

Analysis of Hospital management information systems using cobit 5 framework case study "Saraswati Dental and Oral Hospital in Denpasar"

I Putu Agus Raditya Pramita ^{a,1,*}, Gede Indrawan ^{a,2}, Komang Setemen ^{a,3}

^a Universitas Pendidikan Ganesha, Jalan Udayana No.11, Singaraja, 81116, Indonesia

¹ agus.raditya@student.undiksha.ac.id; ² gindrawan@undiksha.ac.id; ³ k.setemen@undiksha.ac.id

* corresponding author

ARTICLE INFO

Article history

Received July 18, 2023

Revised July 30, 2023

Accepted November 4, 2023

Keywords

System

Hospital

COBIT 5

Evaluation

ABSTRACT

A hospital's operations, such as patient registration, medical management, financial management, and upgrading the services offered in the hospital, are managed and organized using an application system called a hospital management information system (HMIS). Because the lack of evaluation in the usage of HMIS has led to insufficient security in the HMIS, this research focuses on Saraswati Dental and Oral Hospital as the research site. Due to lax security measures, confidential data is readily accessible. The prevalence of duplicate data entry is an issue, and the success of HMIS performance implementation is still unknown. The COBIT 5 framework has been used to administer the HMIS at Saraswati Dental and Oral Hospital using the MEA (Monitor, Evaluate, Assess) and BAI (Build, Acquire, Implement) domains in response to these problems. This decision was made with the intention of aligning the application with the necessary features, monitoring system security, evaluating, and assessing the domain's alignment with the hospital's strategy in order to ascertain whether the current system still achieves the intended goals and maintains the controls required to satisfy the requirements. This study makes use of questionnaire, observation, and interview techniques. The capacity levels used in the COBIT 5 study were taken from ISO/IEC 15504-2-2003, and they were combined using straightforward mathematical calculations in accordance with the rules for computing capability values. Weaknesses or flaws in the security system that need to be fixed can be found by analyzing the capability levels in the MEA and BAI domains. The study's findings include suggestions for increasing the security system, which will enhance Saraswati Dental and Oral Hospital's HMIS performance and give users and patients with more beneficial outcomes.

This is an open access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



1. Introduction

Modern society's almost every facet is now reliant on advanced information technology (IT). Healthcare is one industry that makes extensive use of IT, with hospitals acting as the primary community healthcare providers [1], [2]. The way healthcare services are provided has changed significantly as a result of the adoption of information technology, particularly through the use of hospital management information systems (HMIS) [3], [4]. Effective information system management is essential to achieving this [5], [6]. Every hospital is required by Republic of Indonesia Law Article 52 Paragraph 1 to record and report all hospital management activities using an HMIS [7]–[9]. The Saraswati Dental and Oral Hospital in Denpasar is one location where HMIS has been successfully implemented. This hospital offers convenient and effective healthcare services by making effective use of information technology. The HMIS at Saraswati Dental and Oral Hospital has a number of

capabilities, including staff management, patient registration, pharmacy billing integration, inpatient and outpatient treatment, medical records, and patient billing.

HMIS use is not always seamless, despite multiple IT implementations. For HMIS, a lack of system security and service evaluation has resulted in a number of concerns, including login security issues, duplicate data entry, and inadequate error handling. Although open-SourceHMIS applications have been made available by the Ministry of Health, they fall short of Saraswati Dental and Oral Hospital's standards. To ensure that HMIS operates successfully in accordance with the needs of the hospital, researchers are looking for the best option. They've selected the COBIT 5 framework, a tried-and-true set of best practices for IT management and governance [10], [11]. In order to find flaws in the HMIS security system, researchers are concentrating on the MEA (Monitoring, Evaluate, and Assess) and BAI (Build, Acquire, and Implement) domains [12]–[14]. The aim is to prevent unauthorized users from accessing or abusing sensitive data, such as patient, employee, and HR data.

Security is a key component of HMIS, particularly in protecting the private information of Saraswati Dental and Oral Hospital, which must not be made available to unauthorized parties. Sensitive data security can be anticipated with the help of a framework that can map future security-related incidents using information [15], [16]. A methodology called COBIT 5 has been used by numerous industries to improve IT governance [17], [18]. The COBIT 5 framework includes a number of IT management best practices, and earlier studies have used it to assess healthcare information systems. The use of this framework and the context of evaluating HMIS led researchers to choose COBIT 5 as their primary reference. This study will significantly improve the administration of healthcare information systems, especially in terms of data security and enhanced community services.

The domains MEA01, MEA02, BAI01, BAI02, and BAI03 were selected by the researchers because, within the COBIT 5 framework, they provide tools for identifying flaws and defects in the HMIS at Saraswati Dental and Oral Hospital. MEA01 includes tracking and assessing the HMIS's effectiveness and the degree to which the system achieves its goals. MEA02 entails determining whether the internal controls in place are sufficient to safeguard sensitive information, deal with errors, and thwart unauthorized access. Finding project management flaws including delays and budget overruns is covered in BAI01. The purpose of BAI03 is to determine whether the system architecture supports the best possible integration with other systems and is in alignment with the requirements of Saraswati Dental and Oral Hospital. BAI06 aids in determining whether HMIS changes, including handling of emergency changes and routine maintenance, are properly managed [14], [19].

2. Method

The researchers used a case-only study design and a quantitative research method with a descriptive approach. The data processing comprising numerical replies from the questionnaire to evaluate the alignment of Saraswati Dental and Oral Hospital's strategic objectives with business goals in accordance with COBIT 5 [3] is a good example of the quantitative part of this research. The descriptive technique in this study tries to describe or explain existing phenomena using numerical data. In this example, the maturity level of the COBIT-5-based HMIS IT processes is described using a current-state and target-state analysis [19], [20].

2.1. Research Flow

At Saraswati Dental and Oral Hospital, the researchers gathered data through interviews, questionnaires, observations, and documentation to support their research. Fig. 1 below shows the research flowchart.

- First Review Of The Literature

The first step in this research process entails performing a literature review to find information on the COBIT 5 framework and to pinpoint pertinent problems associated with the study's subject. The sources of information are books, scholarly publications, journals, and the internet [21].

- Initial Study

The second step entails a preliminary investigation that includes watching and closely investigating the environment that serves as the study's subject [21].

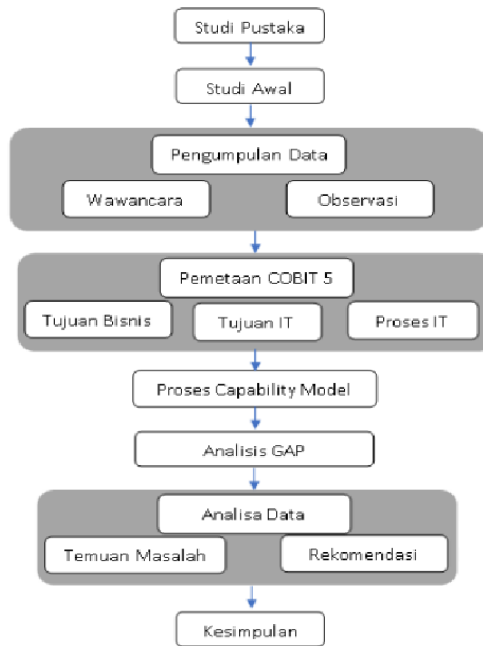


Fig. 1. Research Flow

2.2. Data Gathering Methods

The following techniques are used by the researcher to gather data at this stage :

- Both organized and unstructured interviews were undertaken by the researcher. We utilized structured interviews to evaluate how well the company's goals and the IT goals lined up. Unstructured interviews, on the other hand, took a more free-form approach without formal interview standards. The researcher talked about general HMIS strategies including system usage and security. An overview of the interview questions is provided below, as per Table 1 of the interview rules [21].

Table.1 Interview Rules

No	Question
<i>Interview with the Saraswati Dental and Oral Hospital's Director</i>	
1	The following describes the Saraswati Dental and Oral Hospital's organizational structure?
2	Who would be in charge of managing the Saraswati Dental and Oral Hospital's system?
3	Which department's employees are in charge of running the HMIS at Saraswati Dental and Oral Hospital?
4	Which department's employees are in charge of running the HMIS at Saraswati Dental and Oral Hospital?
5	Do these systems all have distinct purposes?
6	What does the procedure look like at Saraswati Dental and Oral Hospital?
7	Was there a lot of use and security issues with the prior system in use?
8	According to the director, what kind of system is required by Saraswati Dental and Oral Hospital?
<i>Interviews with medical professionals, nurses, administrators, cashiers, and IT staff</i>	
1	What does the procedure look like at Saraswati Dental and Oral Hospital?
2	Did the formerly used system encounter numerous difficulties with regard to system usage and security?
3	What kind of system, in your opinion, is required by Saraswati Dental and Oral Hospital?
4	Is the system in use right now operating efficiently?
5	What are the projections for the system's growth at Saraswati Dental and Oral Hospital in the future?
6	Are you happy with the system as it is now?

- This study tool's questionnaire seeks to collect data and identify issues that already exist. This is done in order for the researcher to get pertinent data, and the sort of questionnaire employed is closed-ended, allowing respondents to only respond to the items that are included in the provided questionnaire. The MEA and BAI domains of COBIT 5, which are the subject of this study, are used to structure the questionnaire. On the basis of the Process Assessment Model (PAM) in COBIT 5 [19], respondents respond to the questionnaire.
- Observations were made by the researcher at Saraswati Dental and Oral Hospital with the goal of discovering and compiling diverse data. Direct observation of the hospital's use of the security system served as the method for gathering data. The rules that the researcher adhered to while conducting the observation method are listed in [Table 2](#).

Table.2 Observational Instructions

No	Success Indicators
1	The Saraswati Dental and Oral Hospital's Organizational Structure
2	The Saraswati Dental and Oral Hospital's objectives, vision, and mission
3	Saraswati Dental and Oral Hospital's HMIS (Hospital Management Information System)
4	Saraswati Dental and Oral Hospital's HMIS Management
5	Saraswati Dental and Oral Hospital's HMIS Services

- Preserving proof of the research carried out at Saraswati Dental and Oral Hospital, including images, documents, permissions, and the essential information

2.3. Processing of Data

It is simpler to convey the research findings because COBIT 5 uses both graphical and numerical formats to represent the assessment of capability levels. Following processes, such as analysis, prioritization, and suggestions for improvement, can be built on this data. The evaluation procedure additionally uses five indicators that were adopted from ISO/IEC 15504-2-2003. For the COBIT 5 assessment, see [Table 3](#) [22].

Table.3 COBIT 5 Assessment

Rating	Description	Percentage	Information
N	Not Achieved	0-15%	There is little or no evidence of achievement of these process attributes.
P	Partially Achieved	>15-50%	There is reported evidence of the approach and some conversations attribute to the process.
L	Largely Achieved	>50-85%	There is proof of a methodical approach and major process accomplishment, while there may still be minor flaws.
F	Fully Achieved	>85-100%	There is proof of a methodical and thorough approach, total accomplishment of the process attribute, and absence of any process attribute related deficiencies.

^a (Source: A Business Framework for the Governance and Management of Enterprise IT, ISACA 2012) [23]

In order for a process to be categorized as reaching the process capability level, it must be able to achieve an L Rating where 51-85% of eligibility is achieved. Meanwhile, in order for a process to continue to the next level, the process must be able to achieve an F Rating where 86-100% of the requirements are achieved. This is because the assessment begins by looking at whether the process has been executed and is at scale [24], [25]. In accordance with [Table 4](#) mapping attributes to capability levels [14].

Table.4 Attribute Mapping to Capability Levels

Capability Level	Capability Dimension
Incomplete Proses Level 0	This level has evidence if the process of achieving each target is less than optimal or fails.
Performed Proses Level 1	At this level, there are processes that have been carried out in accordance with good procedures.
Manage Proses Level 2	This level has been implemented with planning, monitoring and adjustment.
Established Proses Level 3	This level of process that has been achieved Manage Process is well implemented and measured regularly to ensure that the processes that are run can produce consistent and measurable.
Predictable Proses Level 4	This level of process defined at the Established Process level can be operated in a controlled and consistent manner within established limits.
Optimizing Proses Level 5	This level allows companies to continuously improve process performance and effectiveness by introducing the latest innovations and technologies in order to take advantage of new opportunities quickly and effectively.

^b (Source: COBIT® 5 Supplementary Guide for the COBIT 5 Process Assessment Model (PAM), ISACA 2012)

The calculation steps were carried out to obtain the results of the Hospital Management Information System (HMIS) Analysis at Saraswati Dental and Oral Hospital [26].

The formula for the first stage of the process is to conduct a respondent assessment :

$$\frac{\sum \text{Top Respondents} - \sum \text{Smallest Respondents}}{\sum \text{Number of Question}} \tag{1}$$

The formula for the second stage of the process is to calculate the capability value :

$$\text{Index Value} = \frac{\sum \text{Respondent Score}}{\sum \text{Question Value}} \tag{2}$$

The formula for the first stage of the process is to conduct a respondent assessment :

$$\text{GAP Value} = \sum \text{Indeks} - \sum \text{Target} \tag{3}$$

2.4. COBIT 5

Control Objective for Information & Related Technology 5 (COBIT) is an Information Technology (IT) governance standard developed by the IT Governance Institute (ITGI), an organization formed by ISACA that conducts studies on IT governance models based in the United States [13], [17], [18]. One of the principles in COBIT 5 is the division between governance and management processes. The following domain division is shown in Fig. 2 below.

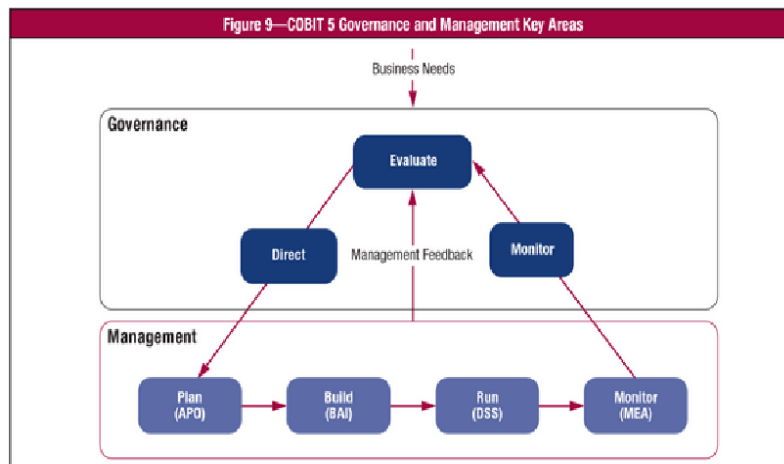


Fig. 2. Domain of Governance and Management Process

2.5. Research Instruments

To get the data needed in this study, the researchers made a questionnaire. The questions created in the questionnaire were developed from the COBIT 5 Framework. In this study, the Capability Level questionnaire with the following explanation [20].

- Questionnaire Capability Level

The question objects on the Capability Level were developed from the description of the COBIT 5 Framework maturity level model in the AEC domain and BAI domain processes. Each question given by the activity contained in COBIT 5 is made into a question to find out the condition of the HMIS to achieve the desired to be with YES or NO answer choices with a value of 1 (YES) and 0 (NO) using the Guttman Scale [12], [21].

- Purposive Sampling

In the Purpose Sampling technique for the MEA domain process and the BAI domain is determined and adjusted using the RACI diagram found in the COBIT 5 Framework [13], [22]. This stage will explain the process of making MEA domain and BAI domain questionnaires and calculating these questionnaires using the Guttman Scale calculation.

3. Results and Discussion

3.1. Results of IT Related Goals HMIS Analysis at Saraswati Dental and Oral Hospital

After knowing IT-related goals, the next step is to carry out business goals with IT goals by doing a mapping or mapping. The purpose of mapping or mapping aims to get processes on business goals with IT objectives using the COBIT 5 Framework as Table 5 below.

Table.5 IT Related Goals Results

IT BSC Dimensions	IT Related Goals
	1 IT and business strategy alignment
	2 Using IT to compliance with external rules and regulations and support company compliance
<i>Financial</i>	3 Administration's dedication when deciding on IT-related matters
	4 Business IT-related risk management managed
	5 Benefits realized from IT-based investments and service portfolios
	6 IT cost, benefit, and risk transparency
<i>Costumer</i>	7 IT service delivery in line with business needs
	8 Adequate use of applications, information and technological solutions.
	9 IT Conformity.
	10 Information security, processing infrastructure, and applications.
	11 Optimization of IT assets, resources, and capabilities.
<i>Internal</i>	12 Empowerment and support of business processes through the integration of applications and technology into business processes.
	13 Delivering programs that are beneficial, on schedule, within budget, and up to quality standards.
	14 Information that is trustworthy and helpful for making decisions is available.
	15 IT adherence to internal regulations.
<i>Learning and Growth</i>	16 IT and business personnel who are competent and driven.
	17 Initiatives, knowledge, and skills for corporate innovation.

^c (Source: A Business Framework for the Governance and Management of Enterprise IT, ISACA 2012)

3.2. COBIT 5 Sub Domain Process Results selected

The result of this stage is to determine the sub domain used for HMIS Analysis at Saraswati Dental and Oral Hospital by going through the cascading stage process to obtain the appropriate sub domain. Here are the results from Table 6, namely the COBIT 5 subdomain.

Table.6 COBIT 5 Sub Domains

No	IT Related Goals	Sub Domain Process
1	IT and business strategy alignment	MEA01
3	Using IT to compliance with external rules and regulations and support company compliance	MEA02
4	Administration's dedication when deciding on IT related matters	MEA01
5	Business IT-related risk management managed	BAI01, BAI02, BAI06
6	Benefits realized from IT-based investments and service portfolios	BAI01, BAI02, BAI06
7	IT cost, benefit, and risk transparency	BAI02
8	Adequate use of applications, information and technological solutions	BAI02
9	IT Compliance	BAI01
10	Information security, processing infrastructure, and applications	BAI02, BAI03
13	Delivery of programs that deliver benefits, are on time, within budget, and meet quality requirements and standards	BAI01, MEA01
15	IT adherence to internal regulations.	MEA02
16	IT and business personnel who are competent and driven.	MEA01, MEA02
17	Initiatives, knowledge, and skills for corporate innovation.	MEA01, MEA02

^d (Source: A Business Framework for the Governance and Management of Enterprise IT, ISACA 2012)

3.3. Results of COBIT 5 Process HMIS Analysis at Saraswati Dental and Oral Hospital

In COBIT 5 this stage, the results are mapped through a cascading process to obtain domain results that are in accordance with the HMIS safety analysis at Saraswati Dental and Oral Hospital. Relevant and appropriate processes are those with clear IT objectives with the COBIT 5 process. Researchers use the MEA (Monitor, Evaluate, and Assess) and BAI (Build Acquire and Implement) domains as a reference to evaluate HMIS that have been made. Here are the results of the IT objectives process in [Table 7](#).

Table.7 IT Process Objectives

No	Domain COBIT 5	Information
BAI (Build, Acquire, Implement)		
1	Manage Programmers and Project (BAI01)	Manage all programmes and projects of the investment portfolio in line with the company's strategy. Initiating, planning, controlling and executing programmes and projects.
2	Manage Solutions Identification and Build (BAI03)	Establish and maintain solutions that have been identified according to hospital needs, including design, development, and procurement/resources.
3	Manage Changes (BAI06)	Manage all changes in a controlled manner, including standard changes and emergency maintenance related to business processes, applications, and infrastructure. This includes change standards and procedures, impact assessment, emergency change prioritization and authorization, tracking, reporting, closure and documentation.
MEA (Monitor, Evaluate, Assess)		
4	Monitor, Evaluate, and Assess Performance and Conformance (MEA01)	Collect, validate, and evaluate business, IT, and related process objectives. Monitor whether processes are achieving agreed performance and conformity objectives, and provide systematic and timely reporting.
5	Monitor, Evaluate and Assess the System of Internal Control (MEA02)	Continuously monitor and evaluate the control environment, including self-assessment and independent assurance reviews. Enable management to identify control deficiencies and inefficiencies and initiate corrective actions.

^e (Source: A Business Framework for the Governance and Management of Enterprise IT, ISACA 2012)

3.4. Data Collection

The researcher used questionnaires to collect respondent data, with questions structured based on the MEA and BAI domains for evaluating the HMIS in a mapping phase. Respondents who filled out the questionnaire included all employees who manage and operate the HMIS at Saraswati Dental and Oral Hospital. Sample selection was done using the Purposive Sampling technique to obtain respondent samples determined by the researcher using the RACI diagram found in the COBIT 5 Framework [27].

3.5. Calculating Capability Level

As shown in the table below, the data analysis performed on the questionnaire will be processed along with the calculation outcomes of the MEA01, MEA02, BAI01, BAI03, and BAI06 processes. Calculating shoa as Table 8 – Table 12.

Table.8 The output from the MEA01 process calculation

Process Activities	Criteria Yes/No	Activity Description	Capability Level
MEA01. 1	Yes	Can you get timely performance reporting from the HMIS?	4
MEA02. 2	Yes	The Saraswati Dental and Oral Hospital IT team continuously monitors the HMIS?	4
MEA03. 3	Yes	Has the IT staff periodically reviewed the HMIS to make sure no crucial components are missing?	4
MEA04. 4	Yes	Have the Saraswati Dental and Oral Hospital's stakeholders approved the HMIS's goals?	4
Average			4

Table.9 The output from the MEA02 process calculation

Process Activities	Criteria Yes/No	Activity Description	Capability Level
MEA02. 1	Yes	The internal control team monitors and assesses the HMIS, right?	4
MEA02. 2	Yes	Has the HMIS been assessed in the event that any necessary characteristics are not present?	4
MEA02. 3	Yes	Has the HMIS ever experienced a security compromise that allowed data to leak?	4
MEA02. 4	Yes	Do the employees of Saraswati Dental and Oral Hospital often inspect the HMIS?	4
Average			4

Table.10 The output from the BAI01 process calculation

Process Activities	Criteria Yes/No	Activity Description	Capability Level
BAI01. 1	Yes	Are the HMIS's features compatible with Saraswati Dental and Oral Hospital's requirements?	5
BAI01. 2	Yes	Is the HMIS deemed appropriate and in line with Saraswati Dental and Oral Hospital's objectives?	5
BAI01. 3	Yes	Does the HMIS have the ability to help Saraswati Dental and Oral Hospital achieve the desired results?	5
BAI01. 4	Yes	Do you have enough resources to run the HMIS safely?	5
Average			5

Table.11 The output from the BAI03 process calculation

Process Activities	Criteria Yes/No	Activity Description	Capability Level
BAI03. 1	Yes	Does the HMIS's user interface design suit Saraswati Dental and Oral Hospital's needs? Can it completely eliminate all hazards of operational delays?	5
BAI03. 2	Yes	Is the HMIS outfitted with adequate controls, strong security, and compliance with corporate standarts?	5
BAI03. 3	Yes	Has the HMIS undergone successful testing and is its quality acceptable?	5
BAI03. 4	Yes	Is the HMIS interface easy to use, and are the features' functions clear to understand?	5
BAI03. 5	Yes	Does the HMIS's data security meet the criteria of Saraswati Dental and Oral Hospital?	5
Average			5

Table.12 The output from the BAI06 process calculation

Process Activities	Criteria Yes/No	Activity Description	Capability Level
BAI06. 1	Yes	Do the effects of modifications to the HMIS, especially those to its features, correspond to the desired results?	5
BAI06. 2	Yes	Is the HMIS's data security system regarded as effective?	5
BAI06. 3	Yes	Did the HMIS's development make use of cutting-edge technology?	5
BAI06. 4	Yes	Has there been any component procurement that takes into account the HMIS's ability to expand its capacity, reduce costs, and improve security?	5
BAI06. 5	Ya	Is there a security tracking and reporting system for all change requests in the most recent HMIS?	5
Average			5

3.6. Gap Analysis

The competence level or percentage level of the HMIS procedures at Saraswati Dental and Oral Hospital is determined by the researcher using figures and values from level 0 to level 5. The existing condition (As Is) and the anticipated target state (To Be) are compared using gap analysis calculations to see if they match up with expectations. The analysis of the HMIS at Saraswati Dental and Oral Hospital produced the results listed below, which are depicted in Table 13 [20], [28] and COBIT 5 capability level graph results show as Fig. 3.

Table.13 COBIT 5 Capability Levels using GAP Analysis

No	Sub Domain COBIT 5	Capability Level		GAP
		As Is	To Be	
1	MEA01	4	5	1
2	MEA02	4	5	1
3	BAI01	5	5	0
4	BAI03	5	5	0
5	BAI06	5	5	0

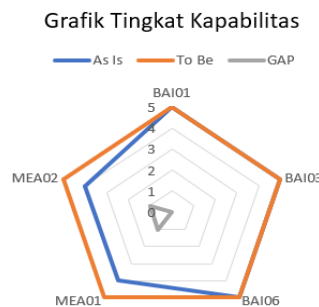


Fig. 3. COBIT 5 Capability Level Graph Results

3.7. Improvement Recommendations

The results of the HMIS analysis at Saraswati Dental and Oral Hospital are used as recommendations for other Dental and Oral Hospitals to be used properly. The results of research conducted by researchers on BAI01 obtained a value with a capability level of 5 which in this Manage Programmers and Project and is at the Optimizing stage. At this level, Saraswati Dental and Oral Hospital can already use the latest features on HMIS to make it easier for users to use the HMIS. The results of research conducted by researchers on BAI03 obtained a value with a capability level of level 5 which in this Manage Solutions Identification and Build is at the Optimization stage. At this level, Saraswati Dental and Oral Hospital has managed solutions for the creation of HMIS by identifying the latest features. The results of research conducted by researchers on BAI06 obtained a value with a capability level of level 5 which in this Manage Changes and is at the Optimization stage. This level Saraswati Dental and Oral Hospital has replaced features that previously did not work, and has adjusted the latest and easy-to-understand appearance. The results of research conducted by researchers on MEA01 obtained a value with a capability level of level 4 which in this case is Monitor, Evaluate, and Assess Performance and Conformance and is at the Predictable stage. At this level, Saraswati Dental and Oral Hospital has validated and tested each document that complies with the SOP standards of Saraswati Dental and Oral Hospital. The results of research conducted by researchers on MEA02 obtained a value with a capability level of level 4 which in this case is Monitor, Evaluate, and Assess The System of Internal Control and is at the Predictable stage. At this level, Saraswati Dental and Oral Hospital monitors HMIS and evaluates whether HMIS is running well or not. However, there is still something missing in the fact that each user complaint has not been handled or processed quickly for improvement to minimize the risk of duplicate data.

Researchers provide recommendations for improvements to the MEA01 subdomain and MEA02 subdomain because they are still at level 4 which should be targeted at level 5. Here are the improvement recommendations:

- MEA01 subdomain improvement recommendations
 - It is necessary to supervise HMIS so that it runs well
- MEA02 subdomain improvement recommendations
 - The repair process is still not fast when there is an error in the HMIS

4. Conclusion

In this study, researchers have determined the value of the level of HMIS Analysis capability at Saraswati Dental and Oral Hospital using the COBIT 5 Framework. The Dental and Oral Hospital can align IT Goal Governance with goals and strategies to achieve better HMIS and can benefit users.

The results of the study through questionnaire assessment showed that the current level of capability (As Is) with the BAI domain (Build, Acquire, Implement) in the BAI01 subdomain was at level 5 capability, the BAI03 subdomain was at level 5 capability, the BAI06 subdomain was at level 5 capability showed, that it can continuously improve process performance and effectiveness by introducing innovations and features latest in HMIS at Saraswati Dental and Oral Hospital. In the MEA domain (Monitor, Evaluate, Assess) the MEA01 subdomain is at level 4 capability level, and the MEA02 subdomain is at level 4 capability level shows, that it has been running by the HMIS SOP standards at Saraswati Dental and Oral Hospital by evaluating HMIS, monitoring supervision of HMIS, but in improvement there is still no quick action in its completion.

The implementation of HMIS at Saraswati Dental and Oral Hospital has been carried out quite well but still needs to be improved in the MEA01 subdomain, and the MEA02 subdomain with level 4 results to achieve the desired Capability Level target. The results of the gap analysis that have been obtained should be used as a reference and preparation of improvement recommendations in HMIS at Saraswati Dental and Oral Hospital, especially in the MEA01 subdomain, and MEA02 subdomain.

Acknowledgment

This research is supported by the Indonesian Ministry of Education, Culture, Research, and Technology through a research grant in the area of ICT for OSS-based system/platform development.

References

- [1] K. Abouelmehdi, A. Beni-Hessane, and H. Khaloufi, "Big healthcare data: preserving security and privacy," *J. Big Data*, vol. 5, no. 1, p. 1, Dec. 2018, doi: [10.1186/s40537-017-0110-7](https://doi.org/10.1186/s40537-017-0110-7).
- [2] K. Abouelmehdi, A. Beni-Hessane, H. Khaloufi, and M. Saadi, "Big data security and privacy in healthcare: A Review," *Procedia Comput. Sci.*, vol. 113, pp. 73–80, Jan. 2017, doi: [10.1016/j.procs.2017.08.292](https://doi.org/10.1016/j.procs.2017.08.292).
- [3] L. Arora and F. Ikbal, "Experiences of implementing hospital management information system (HMIS) at a tertiary care hospital, India," *Vilakshan - XIMB J. Manag.*, vol. 20, no. 1, pp. 59–81, Feb. 2023, doi: [10.1108/XJM-09-2020-0111](https://doi.org/10.1108/XJM-09-2020-0111).
- [4] M. J. Yogesh and J. Karthikeyan, "Health Informatics: Engaging Modern Healthcare Units: A Brief Overview," *Front. Public Heal.*, vol. 10, p. 854688, Apr. 2022, doi: [10.3389/fpubh.2022.854688](https://doi.org/10.3389/fpubh.2022.854688).
- [5] O. K. Aramide, R. E. Ajibola, A. A. Alarape, and T. Oyinade, "Achieving Organization Objectives Through Management Information System In Organizations," University of Nebraska - Lincoln, p. 20, 2020. [Online]. Available at : <https://digitalcommons.unl.edu/> .
- [6] M. S. Rahman, M. A. Hossain, A. H. Chowdhury, and M. T. Hoque, "Role of enterprise information system management in enhancing firms competitive performance towards achieving SDGs during and after COVID-19 pandemic," *J. Enterp. Inf. Manag.*, vol. 35, no. 1, pp. 214–236, Feb. 2022, doi: [10.1108/JEIM-04-2021-0163](https://doi.org/10.1108/JEIM-04-2021-0163).
- [7] R. A. Wahab, Q. D. Kusumawardani, and F. P. Wijaya, "The Potential Implementation of Telemedicine in Frontier, Outmost, and Underdeveloped Region of Indonesia," in *2021 2nd International Conference on ICT for Rural Development (IC-ICTRuDev)*, Oct. 2021, pp. 1–6, doi: [10.1109/IC-ICTRuDev50538.2021.9656502](https://doi.org/10.1109/IC-ICTRuDev50538.2021.9656502).
- [8] D. Romodon and A. Rahardian, "Analysis of Hospital Management Information System (SIMRS) in Purwokerto Islamic Hospital," in *4th International Conference on Vocational Innovation and Applied Sciences 2022*, 2022, vol. 4, pp. 5–8, [Online]. Available at: <https://nstproceeding.com/index.php/nusciencetech/article/view/839>.
- [9] L. Jaime and J. Barata, "How can FLOSS Support COBIT 2019? Coverage Analysis and a Conceptual Framework," *Procedia Comput. Sci.*, vol. 219, pp. 680–687, Jan. 2023, doi: [10.1016/J.PROCS.2023.01.339](https://doi.org/10.1016/J.PROCS.2023.01.339).
- [10] W. Sardjono, W. Priatna, E. Lusia, G. R. Putra, and H. Juwitasary, "Information technology implementation and its performance in educational institution using the cobit framework," *ICIC Express Lett. Part B Appl.*, vol. 12, no. 12, pp. 1091–1099, 2021, [Online]. Available at: <http://www.icicelb.org/ellb/contents/2021/12/elb-12-12-01.pdf>.
- [11] Resad Setyadi, Aedah Abd Rahman, Aang Subiyakto, and Anwar Fattah, "Trust of Information Technology Governance in High School Institution (HSI): A Conceptual Framework," *Int. J. Sci. Technol. Manag.*, vol. 2, no. 3, pp. 844–855, May 2021, doi: [10.46729/ijstm.v2i3.189](https://doi.org/10.46729/ijstm.v2i3.189).
- [12] F. Muttaqin, M. Idhom, F. A. Akbar, M. H. P. Swari, and E. D. Putri, "Measurement of the IT Helpdesk Capability Level Using the COBIT 5 Framework," *J. Phys. Conf. Ser.*, vol. 1569, no. 2, p. 022039, Jul. 2020, doi: [10.1088/1742-6596/1569/2/022039](https://doi.org/10.1088/1742-6596/1569/2/022039).
- [13] D. Pliatsios, P. Sarigiannidis, T. Lagkas, and A. G. Sarigiannidis, "A Survey on SCADA Systems: Secure Protocols, Incidents, Threats and Tactics," *IEEE Commun. Surv. Tutorials*, vol. 22, no. 3, pp. 1942–1976, 2020, doi: [10.1109/COMST.2020.2987688](https://doi.org/10.1109/COMST.2020.2987688).
- [14] H. M. Astuti, F. A. Muqtadiroh, E. W. Tyas Darmaningrat, and C. U. Putri, "Risks Assessment of Information Technology Processes Based on COBIT 5 Framework: A Case Study of ITS Service Desk," *Procedia Comput. Sci.*, vol. 124, pp. 569–576, Jan. 2017, doi: [10.1016/j.procs.2017.12.191](https://doi.org/10.1016/j.procs.2017.12.191).
- [15] M. Wolden, R. Valverde, and M. Talla, "The effectiveness of COBIT 5 Information Security Framework for reducing Cyber Attacks on Supply Chain Management System," *IFAC-PapersOnLine*, vol. 48, no. 3, pp. 1846–1852, Jan. 2015, doi: [10.1016/j.ifacol.2015.06.355](https://doi.org/10.1016/j.ifacol.2015.06.355).

-
- [16] M. Evans, Y. He, L. Maglaras, and H. Janicke, "HEART-IS: A novel technique for evaluating human error-related information security incidents," *Comput. Secur.*, vol. 80, pp. 74–89, Jan. 2019, doi: [10.1016/j.cose.2018.09.002](https://doi.org/10.1016/j.cose.2018.09.002).
- [17] A. M. Harahap and A. Ikhwan, "Implementation of Information Technology Governance in Man 1 Medan Using the Cobit 5 Framework," *Sinkron*, vol. 8, no. 1, pp. 241–246, Jan. 2023, doi: [10.33395/sinkron.v8i1.11936](https://doi.org/10.33395/sinkron.v8i1.11936).
- [18] M. AB, - Prihandoko, P. E, and W. C, "Analyzing COBIT 5 IT Audit Framework Implementation using AHP Methodology," *JOIV Int. J. Informatics Vis.*, vol. 1, no. 2, p. 33, Apr. 2017, doi: [10.30630/joiv.1.2.18](https://doi.org/10.30630/joiv.1.2.18).
- [19] J. S. Neto, R. Almeida, P. L. Pinto, and M. M. da Silva, "A COBIT 5 PAM Update Compliant With ISO/IEC 330xx Family," *ISACA*, pp. 1-5, 2018. <https://www.isaca.org/resources/isaca-journal/issues/2018/volume-1/a-cobit-5-pam-update-compliant-with-isoiec-330xx-family>.
- [20] A. F. Apriliana and E. Suryani, "Gap Analysis of IT Governance in Supporting Integration of Organizational Universities (Case Study: University of General Achmad Yani Yogyakarta)," *IPTEK J. Proc. Ser.*, vol. 0, no. 5, p. 396, Dec. 2019, doi: [10.12962/j23546026.y2019i5.6374](https://doi.org/10.12962/j23546026.y2019i5.6374).
- [21] J. van Wyk and R. Rudman, "COBIT 5 compliance: best practices cognitive computing risk assessment and control checklist," *Meditari Account. Res.*, vol. 27, no. 5, pp. 761–788, Oct. 2019, doi: [10.1108/MEDAR-04-2018-0325](https://doi.org/10.1108/MEDAR-04-2018-0325).
- [22] S. D. Rehatta and A. D. Manuputty, "Measurement of the Maturity Level of IT Governance in Implementing Personnel Management Information System Using the MEA Domain COBIT 5 Framework In Regional Personnel, Education and Training Agency," *J. Inf. Syst. Informatics*, vol. 1, no. 2, pp. 123–135, Sep. 2019, doi: [10.33557/journalisi.v1i2.16](https://doi.org/10.33557/journalisi.v1i2.16).
- [23] ISACA, *COBIT 5 - A Business Framework for the Governance and Management of Enterprise IT*. pp. 1-94, 2012. [Online]. Available at: <https://privacy.sccgov.org/>.
- [24] R. Yaniar Sianida, F. Nur Afiana, and R. Wahyudi, "IS Governance Evaluation Using COBIT 5 Framework on the Central Statistics Agency of Banyumas District," *J. Comput. Sci. Eng.*, vol. 1, no. 1, pp. 1–9, Feb. 2020, doi: [10.36596/jcse.v1i1.9](https://doi.org/10.36596/jcse.v1i1.9).
- [25] A. Harits, G. M. Noer, and A. P. Widodo, "Capability Level Measurement Using COBIT 5 Framework (Case Study: PT. Jasa Cendekia Indonesia)," *J. Inf. Syst. Informatics*, vol. 3, no. 2, pp. 341–351, Jun. 2021, doi: [10.33557/journalisi.v3i2.134](https://doi.org/10.33557/journalisi.v3i2.134).
- [26] W. Gunawan, E. P. Kalensun, A. N. Fajar, and Sfenrianto, "Applying COBIT 5 in Higher Education," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 420, no. 1, p. 012108, Oct. 2018, doi: [10.1088/1757-899X/420/1/012108](https://doi.org/10.1088/1757-899X/420/1/012108).
- [27] S. Fuada, "Incident Management of Information Technology in the Indonesia Higher Education based on COBIT Framework: A Review," *EAI Endorsed Trans. Energy Web*, vol. 6, no. 22, p. 156387, Jul. 2018, doi: [10.4108/eai.13-7-2018.156387](https://doi.org/10.4108/eai.13-7-2018.156387).
- [28] A. Pasquini and E. Galie, "COBIT 5 and the Process Capability Model. Improvements Provided for IT Governance Process," *Proc. FIKUSZ '13*, pp. 67–76, 2013. [Online]. Available at: <https://ideas.repec.org/h/pkk/sfyr13/67-76.html>.
-