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# Information Technology Governance Audit Using the COBIT 5 Framework (Case Study of PDAM Tirta Patriot Kota Bekasi)

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**Abstract**

PDAM Tirta Patriot has implemented information systems for its business process but still has deficiencies, including some business processes that do not have documented guidelines and procedures. Furthermore, the human resources in PDAM Tirta Patriot are insufficient for improving IT governance due to the lack of reliable personnel in the IT unit. Given the importance of IT for PDAM, an audit is needed to evaluate the capability of the IT unit in managing IT. COBIT 5 provides a goals cascade to align the company with its business goals. However, the goals cascade does not provide priority to IT-related goals. Therefore, for prioritizing IT-related goals, this research uses Analytical Hierarchy Process (AHP). From the AHP result, the selected domains are APO01, MEA01, and APO07. This research aims to determine the current capability level and analyze the gap between it and the chosen target capability level, precisely level 2. The current capability level of PDAM Tirta Patriot from domain APO01 is 1, MEA01 is 0, and APO07 is 0, which means none of those have reached the target capability level. Recommendations are given based on the unfulfilled work product for domains that do not reach the target capability level.
**Keywords**: AHP, COBIT 5, IT governance, PDAM Tirta Patriot.

**Abstrak**

PDAM Tirta Patriot telah mengimplementasikan sistem informasi dalam proses bisnisnya. Namun masih memiliki kekurangan, diantaranya terdapat proses bisnis yang belum memililki pedoman dan prosedur yang terdokumentasi. Selain itu, kondisi SDM PDAM Tirta Patriot yang belum cukup untuk meningkatkan tata kelola IT, dikarenakan masih kurangnya personil yang dapat diandalkan dalam unit IT. Mengingat pentingnya IT bagi PDAM, dibutuhkan sebuah audit untuk mengevaluasi kemampuan unit IT dalam mengelola IT agar selaras dengan tujuan perusahaan. COBIT 5 menyediakan mekanisme *goals cascade* untuk menyelaraskan perusahaan dengan tujuan bisnisnya. Namun, mekanisme tersebut tidak memberikan prioritas terhadap pemilihan *IT-related goals*. Oleh sebab itu, penelitian ini dibantu metode *Analytical Hierarchy Process* (AHP) yang berguna untuk memilih prioritas *IT-related goals*. Dari hasil AHP, domain yang digunakan adalah APO01, MEA01, serta APO07. Tujuan penelitian ini untuk mengetahui *current capability level* PDAM, serta menganalisis kesenjangannya dengan *target capability level* yang dipilih yaitu level 2. *Current capability level* PDAM Tirta Patriot dari domain APO01 adalah level 1, MEA01 level 0, serta APO07 level 0, yang berarti ketiga domain tersebut tidak ada yang mencapai *target capability level*. Untuk domain yang tidak mencapai target, diberikan rekomendasi sesuai dengan *work product* yang tidak terpenuhi.
**Kata Kunci:** AHP, COBIT 5, IT governance, PDAM Tirta Patriot.

## I. Introduction

IN today's business world, information technology (IT) has become an essential element of progress, as many companies depend on IT to maintain and accelerate organizational growth [1]. In its development, IT requires

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governance to aid in the use of information technology to accomplish the goal of the organizations [2]. An IT audit helps to assess the organization to function optimally and on target according to its business process [3].

PDAM Tirta Patriot is a BUMD-owned company established following the Bekasi City Regional Regulation number 02 of 2006. PDAM Tirta Patriot has already implemented information systems for business operations, but it also has deficiencies in information management. Including some processes that do not have documented procedures and guidelines. Furthermore, the condition of human resources in PDAM Tirta Patriot is insufficient for improving IT governance due to the lack of reliable staff in the IT unit, which was indicated by having only one reliable IT unit. Also, even though the IT unit was formatted in 2016 [4], but until December 2019, PDAM still relied on an IT consultant who previously managed IT in PDAM Tirta Patriot [5].

To realize the BUMN/BUMD implementation of an independent water supply system, the Institution for the Improvement of the Drinking Water Supply System requires strengthening the management of BUMD to PDAM. So that it is carried out with good governance, such as increasing the effectiveness and efficiency, whether technical, management, or financial, it also necessitates implementing an information system to monitor and evaluate the facilities' efficiency [6].

The existing problems can be identified by measuring the performance of implementing IT governance in the company. From the existing problems and considering the importance of IT in the business process, measurement is needed to maintain IT governance to remain effective following the company's goals [7]. PDAM Tirta Patriot has never conducted an audit for the IT unit. So, this research was conducted to determine the current condition of the IT unit's capabilities in managing IT. An audit for IT governance is needed to evaluate the IT governance that already operated in compliance with the approved standard, guidelines, regulations, and practices [8].

COBIT, ITIL, and ISO/IEC 27000 families are the most widely used today for managing information systems [9]. ITIL is wholly based on IT and how it can be handled to have benefited [10]. If ISO covers relevant guidelines, processes, requirements, and procedures, ITIL only focuses on the logical stage of the process, inscribing what can be performed but not how [11]. Also, ISO 27001 is concerned chiefly with information security, while COBIT covers a broader range of topics [12]. COBIT, because of its broad coverage, can serve as an integrator and can be mapped into enterprise goals – IT-related goals (EGIT) that cover specific areas [11].

Control Objective for Information and Related Technology (COBIT) 5 provides a systematic structure to help businesses meet their IT governance and management goals. It allows IT to be regulated and managed comprehensively for all types of organizations, whether private, non-profit, or public sector. Every organization works in a different context, so it needs customized governance and management system. COBIT 5 has five domains and 37 processes for conducting an audit. The domains are Evaluate, Direct, and Monitor (EDM), Align, Plan, and Organise (APO), Build, Acquire, and Implement (BAI), Deliver, Service, and Support (DSS), and Monitor, Evaluate, and Assess (MEA) [13].

Many authors have selected the COBIT 5 framework when implementing IT governance audits. One of those is the audit at PDAM Tirta Satria by Alief Maulana Hisyam et al... However, there is no systemic approach for selecting the audit domain [14]. Therefore, this research presents an approach that identifies the prioritized IT-related goals that lead to the selecting audit domains that are more related to the company's goals. This approach uses Analytical Hierarchy Process (AHP) using the company's governance objective indicator in a balanced scorecard (BSC) [15]. This research also identifies the current capability level of the IT governance in PDAM Tirta Patriot and provides recommendations based on COBIT 5 for the improvement that is expected to be implemented so that the IT unit can be in optimal condition for its target level. The domains that are used in this research are APO01 (Manage the IT Management Framework), MEA01 (Monitor, Evaluate, and Assess Performance and Conformance), and also APO07 (Manage Human Resource).

## II. Literature Review

### *A. Audit of Information Technology*

Information Technology (IT) is no longer regarded simply as helping the business process but also supporting business strategy to achieve organizational objectives [16]. To assess and ensure the compliance of IT management with the provisions and standards to the organizations, an audit of IT needs to be carried out so that improvements can be made more explicitly under a framework for performance improvements [17].

Control Objectives for Information and Related Technology (COBIT) 5, Information Technology Infrastructure Library (ITIL), and International Organization for Standardization (ISO) 27000 families are the most valuable and common EGIT frameworks currently in use. ISO 270001 is mainly concerned with information security. It covers relevant guidelines, processes, requirements, and procedures. COBIT 5 ensures that governance is achieved through the whole enterprise, including policies, people, information, structures, and applications [10], [11].

COBIT can be mapped to EGIT frameworks that cover specific areas in greater depth, such as ITIL. However, ITIL is entirely focused on IT and how it can be handled to achieve the benefits such as improve service quality and return on investment. There are few flaws in ITIL. Its implementations show a lack of standards, guidelines, and manuals. It also focuses on the logical level of processes, instructing what to do but not how to do it [11].

The organizations have been required to follow many EGIT practices due to increasing market demands and compliance criteria. Organizations are commonly implementing COBIT in practices. COBIT 5 provides a Process Reference Model (PRM), a systemic practice that helps an organization achieve its IT governance and management goals. PRMs are often linked to Process Assessment Model (PAM), which contains all of the information needed to evaluate the capability of the process [10], [11], [12]. COBIT 5 also provides a goals cascade for transforming stakeholder needs into specific enterprise goals, IT-related goals (ITrG), and enabler goals. It efficiently facilitates the alignment between enterprise needs and their IT solution. Goals cascade consists of stakeholder drivers that influence stakeholder needs, and stakeholder needs cascade to enterprise goals, enterprise goals cascade to IT-related goals, and IT-related goals cascade to enabler goals [13].

### *B. COBIT 5 Process Assessment Model*

The process assessment model is the basis for evaluating the capability for each process of COBIT 5. It is made out of 2 dimensions; the process dimension and the capability dimensions. The process dimension consists of classified domains such as Evaluate, Direct, and Monitor (EDM), Align, Plan, and Organise (APO), Build, Acquire, and Implement (BAI), Deliver, Service, and Support (DSS), and Monitor, Evaluate, and Assess (MEA) [18].

Meanwhile, the capability dimension consists of a set of process attributes organized into capability levels. The capability level consists of 6 levels as shown in Table I. Each of the process attributes is evaluated using six rating scales according to ISO/IEC 15504 [7]. Each process attribute is determined by whether the process attributes at that level have been largely or fully achieved as shown in Table III [18].

TABLE I
CAPABILITY LEVEL

| Level | | Description |
|---|---|---|
| Level 0 | Incomplete Process | Process fails to be implemented and has no proof of achievement |
| Level 1 | Performed Process | Process achieves its purpose |
| Level 2 | Managed Process | Process has reached level 1 with the addition of planning, documentation, monitoring |
| Level 3 | Established Process | Process has reached level 2 with the standard and can achieve the purpose |
| Level 4 | Predictable process | Process has reached level 3 but can already be predicted |
| Level 5 | Optimizing Process | Process has reached level 4 and continues to be improved for innovation |

TABLE II
RATING SCALES

| Abbreviation | Description | % Achieved |
|---|---|---|
| N | Not achieved | 0% to 15% achievement |

| | | |
|---|---|---|
| P | Partially achieved | > 15% to 50% achievement |
| L | Largely achieved | > 50% to 85% achievement |
| F | Fully achieved | > 85% to 100% achievement |

TABLE III
PROCESS ATTRIBUTE RATING

| Scale | Process Attribute | Rating |
|---|---|---|
| Level 1 | Process Performance | Largely or fully achieved |
| Level 2 | Process Performance | Fully achieved |
| | Performance Management | Largely or fully achieved |
| | Work Product Management | Largely or fully achieved |

### *C. Analytical Hierarchy Process (AHP)*

AHP is known as an excellent approach for dealing with complex decision-making [19]. It facilitates the systematic assessment of alternatives with multiple objective and evaluation criteria [15]. In this research, the objective is to prioritize the attribute of COBIT 5, which consists of enterprise goals and IT-related goals. The AHP is the effective method for resolving problems with hierarchically criteria and alternatives with multiple objectives [20]. It is expected that AHP will be able to solve a complex problem using a hierarchy of criteria to determine priorities or weights [21]. Furthermore, AHP includes a valuable approach for assessing the consistency of the decision maker's evaluation, therefore decreasing bias in the decision-making process [19]. It requires a pairwise comparison matrix to use AHP [15], which compares entities to decide whether the entities are similar or not [22].

$$M = \begin{bmatrix} 1 & \alpha_{12} & \alpha_{13} & \alpha_{14} \\ \alpha_{21} & 1 & \alpha_{23} & \alpha_{24} \\ \alpha_{31} & \alpha_{32} & 1 & \alpha_{34} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 \end{bmatrix} \quad (1)$$

The example of a pairwise comparison matrix can be seen in the M matrix (1). The M is a four-by-four matrix with rows and columns in order of financial, customer, internal, learning and growth. We can get the ij matrix element ($\alpha$) by comparing the i-th row and j-th column [15]. For example, to obtain the value of $\alpha_{12,}$ we have to compare the first row of the matrix (financial) with the second column of the matrix (customer). For the ii component, it becomes 1 since the same object obtains the same evaluation (e.g., comparing financial to financial). To get the ij matrix elements for this research, it is further discussed in section III, where the matrix will be transformed into Table V. The AHP functions by generating weights for each evaluation criteria [19] which is further discussed in Section III in Table VI. The higher the weight score, the more important it is [19].

## III. RESEARCH METHOD

### *A. The Flowchart of the Research*

The following is the research flowchart that starts with the planning stage, implementation of COBIT 5 goals cascade, process assessment model, and recommendation.

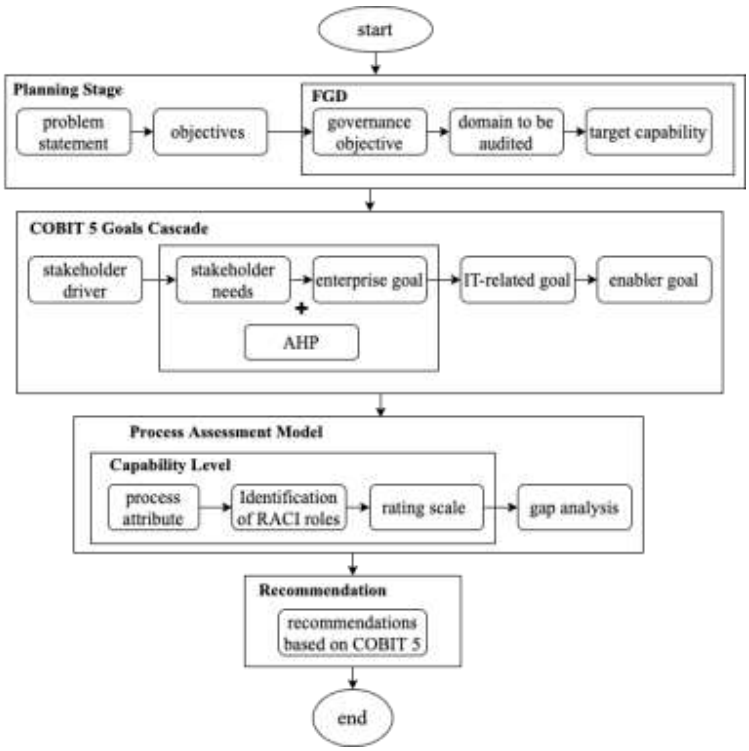


Fig. 1. The Flowchart of the Research

### *B. Planning Stage*

The planning stage is initiated with finding the problem of IT governance in PDAM Tirta Patriot along with the research objectives. Then, Focus Group Discussion (FGD) was conducted with several stakeholders of PDAM Tirta Patriot to determine the governance objective, which is the resource optimization that leads to the selection of audited domain. Also, the target capability level is set in level 2.

### *C. COBIT 5 Goal Cascade*

After determining the governance objective and target level, we collected data about stakeholders' needs to manage their IT governance by following the COBIT 5 Goals Cascade. First, determining the stakeholder needs, and then cascading into enterprise goals. Next, enterprise goals cascade into IT-related goals, and last, cascade them into enabler goals. We then distributed a questionnaire about enterprise goals (EG) provided by ISACA to the stakeholders. There are 12 selected enterprise goals of PDAM Tirta Patriot from the questionnaire: EG-01, EG-03, EG-04, EG-05, EG-06, EG-07, EG-10, EG-11, EG-12, EG-14, EG-15, EG-16 as shown in Attachment 1.

Achievement of enterprise goals requires the number of IT-related outcomes represented by IT-related goals (ITrG) [10]. Therefore, a mapping between EG and ITrG was done by choosing the value that has Primary (P). From the mapping, the selected ITrG are ITrG-01, ITrG-02, ITrG-03, ITrG-04, ITrG-05, ITrG-06, ITrG-07, ITrG-08, ITrG-09, ITrG-10, ITrG-11, ITrG-12, ITrG-14, ITrG-15, ITrG-16 as shown in Attachment 2.

### *D. Analytic Hierarchy Process (AHP)*

ISACA develops enterprise goals by using a balanced scorecard (BSC) in the form of a table, which shows the relationship between the goal of the enterprise and the three main governance objectives; benefit realization, risk optimization, and resource optimization with the value of Primary (P) and Secondary (S) [23]. From the

result of FGD, as shown in Attachment 3, the stakeholder selected the resource optimization for this research. There are four dimensions in BSC, financial, customer, internal, also learning and growth.

There is a relationship between governance objective and each of the BSC dimensions as shown in Attachment 4, with Primary (P), Secondary (S), and none distinctions. P is assigned with 1, S is assigned with 0.5, and none is assigned with 0. For example, to calculate for financial (F) dimension and the governance objective is resource optimization (R), so the equation for this is expressed in the following equation [15].

$$\sum F_R = 1 * (Numberof\ P \in F \cap R) + 0.5 * (Numberof\ S \in F \cap R) \quad (2)$$

There are 4 S in the financial dimension, meaning that (0.5*4) = 2. For customer dimension, there are 2 P and 2 S, that means (1*2) + (0.5*2) = 3. Complete the process until learning and growth dimension. Then, to get the mean of the weight is dividing it by the number of enterprise goals in each dimension.

TABLE IV
A MEASURE OF BSC ATTRIBUTE

| A measure of BSC Attribute | | | |
|---|---|---|---|
| Financial (F) | Customer (C) | Internal (I) | Learning and Growth (LnG) |
| 2 | 3 | 3,5 | 1 |
| Mean of The Weight | | | |
| 2/5 | 3/5 | 3,5/5 | 1/2 |

To use AHP, it needs a pairwise comparison matrix [15]. Value in the matrix is obtained by comparing each of the means of the weight of the BSC dimension. For example, when comparing the mean of financial with mean of customer, the mean of financial is 2/5 and mean of the customer is 3/5. Therefore, (2/5)/(3/5) = (2/3), which means the financial is 2/3 more important than the customer. Complete the calculation until all of the cells are filled. Then, calculate the sum of columns for each dimension.

TABLE V
MATRIX PAIRWISE COMPARISON AND SUMS OF THE COLUMNS

| | Matrix Pairwise Comparison | | | |
|---|---|---|---|---|
| | Financial | Customer | Internal | Learning and Growth |
| Financial | 1 | 2/3 | 2/3,5 | 4/5 |
| Customer | 3/2 | 1 | 3/3,5 | 6/5 |
| Internal | 3,5/2 | 3,5/3 | 1 | 7/5 |
| Learning and Growth | 5/4 | 5/6 | 5/7 | 1 |
| Sum of Columns | 5,5 | 3,666 | 3,142 | 4,4 |

To get the weight of each BSC attribute, divide the value of each cell by their sums of columns. Complete the process until all cells are filled, then calculate the sum of rows. For the weight, divide the sum of rows by 4 (because there are four dimensions) to obtain the average.

TABLE VI
THE WEIGHT OF EACH BSC ATTRIBUTE

| | The Weight of Each BSC Attribute | | | | | |
|---|---|---|---|---|---|---|
| | F | C | I | LnG | sum of rows | weight |
| F | 0,182 | 0,182 | 0,182 | 0,182 | 0,727 | 0,182 |
| C | 0,273 | 0,273 | 0,273 | 0,273 | 1,091 | 0,273 |
| I | 0,318 | 0,455 | 0,318 | 0,318 | 1,409 | 0,352 |
| LnG | 0,227 | 0,227 | 0,227 | 0,227 | 0,909 | 0,227 |

The AHP methodology needs to calculate the Consistency Index (CI) to ensure the resulting weight is reliable.

If the CI is less than 0.1, meaning that the comparison is consistent [15]. In this comparison, the CI value is 0.035534, meaning that this comparison is consistent. The following equation shows the calculated CI.

$$CI = \left(\frac{\lambda_{max} - n}{n-1}\right) = \frac{(4.106602 - 4)}{4-1} = 0.035534 \quad (3)$$

The matrix shows that the highest value of the BSC dimension is the internal dimension, which means that the internal dimension is the first alternative for prioritizing IT-related goals (ITrG).

TABLE VII
PRIORITIZED ITRG

| No. | Dimension | IT-related goals | |
|---|---|---|---|
| 1 | Internal | ITrG-09 | IT agility |
| | | ITrG-10 | Security of information, processing infrastructure, and application |
| | | ITrG-11 | Optimization of IT assets, resource, and capabilities |
| | | ITrG-12 | Enablement and support of business process by integrating applications and technology into business process |
| | | ITrG-14 | Availability of reliable and useful information for decision making |
| | | ITrG-15 | IT compliance with internal policies |

After getting the prioritized ITrG, the next step is mapping the ITrG to the enabler goal by taking the highest value of Primary (P) [24]. The mapping can be done by following COBIT 5 guidelines in the book of Enabling Process by ISACA [23]. The mapping with a high value of P between ITrG to enabler goal can be seen in Table VIII below.

TABLE VIII
A MAPPING BETWEEN ITRG AND ENABLER GOAL

| | ITrG-09 | ITrG-10 | ITrG-11 | ITrG-12 | ITrG-13 | ITrG-14 | ITrG-15 | SUM P |
|---|---|---|---|---|---|---|---|---|
| EDM03 | | P | | | S | S | P | 2 |
| EDM04 | P | | P | | S | | | 2 |
| APO01 | P | S | P | S | S | S | P | 3 |
| APO03 | P | S | P | S | | S | | 2 |
| APO04 | P | | P | S | | S | | 2 |
| APO07 | S | S | P | | P | | S | 2 |
| APO12 | S | P | | | P | S | S | 2 |
| APO13 | | P | | | | P | | 2 |
| BAI04 | S | | P | | S | P | | 2 |
| BAI10 | S | S | P | | | P | S | 2 |
| DSS03 | S | | P | S | | P | S | 2 |
| MEA01 | S | S | P | | S | S | P | 2 |

From the mapping, the domain APO01 has the highest value of P that is equal to 3. However, 11 domains have the same value of P that is equal to 2. In this case, the stakeholders selected the most related domains to the company's needs [25] which are MEA01 and APO07. So, the domains for this research are APO01 (Manage the IT Management Framework), MEA01 (Monitor, Evaluate, and Assess Performance and Conformance), and APO07 (Manage Human Resource).

### *E. Process Assessment Model*

Process assessment is carried out by giving questionnaires to several stakeholders by using RACI Chart. The RACI chart is used to determine respondents on the capability level questionnaire [17]. RACI Chart consists of R (Responsible), A (Accountable), C (Consulted), I (Informed). The organizational structure of PDAM Tirta Patriot does not fully correspond to the RACI chart in COBIT 5. Therefore the mapping results are

representative of the RACI chart in COBIT 5. Here is the mapping between the organizational structure of PDAM Tirta Patriot and the RACI Chart. The details may be found in Attachment 5.

TABLE IX
A MAPPING BETWEEN COBIT 5 STAKEHOLDER AND ORGANIZATIONAL STRUCTURE OF PDAM TIRTA PATRIOT

| COBIT 5 Stakeholders | Organizational Structure of PDAM Tirta Patriot |
|---|---|
| Chief Executive Officer (CEO) | Direktur Utama PDAM Tirta Patriot |
| Head of Human Resource (Head of HR) | Kabag Kepegawaian PDAM Tirta Patriot |
| Compliance | Kabag Pengawas Internal PDAM Tirta Patriot |
| Head of IT Administration | Kasubag IT PDAM Tirta Patriot |

The questionnaires are only given to RACI's roles in each domain process. Here is an example of RACI's roles in the domain process of MEA01 in the organizational structure of PDAM Tirta Patriot. The details may be found in Attachment 6.

TABLE X
THE EXAMPLE OF RACI IN DOMAIN PROCESS MEA01

| Domain | CEO | Head of HR | Compliance | Head of IT Administration |
|---|---|---|---|---|
| MEA01.01 | A | C | C | I |
| MEA01.02 | I | C | | I |
| MEA01.03 | | C | | I |
| MEA01.04 | | C | C | C |
| MEA01.05 | I | C | C | C |

We can analyze the current capability level and the gap between the current capability level and the target capability level for each domain from the questionnaires. The target capability level that stakeholders selected is level 2.

### *F. Recommendation*

After getting the gap analysis, recommendations are given based on the unfulfilled work product/general work product for each process attribute in each domain. Recommendations are expected for each process attribute to meet its target level.

## IV. RESULTS AND DISCUSSION

The following results from the process assessment of the current capability level of IT governance in PDAM Tirta Patriot in the domains APO01, MEA01, and APO07. The assessment process is carried out by matching the answer of the questionnaire with collections of evidence in the form of a work product or generic work product for each domain. The details may be found in Attachment 7.

### *A. Capability Level*

TABLE XI
CAPABILITY LEVEL APO01

| **APO01** | | | | | | |
|---|---|---|---|---|---|---|
| Process Attribute | % Base Practice (% BPs) | % Outcomes (% Os) | Work Product (WPs) | Percentage | Rating | Level |
| 1.1 (Process Performance) | BP01 = 100 %<br>BP02 = 50 %<br>BP03 = 100 %<br>BP04 = 100 %<br>BP05 = 100 % | Os01 ((BP01 + BP02 + BP03 + BP05 + BP07 + BP08)/6) = (100%+50%+100%+100 %)/6 = 58.33 % | WP05, WP06, WP07, WP08, WP01, WP13, WP03, WP04. | (58.33 % + 50%)/ 2 = | L | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | BP06 = 0 %<br>BP07 = 0 %<br>BP08 = 0 % | | Os02 ((BP04 + BP06)/2) = (100%)/2= 50 % | | | | **54.1 %** | | |
| 2.1 (Performance Management) | % Base Practice (% BPs) | | | | | | Percentage | Rating | |
| | GP2.1.1 = 0% | GP2.1.2 = 0% | GP2.1.3 = 0% | GP2.1.4 = 0% | GP2.1.5 = 100% | GP2.1.6 = 0% | (100%)/6 = **16.7**% | P | |

TABLE XII
CAPABILITY LEVEL MEA01

| **MEA01** | | | | | | |
|---|---|---|---|---|---|---|
| Process Attribute | % Base Practice (% BPs) | % Outcomes (% Os) | Work Product (WPs) | Percentage | Rating | Level |
| 1.1 (Process Performance) | BP01 = 0 %<br>BP02 = 0 %<br>BP03 = 0 %<br>BP04 = 100 %<br>BP05 = 100 % | Os01 ((BP01)/1) = 0%<br>Os02 ((BP02)/1) = 0%<br>Os03 ((BP03)/1) = 0%<br>Os04 ((BP05)/1) = 100%<br>Os05 ((BP04)/1) = 100% | WP05, WP06, WP07. | (100% + 100 %)/5 = **40 %** | P | 0 |

TABLE XIII
CAPABILITY LEVEL APO07

| **APO07** | | | | | | |
|---|---|---|---|---|---|---|
| Process Attribute | % Base Practice (% BPs) | % Outcomes (% Os) | Work Product (WPs) | Percentage | Rating | Level |
| 1.1 (Process Performance) | BP01 = 33. 3 %<br>BP02 = 100 %<br>BP03 = 33.3 %<br>BP04 = 33.3 %<br>BP05 = 0 %<br>BP06 = 100 % | Os01 (BP01 + BP02 + BP05)/3 = (33.3% + 100 %)/3 = 44.43 %<br>Os02 ((BP03 + BP04 + BP06)/3 = ((33.3% + 33.3% + 100%)/3 = 55.53% | WP01, WP05, WP08, WP13, WP14, WP15. | (44.43% + 55.53%)/2 = **49.98 %** | P | 0 |

The percentage in the process attribute (PA) is adjusted to the rating scale in Table II. The percentage of domain APO01 PA 1.1 is 54.1%, which means it has rating scale of largely achieved (L). In this case, if the percentage is >50%, it can be continued to the next PA according to the criteria in Table III. Since PA 1.1 is largely achieved so that it can be continued to PA 2.1. PA 2.1 has a percentage of 16.7%, which means it is partially achieved (P) since the rating is partially achieved, so it cannot be continued to PA 2.2.

Next, the percentage of domain MEA01 PA 1.1 is 40%, which means it is partially achieved (P), so it cannot be continued to PA 2.1. The percentage of domain APO07 PA 1.1 is 49.98%, which means it is partially achieved (P), so it cannot be continued to PA 2.1. None of the domains have reached the target capability level, precisely level 2.

### *B. Gap Analysis*

After getting the current capability level of each domain, the gap between the current capability level and target capability level can be seen in Table XIV below.

TABLE XIV
GAP ANALYSIS

| Process Name | Process Capability Level | | | Current Capability Level | Target Capability Level | Gap |
|---|---|---|---|---|---|---|
| | 1 | 2 | | | | |
| | PA 1.1 | PA 2.1 | PA 2.2 | | | |
| APO01 | 54.1 % | 16.7 % | - | 1 | 2 | 1 |
| MEA01 | 40% | - | - | 0 | 2 | 2 |
| APO07 | 49.98% | - | - | 0 | 2 | 2 |

*C. Recommendation*

Recommendations are provided based on the unfulfilled work product (WP) or generic work product (GWP) based on the book of Process Assessment Model (PAM): Using COBIT 5 [26]. Recommendations can be seen in Table XV, Table XVI, and Table XVII below.

TABLE XV
RECOMMENDATION FOR APO01

| **APO01** | | |
|---|---|---|
| Process Attribute | Work Product (WP)/General Work Product (GWP) | Recommendation |
| 1.1 | APO01-WP02 | Take remedial actions for non-compliance to maintain compliance with policies and procedures |
| | APO01-WP09 | Conduct supervisory practices in determining IT roles and responsibilities |
| | APO01-WP10 | Conduct a capability assessment to manage the continual improvement of process business |
| | APO01-WP11 | Conduct process improvement opportunities to manage the continual improvement of business process |
| | APO01-WP12 | Establish performance goals and metrics for continual improvement of business process |
| | APO01-WP14 | Create data classification guidelines to define system ownership |
| | APO01-WP15 | Create data security and control guidelines to define system ownership |
| | APO01-WP16 | Create data integrity procedures to define system ownership |
| 2.1 | APO01-GWP1.1 | Create outline documentation about managing the IT management |
| | APO01-GWP2.1 | Create a detailed process plan of the objectives for managing IT management |
| | APO01-GWP2.2 | Create a detailed process plan of the objectives for managing IT management |
| | APO01-GWP9.2 | Create performance records that provide outcomes for managing IT |
| | APO01-GWP4.3 | Create a quality record of action when performance is not achieved |
| | APO01-GWP1.4 | Create documentation that provides the process owner and RACI |
| | APO01-GWP2.4 | Create a plan that includes performance experience and skill requirement |
| | APO01-GWP1.6 | Create documentation that provides supplier, customer, and RACI |
| | APO01-GWP2.6 | Create a plan that provides details of the communication plan |

TABLE XVI
RECOMMENDATION FOR MEA01

| **MEA01** | | |
|---|---|---|
| Process Attribute | Work Product (WP)/General Work Product (GWP) | Recommendation |
| 1.1 | MEA01-WP01 | Make requirements for monitoring IT activities in the form of daily/weekly reports or in dashboard system |
| | MEA01-WP02 | Establish approved monitoring goals and metrics for monitoring activities |
| | MEA01-WP03 | Set the targets of performance and conformance of monitoring activities |

| | | |
|---|---|---|
| | MEA01-WP04 | After conducting monitoring, then create documents for processed monitoring data |

TABLE XVII
RECOMMENDATION FOR APO07

| **APO07** | | |
|---|---|---|
| Process Attribute | Work Product (WP)/General Work Product (GWP) | Recommendation |
| 1.1 | APO07-WP02 | Establish competency and career development plans for IT employee |
| | APO07-WP03 | Establish personnel sourcing plans for IT employee |
| | APO07-WP04 | Create skills and competencies matrix of each IT employee |
| | APO07-WP06 | Reviewing the IT employee skill and competencies matrix reports |
| | APO07-WP07 | Evaluating employee job performance by making report of IT employee personnel goals |
| | APO07-WP09 | Evaluating employee performance by making improvement plans for IT employee |
| | APO07-WP10 | Make records regarding the inventory of business and IT human resources |
| | APO07-WP11 | Create document about resourcing shortfall analyses |
| | APO07-WP12 | Create records about resource utilization |

## V. CONCLUSION

Based on the assessment process results, PDAM Tirta Patriot has not reached the target capability level, precisely level 2 in the domains APO01, MEA01, and APO07. The current capability level of APO01 is level 1, and both MEA01 and APO07 are in level 0. Therefore, the gap between the current capability level and the target capability level in APO01 is 1, and both MEA01 and APO07 are 2.

Domain APO01 can reach the rating scale of largely achieved (L), meaning that there is evidence of systematic approach and significant achievement, but some weaknesses are related to the attribute. Domain MEA01 and APO07 can reach the rating scale of partially achieved (P), meaning that there is some evidence of an approach and some achievements, but some achievements may be unpredictable. Recommendations are provided based on the unfulfilled work products/general work products that have not been achieved/existed in each process attribute.

Attachment: https://drive.google.com/file/d/1W0L0ckUxEZS2kXFWcwqd1_jKesrk4WLb/view?usp=sharing

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## REFERENCES

[1] L. Al Omari, “IT Governance Evaluation : Adapting and Adopting The COBIT Framework for Public Sector Organisations,” p. 266, 2016.
[2] A. S. Abdul Hakim, Hoga Saragih, “Evaluasi Tata Kelola Teknologi Informasi dengan Framework COBIT 5 di Kementrian ESDM (Studi Kasus pada Pusat Data dan Teknologi Informasi ESDM),” doi: 10.1017/CBO9781107415324.004.
[3] A. Al-Hatmi, “Analysis of ICT Strategic Alignment In a Public Organisation,” p. 306, 2012.
[4] Walikota Bekasi, “Berita daerah kota bekasi,” *Keputusan Walikota Bekasi No 45 Tahun 2016*, pp. 1–18, 2016.
[5] PDAM Tirta Patriot, “Perjanjian Kerjasama PDAM Tirta Patriot Tentang Perpanjangan Kontrak,” Bekasi, 2019.
[6] Badan Peningkatan Penyeleggaraan Sistem Penyediaan Air Minum, “Rencana Strategis Badan Peningkatan Penyeleggaraan Sistem Penyediaan Air Minum,” 2018.
[7] A. D. Andriana, “Audit Tata Kelola Teknologi Informasi ( It Governance ) Di Pdam Tirtawening Kota Bandung Menggunakan Cobit 5 Universitas Komputer Indonesia,” 2014.

[8] I. W. S. Pramana, P. R. Iswardani, and P. A. Mertasana, "IT Governance Evaluation of Hotel Warehouse Section Using the COBIT 5 Framework," *Int. J. Eng. Emerg. Technol.*, vol. 3, no. 2, pp. 5–12, 2018.
[9] Y. Ozdemir, H. Basligil, P. Alcan, and B. M. Kandemirli, "Evaluation and Comparison of Cobit, ITIL and ISO27K1 / 2 Standards Within the Framework of Information Security," *Int. J. Tech. Res. Appl.*, vol. 11, no. 11, pp. 22–24, 2014.
[10] ISACA, "Lessons Learned While Combining COBIT 5 and ITIL." [Online]. Available: https://www.isaca.org/resources/news-and-trends/industry-news/2019/lessons-learned-while-combining-cobit-5-and-itil?__cf_chl_captcha_tk__=8af20d71d8e65061ff051408e4f90a446083d26d-1621921478-0-AeAbJUOmLQwYSgMNtMUG6TEyu43UYhWZJRU53lWjIKIYOCcEz_K05Ptb_WrcDFm. [Accessed: 25-May-2021].
[11] B. Sony and L. Borges, "Comparison of COBIT 5 and ITIL V3 using Semantic Analysis," no. October, 2018.
[12] R. Almeida, R. Lourinho, M. M. Da Silva, and R. Pereira, "A model for assessing COBIT 5 and ISO 27001 simultaneously," *Proceeding - 2018 20th IEEE Int. Conf. Bus. Informatics, CBI 2018*, vol. 1, no. July, pp. 60–69, 2018, DOI: 10.1109/CBI.2018.00016.
[13] J. W. Lainhart, *COBIT 5: A business framework for the governance and management of enterprise IT COBIT 5*. 2012.
[14] A. M. Hisyam, A. Wiratama, and A. D. Arianto, "Evaluasi TI PDAM Tirta Satria Menggunakan Framework Cobit 5 pada Domain MEA ( Monitor , Evaluate , And Assess ) Universitas Amikom Purwokerto," vol. 5, pp. 1–8, 2019.
[15] J. Lee, J. Lee, and K. Lee, "A study on the priority decision making of processes for IT governance based on the IT-related goals of COBIT 5," *Proc. 31st Int. Bus. Inf. Manag. Assoc. Conf. IBIMA 2018 Innov. Manag. Educ. Excell. Through Vis. 2020*, pp. 5445–5455, 2018.
[16] Cynthia Octaria, "Audit Tata Kelola Teknologi Informasi di Universitas Lampung Menggunakan Framework COBIT 5 Fokus Domain EDM (Evaluate, Direct and Monitor)," *Univ. Lampung*, 2017.
[17] D. F. Murad, E. Fernando, M. Irsan, R. R. Kosala, B. Ranti, and S. H. Supangkat, "Implementation of COBIT 5 Framework for Academic Information System Audit Perspective: Evaluate, Direct, and Monitor," *Proc. ICAITI 2018 - 1st Int. Conf. Appl. Inf. Technol. Innov. Toward. A New Paradigm. Des. Assist. Technol. Smart Home Care*, pp. 102–107, 2018, DOI: 10.1109/ICAITI.2018.8686700.
[18] P. Copy and R. R. Sabilillah, "COBIT Self-assessment Guide: Using COBIT 5."
[19] A. Mutiara, Prihandoko, E. Prasetyo, and C. Widya, "Analyzing COBIT 5 IT Audit Framework Implementation Using AHP Methodology," *Int. J. Informatics Vis.*, vol. 1, no. 2, pp. 33–39, 2017, DOI: 10.30630/joiv.1.2.18.
[20] T. L. Saaty, "The Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process," *Vol. VI AHP Ser. , 478 pp., RWS Publ., 2000 (revised). ISBN 0- 9620317-6-3*.
[21] A. Arief, D. Natsir, A. Khairan, and D. I. Sensuse, "IT Governance Audit and Determination of Work Priorities Using Analytical Hierarchy Process: Case Study the Government of North Maluku, Indonesia," *J. Phys. Conf. Ser.*, vol. 1577, no. 1, 2020, DOI: 10.1088/1742-6596/1577/1/012046.
[22] J. Ramík, *Pairwise Comparisons Method: Theory and Applications in Decision Making*, vol. 690. 2020.
[23] ISACA, *Enabling Processes*. 2012.
[24] I. Maghfiroh, Murahartawaty, and R. Mulyana, "Analisis dan Perancangan Tata Kelola TI Menggunakan COBIT 4.1 Domain Deliver And Support (DS) PT XYZ," *J. Sist. Inf. (Journal Inf. Syst.*, vol. 12, pp. 82–89, 2016.
[25] E. Hardiansyah, E. Darwiyanto, and I. Asror, "Audit Tata Kelola Teknologi Informasi Menggunakan Framework COBIT 5 pada Domain DSS dan MEA (Studi Kasus : Bappeda Kabupaten Tulungagung)," *e-Proceeding Eng.*, vol. 6 No. 2, no. 3, pp. 8727–8740, 2019.
[26] ISACA, *COBIT ® Process Assessment Model (PAM): Using COBIT ® 5*. 2013.