Readiness Analysis of the Implementation of Indonesian EHMS based on COBIT 5 Enablers

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Abstract—**Implementation of EHMS in Indonesia is not a simple task. The parties related to the implementation, which are Health Ministry and healthcare organizations, should consider many factors related to the issue. Some independent parties have tried to implement it, but none of them are really successful. It is important to analyse the readiness of parties related, before the real implementation can take place. One method which can be used to analyse this readiness is by reference to COBIT 5 enablers concept. This paper presents analysis of 7 (seven) enablers on COBIT 5 as factors to be considered when Indonesian Health Ministry wants to implement EHMS in Indonesia. This analysis can be continued by implementing enabling processes as stated by COBIT 5.**

Index Terms— **COBIT 5, enablers, principles, enable dimensions, EHMS, Indonesia**

I. INTRODUCTION

There are many initiatives separately to implement e-health management system (EHMS) in Indonesia. Some institutions try to implement a fully automated system, some others automates the system partially. The implementation of EHMS in Indonesia involves several stakeholders related to the system. Various factors need to be studied to assess the readiness of the various parties implementing EHMS.

COBIT (Control Objectives for Information & Related Technology) 5, as outlined below, introduces seven enablers (they are explained below), which are factors that individually or collectively affect the success of the governance and management of IT in the enterprise. The concept of enablers is consistent with one of the principles of the COBIT 5, which apply a holistic approach in solving governance and management within the organization. These seven interconnected enablers should work properly to create a conducive environment in implementing a good practice of EHMS.

This paper is the documentation of the preliminary step of research into the development of Indonesian EHMS. By doing analysis on enablers based on COBIT 5, it is possible to provide a good understanding of the needs to be fulfilled on the next steps of developing EHMS prototype.

In this paper, the concept of enablers is used to assess readiness of EHMS implementation in Indonesia. Data and information presented in this paper were collected through a review of literature, interviews and field surveys, as well as data collected through questionnaires. Some theories and methods are used to support the analysis of each of the enablers.

II. THEORY

A. COBIT 5 Principles

COBIT 5 provides a comprehensive framework that assists enterprises in achieving their objectives for the governance and management of enterprise IT. Simply stated, it helps enterprises create optimal value from IT by maintaining a balance between realising benefits and optimising risk levels and resource use.

Principles of COBIT 5 are:

1) *Meeting stakeholder needs.* Enterprises exist to create value for their stakeholders by maintaining a balance between the realisation of benefits and the optimisation of risk and use of resources.

2) *Covering the enterprise end-to-end.* It covers all *functions* and processes within the enterprise. It considers all IT-related governance and management enablers to be enterprisewide and end-to-end.

3) *Applying a single, integrated framework.* COBIT 5 aligns with other relevant standards and frameworks at a high level, and thus can serve as the overarching framework for governance and management of enterprise IT.

4) *Enabling a hollistic approach.* COBIT 5 defines a set of enablers to support the implementation of a *comprehensive* governance and management system for enterprise IT.

5) *Separating governance from management.* These two *disciplines* encompass different types of activities, require different organisational structures and serve different purposes.

B. COBIT 5 Enablers

Principle 4 of COBIT5 (enabling a hollistic approach) states that Efficient and effective governance and management of enterprise IT require a holistic approach, taking into account several interacting components.

COBIT 5 defines a set of enablers to support the implementation of a comprehensive governance and management system for enterprise IT.

Enablers are broadly defined as anything that can help achieving the objectives of enterprise. The COBIT 5 framework defines seven categories of enablers:

1) *Principles, policies and frameworks* are the vehicle to translate the desired behaviour into practical guidance for day-to-day management.
2) *Processes* describe an organised set of practices and activities to achieve certain objectives and produce a set of outputs in support of achieving overall IT-related goals.
3) *Organizational structures* are the key decision-making entities in an enterprise.
4) *Culture, ethics and behavior* of individuals and of the enterprise are very often underestimated as a success factor in governance and management.
5) *Information* is pervasive throughout any organisation and includes all information produced and used by the enterprise. Information is required for keeping the organisation running and well governed, but at the operational level, information is very often the key product of the enterprise itself
6) *Services, infrastructure and applications* include the infrastructure, technology and applications that provide the enterprise with information technology processing and services.
7) *People, skills and competencies* are linked to people and are required for successful completion of all activities and for making correct decisions and taking corrective actions.

C. COBIT 5 Enabler Dimensions

All enablers have four common dimensions, which are:

1) *Stakeholders* − Each enablers has stakeholders (parties who play an active role and/or have an interest in the enabler). For example, processes have different parties who execute process activities and/or who have an interest in the process outcomes; organisational structures have stakeholders, each with his/her own roles and interests, that are part of the structures. Stakeholders can be internal or external to the enterprise, all having their own, interests and needs. Stakeholders' needs translate to enterprise goals, which in turn translate to IT-related goals for the enterprise.
2) *Goals* - Each enabler has a number of goals, and provides value by the achievement of these goals.
3) *Life cycle* - Each enabler has a life cycle, from inception through an operational/useful life until disposal. This applies to information, structures, processes, policies, etc.
4) *Good practices* - For each of the enablers, good practices can be defined. Good practices support the achievement of the enabler goals. Good practices provide examples or suggestions on how best to implement the enabler, and what work products or inputs and outputs are required. COBIT

5 provides examples of good practices for some enablers provided by COBIT 5 (e.g., processes). For other enablers, guidance from other standards, frameworks, etc., can be used.

III. ANALYSIS

Analysis of the readiness of EHMS implementation in Indonesia is done based on the seven enablers in COBIT 5 outlined above.

A. Principles, Policies and Frameworks

Principles and policies refer to the communication mechanisms put in place to convey the governing body's and management's direction and instructions.

Indonesian governance, through *Kementerian Kesehatan Republik Indonesia* (Ministry of Health, Republic of Indonesia) had defined some policies related to the implementation of EHMS, including the following:

- *UU no 29/ 2004* about medical practices. It is stated that medical record is a must for doctors and paramedics in caring patients.
- *Kemenkes RI no 844/Menkes/SK/X/2006* about the definition of data code standards on health field. This defines data code standards as reference of statistics bureau, Health Ministry and Financial Ministry.
- *Kemenkes RI no 129/Menkes/SK/II/2008* about Minimum Service Standard of Hospital. It states metrics for minimum service quality of a hospital.
- *Kemenkes RI no 267/Menkes/SK/III/2008* about Technical Guidance of Organizing *Dinas Kesehatan Daerah*.
- *Permenkes RI no 269/Menkes/PER/III/2008* about Medical Records. It consists of redefinition of medical records, the ownership, utility and responsibility, organization and monitoring of medical records.
- *Kemenkes RI no 828/Menkes/SK/IX/2008* about Technical Guidance of Minimum Service Standard on Healthcare in District/ City. This policy guides district/ city in planning, implementing and monitoring of Minimum Service Standard on Healthcare.
- *UU no 36/2009* about health. It is stated that healthcare institutions should give full access for research and development purposes. They should also provide reports to the Health Ministry.
- *Permenkes RI no 1144/Menkes/PER/VIII/ 2010* about organization and workflow of Health Ministry.
- *Kemenkes RI no 1625/Menkes/SK/VIII/2011* about Officers of Information and Documentation in Health Ministry.

On implementation level, each healthcare organization can have its own procedures and rules to be applied locally in the organization.

B. Processes

A process is defined as 'a collection of practices influenced by the enterprise's policies and procedures that takes inputs from a number of sources (including other processes), manipulates the inputs and produces outputs (e.g., products, services)' [2].

The processes of e-health management system [1] can be categorized as:

1) *Administrative* processes, consist of patient identification and assessment.
2) *Laboratory* processes, consist of order records, results from laboratory instruments, scheduling and billing.
3) *Radiology* processes, include patient tracking, scheduling, results reporting, and image tracking.
4) *Pharmacy* processes, consist of filling prescriptions and payer formularies and medicine administration.
5) *Clinical documentation* processes, for example: physician, nurse and other clinician notes; flow sheets; transcription document management, discharge summaries, medical records abstracts, chart tracking, utilization management, etc.
6) *Reporting* processes, consist of summarizing data and creating reports to be sent to the Health Ministry.

The categorization of processes is not strictly applied in all healthcare organizations. The organization can define their own categorization according to their organizational structures.

C. Organizational Structures

Organizational structure shows the responsibility setting, separation of duties and chains of command within an organization. Fig. 1 shows the organizational structure of Ministry of Health, Indonesia [3].
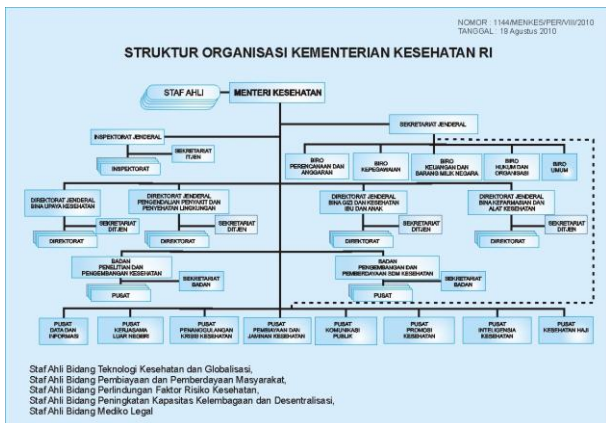

Figure 1. Organizational structure of Ministry of Health, Indonesia [3]

Three most important parts of the Ministry of Health organizational structure related to e-health research are *Dirjen Bina Upaya Kesehatan (BUK)*, *Badan Penelitian dan Pengembangan Kesehatan (Balitbangkes)*, and *Pusat Data dan Informati (Pusdatin)*.

BUK has a task to formulate and implement policies and technical standardization in the field of health development efforts. In doing this task, BUK formulating policies in development of health efforts, giving technical coach and evaluation of health development efforts, and administer the health development efforts. BUK is responsible for setting policy, norms, standards, procedures and criteria and to provide technical guidance

and evaluation in the field of health coaching efforts. Organizational structure of BUK shown in Figure 4 [5].

Balitbangkes functions in doing and monitoring research and development in health subjects. To do this, Balitbangkes establishes some technical policy, planning and research dan development in health subjects. It is responsible for formulating, implementing, monitoring, evaluating and reporting technical policies, plans and programs of health research and development.

Pusdatin is a supporting unit of Health Ministry in health data and information, to manage health statistics, information analysis dan dissemination, and information system and bank data development. Pusdatin, especially subfield of information systems development, under the development of information systems and data banks, is the most responsible division because it is responsible for developing and maintaining all systems.

These three units are responsible for governance roles of healthcare management system. They are responsible for evaluating, directing and monitoring the management roles of e-health. Management roles are done by management levels in hospitals. Management level will be executing the policies, plans and programs of Health Ministry and planning, building, running and monitoring the processes includes in the system.

D. Culture, Ethics and Behavior

Culture, ethics and behaviour refer to the set of individual and collective behaviours within an enterprise.

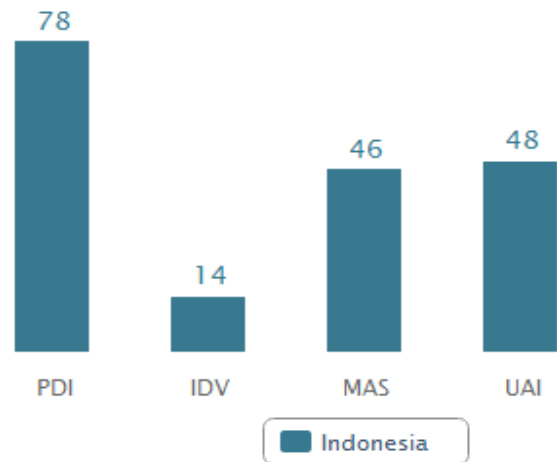Indonesian's culture as defined by Hofstede can be figured as on Fig. 2 [8].

Figure 2. Indonesian culture

As shown ini Fig. 3, Indonesia has a high score (78) of PDI (Power Distance Index), which means that the Indonesian style is being dependent on hierarchy, unequal rights between power holders and non power holders, superiors in-accessible, leaders are directive, management controls and delegates. Power is centralized and managers count on the obedience of their team members. Employees expect to be told what to do and when. Control is expected and managers are respected for their position.
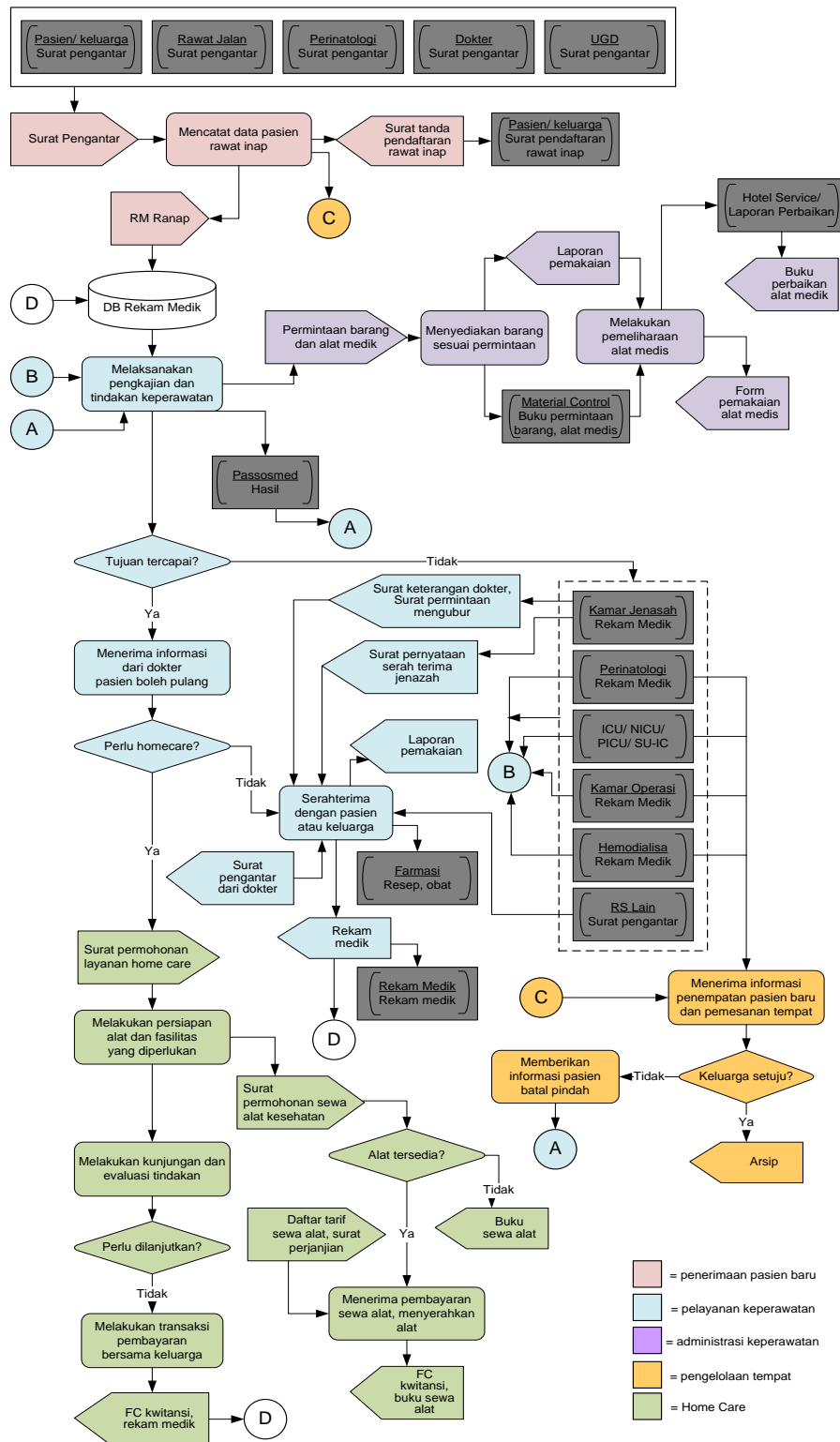
Figure 3. IPMap of a Hospital

In IDV (individualism), Indonesia has a low score (14). This means there is a high preference for a strongly defined social framework in which individuals are expected to conform to the ideals of the society and the in-groups to which they belong. Indonesia has a low score (46) of MAS (masculinity). Indonesia is less Masculine than some other Asian countries like Japan, China and India. In Indonesia status and visible symbols of success are important but it is not always material gain that brings motivation. The UAI (uncertainty avoidance index) score for Indonesia is medium low (48). This means that there is a strong preference in Indonesia toward the Javanese culture of separation of internal self from external self. When a person is upset, it is habitual for the Indonesian not to show negative emotion or anger externally. They will keep smiling and be polite, no

matter how angry they are inside. This also means that maintaining work place and relationship harmony is very important in Indonesia, and no one wishes to be the transmitter of bad or negative news or feedback.

E. Information

The information enabler deals with all information relevant for enterprises. Information can be structured or unstructured, formalised or informalised.

Information flow in a healthcare organization can be illustrated using IPMap notation. It shows data and information elements in an organization and the relationships through processes. The medical record data flow from admission process of a patient and are saved until some years to keep a historical record of that patient's health. An example of information flow of a hospital in IPMap notation is shown at Fig. 3.

The start of administrative processes is registration process (*Mencatat data pasien*). The patient data is saved in medical record database (*DB rekam medik*). The patient is then observed by the paramedic, who decides the next treatment to be done. Patient can get involved in laboratory processes (*laboratorium*), radiology processes (*radiologi*), and/or pharmacy processes (*farmasi*), based on the diagnostic of paramedic. Any treatment received by patients will be recorded in the medical record, based on clinical documentation processes done by paramedics.

In addition, the supporting processes are also applied in the healthcare system in hospitals. The use of drugs and medical devices (*Menyediakan obat dan alat medis*) is analyzed for any health care service provided to patients. The usage of inpatient rooms is also recorded to measure the occupancy and hospital capacity.

The sample of hospital also provides home care services that can be used by patients. When a patient obtain this service, patients can receive health care services in patients' homes. Health workers will visit according to a predetermined schedule, providing health care, and noted the visit in the patient's medical record.

All data generated during the health care will be stored in a database of medical records. The e-health management system is designed to generate subsequent reports of such activity automatically in accordance with the provisions of the health.

F. Services, Infrastructure and Applications

The type of minimal hospital services, as stated in *Kemenkes RI no 129/Menkes/SK/II/2008* about Minimum Service Standard of Hospital, are: Emergency services, Outpatient and inpatient services, Surgical services, Service delivery and perinatology, Intensive care, Radiology services, Clinical pathology laboratory services, Medical rehabilitation services, Pharmacy and nutrition services, Blood transfusion services, Poor service, Medical record service, Waste management, Administrative services management, Services ambulance/ hearse, Services undertakers, Laundry services, Maintenance of hospital services, and Prevention of Infection Control.

The e-Health Management System is expected to has the following main characteristics [9]:

1. Patients should be able to access and view their medical records through the system
2. Information in the system should be up-to-date
3. Medical information should be presented in a cognitively accessible way
4. Patients should be able to edit their medical records, annotate them or in the least request the responsible medical professionals to make correctionis for them
5. The system should be technically accessible
6. Each individual should control access to their data
7. A possibility for an emergency access should exist

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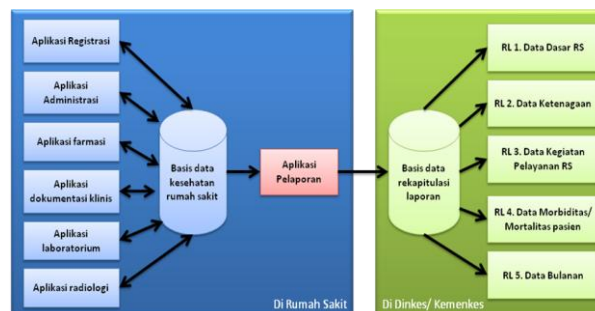

Figure 4. System Architecture

Service capabilities refer to resources such as applications and infrastructures that are leveraged in the delivery of IT-related services. It should be able to integrate the need of healthcare organization to manage health records of their patient, the interconnection between healthcare organizations, and the reporting functions from each organization to the Health Ministry. Architecture of services and application proposed in this research is shown at Fig. 4.

H. People, Skills and Competencies

The last enabler to take care is people, skills and competencies. Data of paramedics in Indonesia can be summarized as in Table 1 [7].

Health Ministry through its personnel bureau, based on Permenkes 1144/ 2010, is doing human resource

management processes, including the preparation of formation and human resource recruitment, civil assignment, non-permanent employee assignment, rank assignment, transfer and discharge, assesment and career development, functional degree administration, awards and employee welfare. This bureau also conducts planning, monitoring, evaluation and reporting, and the implementation of administrative affairs of the bureau.

IV. CONCLUSION

This preliminary analysis of readiness on EHMS implementation in Indonesia can be helpful in creating conducive environments in implementing IT in health field. It can be concluded that:

1. Principle, policies and framework of health system is complete and allows the implementation of an EHMS.
2. Processes within the healthcare service might be changed due to the implementaion of EHMS.
3. Organizational structure of health ministry and below is not ready to implement EHMS because they have not enough IT employees who can operate EHMS.
4. Culture, ethics ad behavior of individuals in the enterprise should be taken care of to support the implementation of EHMS smoothly.
5. Information and the data related to the EMS have been collected separately and need to be integrated so that the system can run optimally.
6. Services, infrastructure and application of EHMS should be prepared based on processes and other enablers setting.
7. People, skills and competencies should be managed carefully because this is the most crucial enabler of successful implementation of e-health management system. Competence and expertise of the people involved in it must also be increased in accordance with the needs of the system.

ACKNOWLEDGMENT

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