Audit of Health Agency for Supporting an e-Health Management System (EHMS) Case Study: Ciparay Health Center, Bandung

Riezka Amalia Faoziah, Angelina Prima Kurniati, Kusuma Ayu Laksitowening, Adiwijaya
School of Computing, Telkom Engineering School
Telkom University, Bandung, Indonesia
Email: (riezka, angelina, ayu, adiwijaya)@telkomuniversity.ac.id

***Abstract*—This paper explains audit of information systems as a preparation of the implementation e-health management system (EHMS) especially in health-centers information system (SIMPUS). SIMPUS is used for manage health data and information which are supported by the application of information technology (IT). The proposed method is implemented in one of health agency in Ciparay Health Center which is one of the state-owned health facilities which will receive SIMPUS. Hence, audit is needed to measure utilization rate of IT at Ciparay Health Center such that the future development process will be easier. This paper uses Control Objectives for Information and Related Technology (COBIT) version 5 as the framework because COBIT is based on process capability model (PCM) and has a characteristic which separates the government who has strategy policy and health-centers management who implement the policy. The result of measurement of best-practice and work-product respectively are 45% and 56%. It shows that the measurement value of Ciparay Health Center is in *1-Performed process*. It means that, Ciparay Health Center uses IT for daily transaction activities only. Hence, this qualification can not be forwarded to the next level.**

***Index Terms*—e-Health Management Systems (EHMS), SIMPUS, audit of health agency, COBIT 5, best-practice, work-product.**

I. Introduction

Ministry of Health of Indonesia is currently developing health-centers information system (SIMPUS), which is part of e-health management system (EHMS) to manage health data and information supported by application of information technology (IT). The usage of IT to get information is a part of current life-style and also health center. Health center as a government agency responsible for health service delivery, requires data management and integrated information to customize the e-ID card that has been initiated in 2012. Thus, each resident can access health data with the same record anywhere. A cutting-edge guide or framework which can organize a variety of related components in it that work in synergy is needed to implement SIMPUS.

At June 2012, Information Systems Audit and Control Association (ISACA) has released a framework that answers these needs, the COBIT 5 [1] is the development of COBIT 4.1. This framework is expected to support the overall governance of health information electronically to the agency. Health agencies that are the object of research on the analysis of information systems audit is Ciparay Health Center. Ciparay Health Center is one of the state-owned health facilities will receive SIMPUS. Before it is implemented, knowledge regarding the extent to which the use of IT in Ciparay health center is needed. So that when the application is already running, the development can be easily done, the evaluation and development process can run well.

Based on observations of the case study, there are some weaknesses in the Ciparay Health Center that drive the need for an audit. The weakness seen by pain points and trigger event parameters. Pain points are the factors which may be a sign for the company to improve management of IT organizations, the issue is health agency staff complaints against the lack of use of IT which caused several problems on some of the business processes. While the trigger event, or things that support the urgent need for an audit, namely the design SIMPUS programs, increasing awareness of the regional government HR III (equivalent to sub-districts) of the information technology needs, as well as the demands of accuracy, speed, and simplicity in performance achievement.

This paper measures and analyzes the data to obtain the results of measurements at the level which health agencies using process capability model (PCM). Based on the obtained results, this paper provides technical recommendations for the management (Ciparay Health Center) and strategic recommendations for the governance (Department of Health) related audit results. The rest of this paper is organized as follows: section II explains the overview and related works, section III describes the system model, section IV describes the simulation results and analysis, and finally section V concludes the paper.

II. Overview and Related Works

A. Audit

According to Weber [2], the audit is the process of collecting and evaluating evidence to see whether the performance of the system to protect assets, maintain data integrity, and operating effectively and efficiently in accordance with the objectives of the organization. Meanwhile, according to Arens [3], audit is the accumulation and evaluation of evidence about information to destine and report on the degree of correspondence between the information and established criteria. Audit should be done by a competent, independent person.

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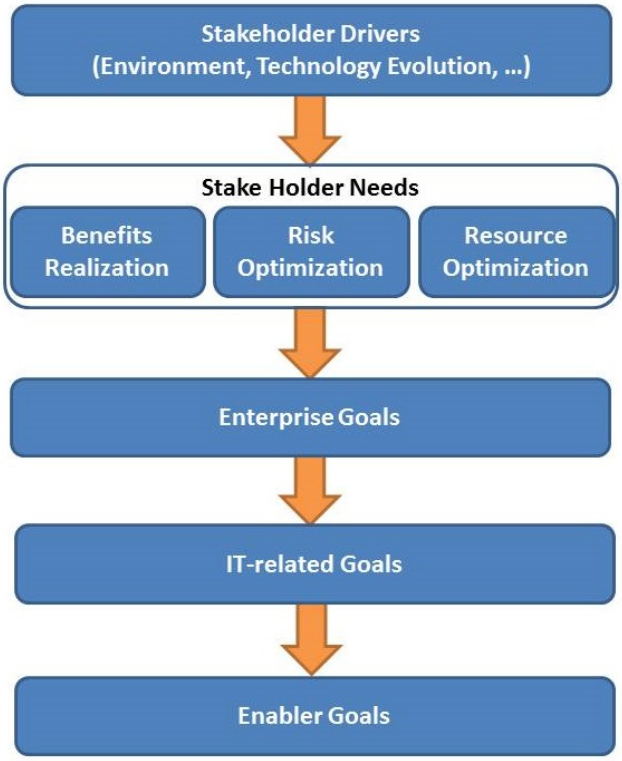

Fig. 1. Goal cascade overview [1].

There are several published studies about audit. In the study [4] presented audit for local taxation management information system. It combined two methods, computer audit and traditional manual audit. The traditional audit method can overcome problems that happened in computer method. In the health area, [5] and [6] presented audit for tracking the patient health record. The results can be used for future treatment for the patient to get better health. However, those studies do not consider the influence of time factor to calculate the similarity calculation.

B. COBIT 5

Control Objectives for Information and Related Technology (COBIT) is a set of documentation that directs and guides on IT governance that can help auditors, management, and user to bridge the gap or separation between business risks, control needs and technical issues. COBIT was developed by the IT Governance Institute (ITGI) which is part of the Information Systems Audit and Control Association (ISACA). Steps being taken to obtain the results of the audit with COBIT 5 standardization, necessary steps as shown in Figure 1.

In general, COBIT 5 is divided into two areas, namely Governance and Management. In the scope of governance, there are domains Evaluate, Direct and Monitor (EDM). While the scope of management, there are four domains, namely the Align, Plan, and Organize (APO), Build, Acquire and Implement (BAI), and Deliver, Service and Support (DSS), and Monitor, Evaluate, and Assess (MEA). The whole domain consists of 37 processes is shown in Figure 2

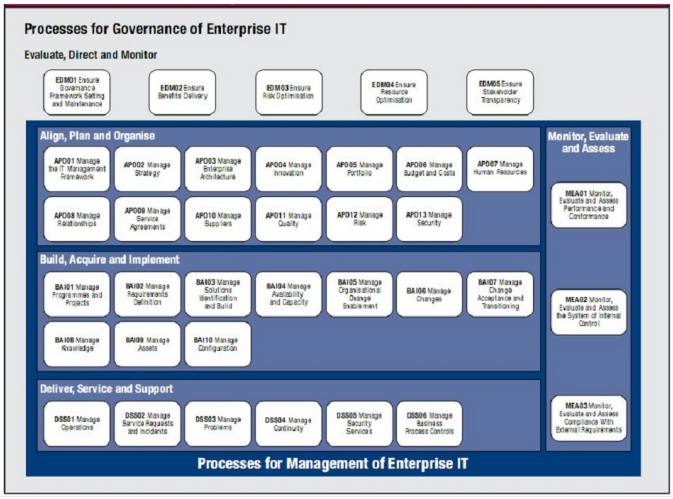

Fig. 2. Process reference model COBIT 5 [1].

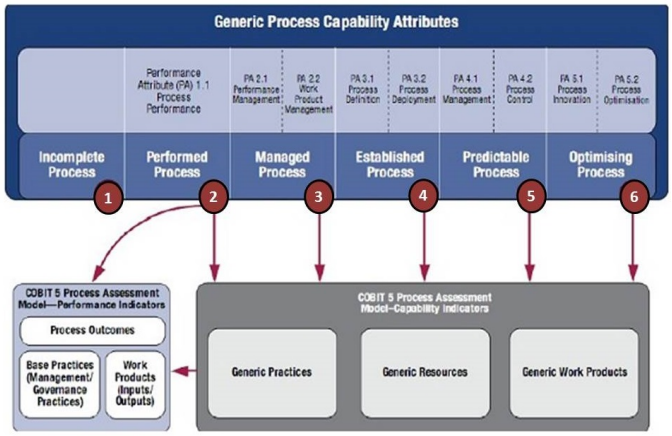

Fig. 3. Process capability model (PCM) [1].

Figure 3 describes each level of Process Capability Model (PCM). Each level is explained as follow:

1) Incomplete Process: IT has not been implemented, even if has been implemented the application is not in accordance with the objectives.

2) Performed Process: the use of IT within an organization are used to support daily activities and operations.

3) Managed Process: organizations applying for the IT implementation work plan, monitor, and adjust the subsequent work products.

4) Established Process: the process is currently managed and implemented that is able to achieve results

5) Predictable Process: the process that has been built by IT operations with undefined limits to achieve the output of the process.

6) Optimizing Process: IT is used to improve business processes continuously to align with strategic objectives.

Stakeholder mapping model

Mapping the technical interview questions used in this audit Ciparay Health Center using RACI. RACI is an acronym of: Responsible, Accountable, Consulted and Informed. RACI

chart is a matrix for the entire activities or authorization decisions to be taken in an organization that is associated with all the parties involved or position.

- *Responsible*: person who performs an activity or does the work;
- *Accountable*: person who is ultimately accountable and has Yes/No veto;
- *Consulted*: person that needs to feedback and contribute to the activity;
- *Informed*: person that needs to know of the decision or action.

C. Related works

Several studies about COBIT have been presented. The study in [7] presented a conceptualizing responsibility based approach for elaborating RBAC policies conforming to CobiT requirements. The aim of this approach was to improve the assignation of permissions to employees and to permit by the mean time to trace this assignment. It consisted of two steps: First, the mapping of the responsibility meta-model with the COBIT framework, which permits to decompose COBIT activities on tasks, map RACI responsibility to these tasks and define the requisite right to perform the task. Second, the mapping of the responsibility meta-model with RBAC has permitted to model the assignment of permissions to employees by the intermediary concept of responsibilities.

Other study in [8] presented how COBIT can enhance the lifecycle management security. The use of COBIT framework is for manage the user-account for small-medium size organization more effectively. The framework was designed to provide a level of flexibility that ensures it can be easily adapted to most IT environments, to help ensure the separation of duties, least privilege and need-to-know principles are enforced, as well as providing the right balance between technical and non-technical controls to help prevent single-point-of-failure.

The most recent study related to COBIT 5 [9] is applied to vocational university governance and their measurement models. The model was expected to be a best practice for university when developing a strategic plan, one of which was include how the governance of university is running. COBIT 5 framework was used as a determining factor in the preparation of the proposed model of governance and measurement model of vocational university governance.

III. Research Method

Ciparay Health Center is a technical unit health districts / cities held responsible for health development in one or more parts of districts. In this paper, the result of an audit that will show the current conditions in the Ciparay Health Center based on standard COBIT 5, along with a list of activities which have reached the top level Fully Achieved. So that when the application is already running, it is easier to evaluate and renew the application. Framework used international standard so that the standard of health in Indonesia is increasingly feasible to face the future challenge such free market era World Custom Organisations (WCO) and the General Agreements of Tariff and Trade (GATT) in 2020 . This is motivated by the Ministry of Health program that is developing a Health Center Information System (SIMPUS) were included into EHMS.

A. Document Evaluation

Documents are evaluated in the audit agency in Ciparay Health Center i.e., supporting evidence consisting of documents, interviews results that are mapped to the questionnaire, and visual recording devices such as cameras. The evidences collections are submitted by auditee as an evaluation and comparison of materials as a reference of secondary data. The evidences evaluators are obtained from the health department of current government.

Evidences Collection

1) Information system recap of Ciparay Health Center (Ms.Excel-based)
2) Annual report of Ciparay Health Center
3) Details of organization and human resources of Ciparay Health Center
4) Discipline civil servants regional office III 2010
5) Case report
6) List acceptance money watch ER and inpatient of Ciparay Health Center
7) Letter of assignment
8) Presence list the Ciparay Health Center
9) Administration of the registration sheet and patient diagnosis.
10) Ciparay Health Center shopping cart
11) Receipt

Evidences Evaluators

1) Ciparay Health Center performance assessment instruments belonging to the District Health Office of Bandung
2) Ciparay Health Center data collection report
3) District Health Profile of Bandung in 2010
4) Human Development Index (HDI), which is built based on the amount of composite indicators of health, economics, and education.

B. I/O Process

Figure 4 shows the input-output process in this paper. Input from this study is the observation, data collection, document review, interview techniques, and sampling. Process or methodology used is the COBIT 5. The output is the result of the audit information system and recommendations for improvement for future development.

Figure 5 shows research method which consists of five main steps; audit preplanning, performance of audit work, auditee selection, measurement, and the last is final report and recommendation. The first to third steps are explained as follow:

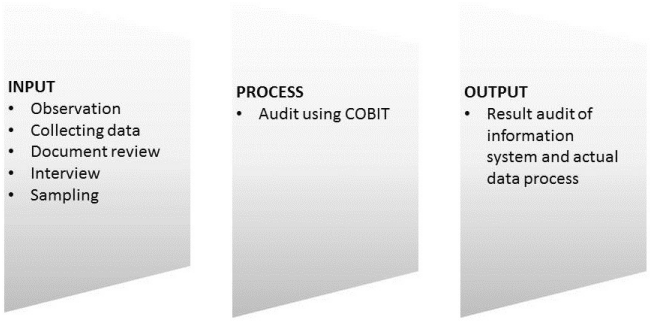

Fig. 4. I/O Process.

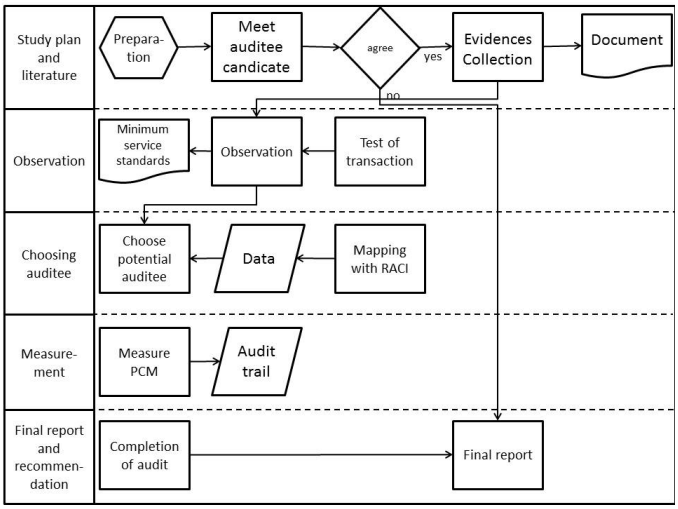

Fig. 5. Research flowchart.

1) Audit preplanning: In the form of a written consent form permitting the relevant agencies. Based on observations in the field, the scope of the problem is obtained as follow;

- Governance: Department of Health Government of Bandung as a requirement to be able to conduct research into the health center.
- Management: Ciparay Health Center. Ensuring the availability of institutions for examination. For the health center: enhancing expertise in the technical field in a simple computer, such as sending an email, how to download documents on the internet, how to optimize the use of MS. Excel, and preparing reports to make it more interesting.

2) Performance of audit work: At first, the researchers checked to see if the organization has a Quality Assurance department, which can be correlated with the researcher during the audit process. Turns Ciparay Health Center do not have the division or the like. So the researchers conducted observations independently. At the stage of observation carried out an analysis of the operational activities, documents relating directly to the service as audit evidence, transactions that occur, and the results that have been obtained correspondence.

3) Auditee selection: Respondents who became speaker of the interview of this research are stakeholder agencies and the Health Center Health Department that are related with the scope of the study.

IV. Results and Analysis

A. Results

The audit method is based on enterprise goals and IT-related goals based on COBIT 5. There are 17 items to be audited. The 17 items are divided based on Balanced Score Card (BSC) which is consists of 4 categories; financial, customer, internal, and learning and growth. The description of each item of each category is explained as follows;

Financial:

1) The role of stakeholders in information management for business investment.
2) Portfolio of products and services are well managed.
3) Risk management of stakeholders in order to maintain the organization's assets.
4) IT fulfillment with external regulations.
5) Financial transparency.

Customer:

6) Customer service-oriented.
7) The availability of business services according to the needs.
8) Rapid response to changes in the business environment.
9) Strategic decision based on the information in the business process.
10) Cost optimization required in service delivery.

Internal:

11) Business process optimization functionality.
12) Cost optimization to support the development of business processes.
13) Business management that supports development programs.
14) Operational and employee productivity.
15) IT Fulfillment with internal regulations.

Learning and growth:

16) Competence and motivation of business and personal IT.
17) Knowledge, expertise, and initiatives for business innovation.

To audit these items the IT-related from COBIT 5 process as explained in section II-B is used. Then we use process capability model (PCM) measurement which divide each item into two categories; primary (**P**) and secondary (**S**). Primary (**P**) means the item has high priority to do, and secondary (**S**) means the item has lower priority. Based on PCM, **P** and **S** have different value which are 0.0588 and 0.0295 respectively.

The measurement result of audit of 17 items is shown in Figure 6. From this figure, we choose 5 IT-related processes that has more than 50% value. According to Table I, 50% is the minimum value for a process is largely achieved. Those 5 IT-related processes are:

- APO5: Manage Portfolio,
- APO7: Manage human resource,
- APO11: Manage quality,
- MEA1: Monitor and evaluate performance,
- MEA3: Monitor and assess compliance with external requirements.

Cobit 5 Process		IT related Goal																	P	S	Sum
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17			
		financial						customer		internal							learning n growth				
Evaluate, Direct, and Monitor	EDM1	P	P				S	S	S			S	P	P		P	S	S	5	6	0,4705882
	EDM2	S				P					S								1	2	0,1176471
	EDM3		S		S				P			S	S		S	P		P	3	5	0,3235294
	EDM4	P	P	P				P				P	P		P	S	P		8	1	0,5
	EDM5	P	S	S		S	S						P	S	S				2	6	0,2941176
Align, Plan, and Organize	APO1			S		S						S			P				1	3	0,1470588
	APO2	S					S					S			S		S		0	4	0,1176471
	APO3	S	P							P					P		S		3	2	0,2352941
	APO4	S	P	P	S		S	P			S	P	S		S	S		P	5	6	0,4705882
	APO5	P	P	S	S	P	S	P	P		S	P	S		P	S	S	P	8	6	0,6470588
	APO6		S	S	S	P		S			P	P		P	S	S	S	S	4	8	0,4705882
	APO7	P	S	S	S	P	S	S	P		S	S	S	P	P	S			5	9	0,5588235
	APO8		P		S	P		S	P		S	S	P			P		S	5	6	0,4705882
	APO9							S					S		P				1	2	0,1176471
	APO10							S					P					S	1	2	0,1176471
	APO11	P	P	S	S		S	S			P	P	P		S	S		P	6	6	0,5294118
	APO12		P								P								2	0	0,1176471
	APO13				S						S					S			0	3	0,0882353
Build, Acquire, and Implement	BAI1		S				P				S		S						1	3	0,1470588
	BAI2		S	P										P	P			P	2	1	0,1470588
	BAI3	P													S			P	2	1	0,1470588
	BAI4		P	S				S				S		P	S	S			2	4	0,2352941
	BAI5	S	S							P									1	2	0,1176471
	BAI6	P			S								P		P	P	S		4	2	0,2941176
	BAI7	P			S								P	P	S		S	P	4	3	0,3235294
	BAI8	P	P											S	S			S	2	3	0,2058824
	BAI9	S	P							P					P		S		3	2	0,2352941
	BAI10		S				S						P			S	P		2	3	0,2058824
Deliver, Service, adn Support	DSS1	P	S	P	S	S		P			S	S	S		P	S	S		4	8	0,4705882
	DSS2	S	S	P	S	S					P	S			P	S			3	6	0,3529412
	DSS3		S					S			P	P						S	2	3	0,2058824
	DSS4	P		S				P		P		S	S	P	S	S		P	5	5	0,4411765
	DSS5	S		S				S					S	P	S				1	5	0,2058824
	DSS6		P															P	2	0	0,1176471
Monitor, Evaluate , and Assess	MEA1	P		P	S	S	S	P			P	P	S	S		S		P	6	6	0,5294118
	MEA2	P					S		S		S	S			S	S			1	4	0,1764706
	MEA3			P	S	P	P	S		S		S			P	P	P	P	8	2	0,5294118

Fig. 6. IT-Related Goals to IT-Related Processes.

TABLE I
STANDARD LEVEL OF PROCESS CAPABILITY MODEL (PCM) [1]

Level	Percentage
N: Not achieved	0%-15%
P: Partially achieved	15%-50%
L: Largely achieved	50%-85%
F: Fully achieved	85%-100%

The next step is we conducted interview regarding these 5 processes. The content of the interview is sub-processes of each process. The result of the interview is shown in Table II. The content of the interview is related to the achievement of the generic practice, generic resources, and generic work products that exist in each process attribute. This means, the accumulated achievement of the 5 processes that do not meet the calculated Fully Achieve (85%), so if based on ISO/IEC 15504 as a standard assessment for software engineering process, the evaluation can not proceed at an advanced stage questionnaire *managed process* (one of requirements for leveling up on COBIT5 is the previous level must be met first).

B. Analysis

Based on the result of previous subsection, we provide analysis of each of 5 processes.

TABLE II
THE RESULT OF THE ACCUMULATION OF WP AND BP OF CIPARAY HEALTH CENTER

Code	Best Practice				Work Product			
	Done	Not	∑	%	Done	Not	∑	%
APO05	2	1	3	67	1	2	3	33
APO07	2	2	4	50	2	2	4	50
APO11	3	1	4	75	3	1	4	75
MEA01	2	2	4	50	2	1	3	67
MEA03	1	5	6	14	2	2	4	50
Total	10	11	21	45	9	7	16	56

APO5: Manage Portfolio

Overall this process has not gone well. It is seen from the physical delivery of the report that takes time, costs, and energy. In fact, the contents of the report are given relatively similar. For example, obtained from interviews, requested a report on the actual Nutrition are also at a similar or monthly reports. The recommendation is the need for classification of any documents requested by the government so there is no redundancy of information which led to loss of material, time, and energy.

APO7: Manage human resource

Human resources is quite good because of the division of labor that has been handed over to any staff well, and the absence of binding regulations and has particularly strict sanctions. The regulations contained in the disciplinary guidelines

of Civil Servants contained in the room and the administration is always available at the desk. However, for the frequency of accessing (reading or not), beyond the capabilities of researchers.

APO11: Manage quality

Quality management in Ciparay Health Center is still not good, this is indicated by the results of the performance assessment of the health center by department stating that Ciparay based target assessment coverage and have the latest 77.95 value, in the group of poor.

MEA1 : Monitor and evaluate performance

Overall this process has good result. There has been correspondence between the health department and Ciparay Health Center, as an analysis of the interview results and confirmation on both sides. Examples related to some important information such as quarterly monitoring meetings for SIMPUS as EHMS program and distribution facilities.

MEA3 : Monitor and assess compliance with external requirements

Overall this process has good result. Based on observations, Ciparay Health Center have openness to external requirements, such as being one of the main EHMS provision to offset the contemporary technological advancement, has been known from the health department staff up to the level of health center staff. known from the health department staff up to the level of health center staff.

V. Conclusion and Future Works

This paper explains audit of information systems as a preparation of the implementation e-health management system (EHMS) especially in health-centers information system (SIMPUS). The audit is based on COBIT5. Based on Process Capability Models, measurement results of best-practices and work-product, respectively, has a score of 45% and 56%. It shows that the value of the measurement for Ciparay Health Center is in stage 1-Performed process. This result do not meet the qualifications to be forwarded to the next level. This means that the Ciparay only use of IT in daily activities are transactional. In other words, it has not implemented the IT implementation work to plan, monitor, and adjust to subsequent work products (2-managed process).

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