITSM)* (pp. 1–6). IEEE. <https://doi.org/10.1109/citsm.2017.8089267>
- Carvalho, J. V., Rocha, Á., Vasconcelos, J., & Abreu, A. (2019). A health data analytics maturity model for hospitals information systems. *International Journal of Information Management, 46*, 278–285. <https://doi.org/10.1016/j.ijinfomgt.2018.07.001>
- Douglas, T. J., & Ryman, J. A. (2003). Understanding competitive advantage in the general hospital industry: evaluating strategic competencies. *Strategic Management Journal, 24*(4), 333–347. <https://doi.org/10.1002/smj.301>
- Earl, M. J. (2013). Approaches to Information Systems Planning Experiences in strategic information systems planning. In *Strategic Information Management* (pp. 195–229). Routledge. <https://doi.org/10.4324/9780080481135-15>
- Elrod, J. K., & Fortenberry, J. L. (2018). Catalyzing marketing innovation and competitive advantage in the healthcare industry: the value of thinking like an outsider. *BMC Health Services Research, 18*(S3). <https://doi.org/10.1186/s12913-018-3682-9>
- Febriyanti, K. D., Samopa, F., & Ambarwati, R. (2019). Strategic Planning for IS/IT of XYZ Internet Service Provider Using Ward and Peppard Method. *IPTEK Journal of Proceedings Series, 0*(5), 473–479. <https://doi.org/10.12962/j23546026.y2019i5.6407>
- Gaol, F. L., Rahayu, S., & Matsuo, T. (2020). The Development of Information System with Strategic Planning for Integrated System in the Indonesian Pharmaceutical Company. *Open Engineering, 10*(1), 721–732. <https://doi.org/10.1515/eng-2020-0081>
- Girinata, I. M. C., & Suryani, E. (2019). Strategic Planning for Systems & Information Technology of XYZ Hospital Using Ward and Peppard Method. *IPTEK Journal of Proceedings Series, 0*(5), 452. <https://doi.org/10.12962/j23546026.y2019i5.6392>
- Gonzalez, M. E. (2019). Improving customer satisfaction of a healthcare facility: reading the customers' needs. *Benchmarking: An International Journal, 26*(3), 854–870. <https://doi.org/10.1108/bij-01-2017-0007>
- Hannesto, R., & Surya, M. M. (2017). Information system strategic planning in XYZ foundation at learning and development division. In *International Conference on Information Management and Technology (ICIMTech)* (pp. 31–34). IEEE. <https://doi.org/10.1109/icimtech.2017.8273506>
- Ismanto, M. A., Harisno, Kusumawardhana, V. H., & Warnars, H. L. H. S. (2018). Strategic Planning Of Information Systems And Information Technology At Agricultural Research And Development Agency, Ministry Of Agriculture. In *Indonesian Association for Pattern Recognition International Conference (INAPR)* (pp. 267–273). IEEE. <https://doi.org/10.1109/inapr.2018.8627011>
- Keesara, S., Jonas, A., & Schulman, K. (2020). Covid-19 and Health Care's Digital Revolution. *New England Journal of*

- Medicine*, 382(23), e82. <https://doi.org/10.1056/nejmp2005835>
- Kodama, M. (2021). Sustainable growth through IT-enabled dynamic capabilities. *Managing IT for Innovation*. Routledge. <https://doi.org/10.4324/9781003027997-9>
- Kouskoukis, M.-N., & Botsaris, C. (2017). Cost-Benefit Analysis of Telemedicine Systems/Units in Greek Remote Areas. *PharmacoEconomics - Open*, 1(2), 117–121. <https://doi.org/10.1007/s41669-016-0006-z>
- Lestari, N. S., Mahardika, A. G., Sujana, A., Adinda, N. R., & Lie, I. D. (2019). Strategic Planning Information System Using Ward and Peppard Method with Anita Cassidy Method. *INTENSIF*, 4(2), 12024. <https://doi.org/10.1088/1742-6596/1424/1/012024>
- Lv, Z., & Qiao, L. (2020). Analysis of healthcare big data. *Future Generation Computer Systems*, 109, 103–110. <https://doi.org/10.1016/j.future.2020.03.039>
- Nabelsi, V., & Gagnon, S. (2016). Information technology strategy for a patient-oriented, lean, and agile integration of hospital pharmacy and medical equipment supply chains. *International Journal of Production Research*, 55(14), 3929–3945. <https://doi.org/10.1080/00207543.2016.1218082>
- Rehman, A., Naz, S., & Razzak, I. (2021). Leveraging big data analytics in healthcare enhancement: trends, challenges and opportunities. *Multimedia Systems*, 28(4), 1339–1371. <https://doi.org/10.1007/s00530-020-00736-8>
- Shao, Z. (2019). Interaction effect of strategic leadership behaviors and organizational culture on IS-Business strategic alignment and Enterprise Systems assimilation. *International Journal of Information Management*, 44, 96–108. <https://doi.org/10.1016/j.ijinfomgt.2018.09.010>
- Sigit Gunanto, Nisar, & Irianto, S. Y. (2019). Penyusunan Rencana Strategis Sistem Informasi Dan Teknologi Informasi (Si/Ti) Organisasi Bisnis Stkip Muhammadiyah Kotabumi Menggunakan Ward Peppard. *Jurnal Informatika*, 19(2), 109–115.
- Sousa, M. J., Pesqueira, A. M., Lemos, C., Sousa, M., & Rocha, Á. (2019). Decision-Making based on Big Data Analytics for People Management in Healthcare Organizations. *Journal of Medical Systems*, 43(9). <https://doi.org/10.1007/s10916-019-1419-x>
- Tallon, P. P., Queiroz, M., Coltman, T., & Sharma, R. (2019). Information technology and the search for organizational agility: A systematic review with future research possibilities. *The Journal of Strategic Information Systems*, 28(2), 218–237. <https://doi.org/10.1016/j.jsis.2018.12.002>
- Yang, S., Zhu, X., & Guo, W. (2018). Cost-Benefit Analysis for the Concentrated Solar Power in China. *Journal of Electrical and Computer Engineering*, 2018, 1–11. <https://doi.org/10.1155/2018/4063691>

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