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An Evaluation of Control Objective for Information Related Technology (COBIT) 4.0 or 4.1: Systematic Literature Review

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Abstract

Control Objective for Information Related Technology (COBIT 4.0 and 4.1) is one of Indonesia's most popular information technology audit frameworks. This article compares the maturity level of implementing information systems in Indonesia, especially government agencies, educational institutions, health institutions, and companies. The method used is a literature study of the research results from 2015-to 2020 related to COBIT 4.0 and COBIT 4.1. This study's results indicate that the conceptual framework of COBIT 4.1 is more dominant than COBIT 4.0. The Plan and Organize (PO) domain and the Delivery and Support (DS) domain are mainly used to focus studies on government agencies and companies. Meanwhile, the maturity level is dominated by the repeatable but intuitive (level 2) and defined process (level 3), which can be repeated and defined. Thus, studies on information system audit using the COBIT 4.0 and 4.1 conceptual frameworks need to be improved in education and health agencies or other agencies that integrate business processes with information technology.

Keywords: Cobit 4.0; Cobit 4.1; Maturity Levels; Information Technology Audit.

1. INTRODUCTION

The Conceptual Framework of Control Objective for Information Related Technology (COBIT) has been used to analyze the maturity level of information systems adopted by the public, private, and university sectors. The results of previous studies indicate that information system audits using COBIT 4.0 and 4.1 are reviewed in terms of facilities to observe additional features that are useful for various stakeholders in optimizing information systems in public, private and educational institutions [1]. However, the literature study was limited to research from 2010 to 2015. In addition, the mapping of the literature review results was not carried out based explicitly on specific domains and processes according to the characteristics of the COBIT model adopted.

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The use of COBIT as a framework to measure the maturity level of technology use in various institutions has attracted several researchers and practitioners. Nevertheless, the COBIT framework has developed quite rapidly along with technological advances. Unfortunately, not all companies can adopt technology as a support for the company's primary activities. It causes the COBIT framework version to be adapted to the company's characteristics, including the use of information technology. Several previous studies have shown that COBIT 5.0 is more principle-oriented and emphasizes enablers than processes [2]–[4]. It shows that a comprehensive survey of COBIT 4.0 and 4.1 is needed to see how the methods of implementing technology in various institutions are before there are new principles and processes in COBIT 5.0.

Several studies on COBIT showed a significant difference between COBIT 4.0/4.1 and COBIT 5. COBIT 5 was published in 2012 to reduce risk and increase trust associated with utilizing IT generated. COBIT 5 focuses on governance and management, known as Evaluating, Direction, Monitoring (EDM) for the Plans, Builds, Runes, Monitors (PBRM) process. COBIT 5 has five principles: meeting stakeholder needs; covering the organization's activities to the end; implementing an integrated framework; applying a holistic approach; and a clear separation between governance and management. Furthermore, COBIT 5 enables the following features: principles, policies, frameworks; processes; organizational structure; culture, ethics and behavior, information, services, infrastructure and applications, people, skills, and competencies.

This research adopts a literature study approach to map the results of previous research related to information technology audits using COBIT 4.0 and 4.1 in Indonesia. Specifically, the classification is carried out in detail based on the domain and process in each Cobit concept framework. Furthermore, the maturity level of implementation is classified based on institutional characteristics: educational institutions, non-profit organizations, companies, and government. This study aims to analyze differences in the maturity level of information technology implementation in Indonesia based on the COBIT 4.0 and 4.1 conceptual frameworks.

The COBIT framework has developed in line with technological developments and company needs. It has implications for adding indicators to the COBIT framework. There are differences in facilities in the COBIT 4.0 domain published in 2005, with COBIT 4.1 published in 2007, namely in governance and compliance. COBIT 4.0 or 4.1 has the principle of providing information for organizations by managing and controlling Information Technology resources (Applications, Information, Infrastructure, and People). COBIT provides an IT governance framework through a Detailed Control Objective (DCO) to optimize policies, plans, procedures, and organizational structure. It consists of four domains, namely Planning and Organization (PO), Acquisition and

Implementation (AI), Delivery and Support (DS), and Monitoring and Evaluate (ME).

Studies on information technology audits using COBIT need to be analyzed periodically. This study conducted a literature study from 2015-to 2020. Previous research that examines information technology audits and adopts the COBIT conceptual framework is limited to several domains and processes used. [5] conducted an audit of information technology in one of the Indonesian Government Agencies by reviewing the following five parts: Evaluate, Direct, Monitor (EDM); Align, Plan and Organize (APO); Build, Acquire and Implement (BAI); Deliver, Service, and Support (DSS), and Monitor, Evaluate and Assess (MEA). The study incorporates COBIT 4.1 and COBIT 5 in the audit process. Based on the audit results of 37 operations in five domains, the research results show that the institution being studied has applied information technology according to the COBIT 4.1 and COBIT 5 conceptual frameworks. It indicates that each researcher can adopt a flexible version of the COBIT conceptual framework to analyze maturity levels. Implementation of information technology based on domain and process.

Several previous studies can be grouped based on the characteristics of institutions such as government institutions, educational institutions, health institutions, and companies. The analysis of the maturity level of information technology implementation using the COBIT conceptual framework in educational institutions can be explicitly observed in the academic and library administrative systems [6]–[14]. Meanwhile, the analysis of the maturity level of COBIT-based information technology implementation in companies can be classified based on the management system [15]–[19].

The COBIT conceptual framework measures maturity levels in government and health institutions [19]–[25]. The discussion about the COBIT concept is very varied. Some researchers focus on particular domains [26]. On the other hand, previous studies have elaborated the COBIT conceptual framework with decision-making methods [25]. The literature study in this article is limited to using references that conduct information technology audit studies using the COBIT 4.0 and 4.1 frameworks in Indonesia. Therefore, recommendations for future research continued by reviewing the maturity level of information technology implementation using COBIT 5 in educational institutions, government, health, and companies. Furthermore, a research gap analysis is carried out that needs to be improved.

The output of the literature study related to the use of the COBIT 4.0 and 4.1 concept frameworks in information technology audits provides an overview of the maturity level of an institution with particular processes in implementing information technology. Also, it gives an overview of research gaps in specific

institutions that need to be adjusted to the domain and strategy to improve performance. Thus, this literature study can contribute to the development of knowledge in information technology, particularly related to information technology audits.

2. METHODS

This study uses a Systematic Literature Review (SLR) approach to examine a scientific issue comprehensively based on a specific study topic. SLR can provide an overview of the development of a scientific study and provide clues about the gaps in the literature that need to be completed by researchers. [27] showed that SLR in information technology study produces a clear visualization of research trends, including methods and algorithms in various kinds of information systems studies. In addition, [28] showed that SLR could provide an overview of the trend approach in information systems research. Therefore, this study adopts SLR in identifying trends in the use of COBIT Framework 4.0 and 4.1 in various forms of evaluating the results of technology implementation in multiple companies based on the Indonesian context. Meanwhile, the stages in the SLR process can be seen in the following figure.

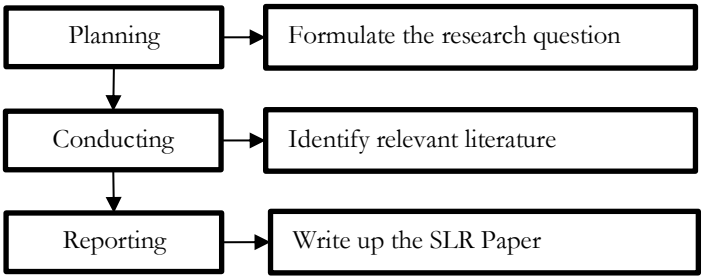

Figure 1. Stage of *SLR of this Research* [29]

At the planning stage, the research question from the SLR process is how are the trends in the use of COBIT 4.0 and 4.1 in Indonesia, based on a literature review from 2015-2020, which is used as a framework to evaluate technology implementation in various institutions? Mainly the most dominant institutions studied related to COBIT 4.0 and COBIT 4.1. Based on these research questions, the literature identified with the keywords COBIT 4.0 and COBIT 4.1 was 122 articles from garuda.kemdikbud.go.id platform at the conducting stage. Furthermore, each article is classified based on the focus of the study on PO (Plan and Organize), AI (Acquire and Implement), DS (Deliver and Support), and ME (Monitor and Evaluate) facilities. Each domain has a different level of maturity according to the institutional context, ranging from 0-Non-Existent, 1-Initial/Adhoc, 2-Repeatable but Intuitive, 3-Defined Process, 4-Managed and

Measurable, 5- Optimal. After carrying out the classification process based on the institution's characteristics, the reporting process shows that each institution in Indonesia has a domain with varying levels of maturity.

COBIT has developed to a better version from year to year, such as COBIT 5 and COBIT 2019, it is necessary to evaluate the implementation results of COBIT 4.0 and 4.1. Therefore, research questions are formulated at the planning stage to determine the study's method, limitations, and primary focus on COBIT. The technique used is a literature study using a Systematic Literature Review (SLR) approach. Meanwhile, the scope of the discussion is limited to the topic of the COBIT 4.0 and COBIT 4.1 frameworks in Indonesia. The Systematic Literature Review (SLR) is carried out in the implementation phase through electronic database searches on the Garuda portal (garuda.ristekbrin.go.id). The keywords used are COBIT, COBIT 4.0, and COBIT 4.1. The Systematic Literature Review (SLR) can identify research trends in Indonesia's COBIT 4.0 and 4.1 frameworks implementation. Meanwhile, the selection and classification of articles are carried out based on the aspects of relevance and coherence. The analysis results are described narratively in scientific papers at the reporting stage.

3. RESULTS AND DISCUSSION

3.1 COBIT Framework

COBIT is one method to reconstruct and integrate information technology according to the organization's needs [30]. OBIT was developed to meet the organizational needs to optimize the control function and provide alternative strategies to manage business risk [18]. COBIT can be used as a guide for stakeholders in an organization to integrate technology into business processes [31]. In addition, [10] showed that COBIT also provides several indicators that can be classified based on domains such as Planning and Organization (PO), Delivery and Support (DS); Monitoring and Evaluation (ME); and Acquisition and Implementation (AI). The COBIT framework consists of three levels as control objectives, starting from the lowest (activities), middle (process), and upper (domain) levels.

COBIT was introduced by the Information System and Control Association (ICASA) to manage IT Governance in various agencies[21]. Specifically, the PO domain provides direction for realizing AI and service delivery (DS) solutions. AI provides the solution and delivers it so that it can be turned into a service, while DS accepts the key and makes it more beneficial to end-users. Meanwhile, ME monitors the entire process to ensure that the activities follow the flow [12], [25]. The COBIT framework can be described as a cube consisting of Information Technology processes, information criteria, and IT resources, as shown in the following figure.

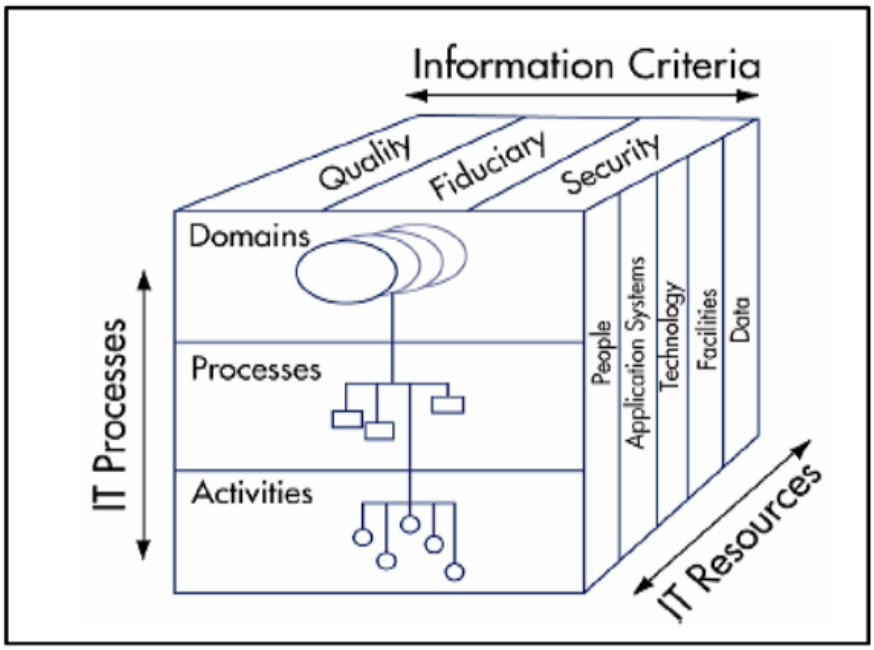

Figure 1. COBIT Box

Figure 1 shows that the Information Technology process consists of Domains, Processes, and Activities. Meanwhile, the information criteria can be in the form of quality, fiduciary, and security. Meanwhile, Information Technology Resources can be in the form of people, application systems, technology, facilities, and data. [1] argues that the use of COBIT in an organization has the following roles: value creation through the effective and innovative use of IT in the organization; IT user satisfaction in business and services; compliance with laws, regulations, contractual agreements, and internal policies; and improving the relationship between business needs and objectives.

In its development, COBIT continues to be updated by adding features or facilities that follow the business processes, both profit and not-for-profit. It is a consideration for COBIT users to adopt the type or version of COBIT according to the needs of each institution. COBIT provides objective control in a language easily understood by IT operations. Institutions will choose control by taking into account the needs of their respective organizations. Furthermore, so that the IT management process can be sustainable, each institution will evaluate the current actual condition (existing) to identify the maturity level of information technology implementation as standard and indicators in the COBIT concept framework [15], [20]. The following is a table of the COBIT 4.1 Maturity Model, which is used to measure the existing conditions and gaps in the achievement targets of each company's maturity level.

Tabel 1. Maturity Model of COBIT [32]

Level	Deskripsi Kematangan
0-Non-Existent	There is no identifiable process, and the company does not know if there are problems that need to be resolved.
1-Initial/Adhoc	Some events are seen as urgent problems and need to be handled by the company. No process or standard is ad hoc and tends to be completed by individuals. Unorganized management
2-Repeatable but Intuitive	The process has evolved, and different actors carry out the same procedure. There has been no formal communication or training regarding standard procedures according to the organization's main tasks and individual functions. There is a firm belief in the ability of individuals, so mistakes are very likely to occur.
3-Defined Process	Procedures or standards have been documented and communicated through training, but implementation is left to each individual, so deviations are not identified. The process is not perfect, and it's just a formality.
4-Managed and Measurable	Able to monitor compliance with procedures and take action on ineffective behavior. Processes constantly improve and provide good practice, but tools are used partially.
5-Optimal	The process is improved at the optimal practice level, following the results of maturity modeling with other companies. IT is used to integrate or automate workflows, providing tools to improve.

Table 1 is the maturity level of IT implementation based on the COBIT 4.1 framework, which can be classified into five levels. Several studies on information technology audits that use the COBIT framework to identify maturity levels show mixed results. Likewise, [6] how the average maturity level of the PO and DS domains in security management and security services at STIKOM Bali is at level one or initialization. In addition, [11], in evaluating the application of information systems and information technology at STMIK AMIKOM Purwokerto, adopted the COBIT concept framework to review the maturity level of IT implementation in the PO and ME domains, with existing conditions at level three or defined and measurable (managed). Thus, the gap between the current needs and the requirements expected by the institution in optimizing information technology-based business processes can be seen.

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3.1 COBIT 4.0 Framework

The difference between COBIT 4.0 and COBIT 4.1 lies in governance and compliance. COBIT 4.0 is more dominant as an information provider for organizations by managing and controlling IT resources (applications, information, infrastructure, and people) through a structured process. To achieve organizational goals in managing and controlling resources, policies, plans, procedures, and organizational structures must be adequately designed. COBIT adds a more specific guideline (Detailed Control Objective) which consists of 34 IT control processes, as shown in Table 2 below.

Tabel 2. Domain and Processes COBIT 4.0 (ITGI [33])

Domain and Processes COBIT 4.0	
PO (Plan and Organize)	**AI (Acquire and Implement)**
1. Define a strategic IT Plan Manage strategy	1. Identify Automated Solutions
2. Define the information architecture	2. Acquire and Maintain Application Sofware
3. Determine Technological Direction	3. Acquire and Maintain Technological Infrastructure
4. Define the IT Processes, Organization, and Relationships	4. Enable Operation and Use
5. Manage the IT Investment	5. Procure IT Resource
6. Communicate Management Aims and Direction	6. Manage Changes
7. Manage IT Human Resources	7. Install and Accredit Solutions and Changes
8. Manage Quality	
9. Assets and Manage IT Risk	
10. Manage Projects	
DS (Deliver and Support)	**ME (Monitor and Evaluate)**
1. Define and Manage Service Levels	1. Monitor and Evaluate IT Performance
2. Manage Third-Party Service	2. Monitor and Evaluate Internal Control
3. Manage Performance and Capacity	3. Ensure Compliance with External Requirements
4. Ensure Continous Service	4. Provide IT Governance
5. Ensure System Security	
6. Identify and Allocate Costs	
7. Educate and Train Users	
8. Manage Service Desk Incidents	
9. Manage the Configuration	
10. Manage Problems	
11. Manage Data	
12. Manage the Physical Environment	
13. Manage Operations	

Table 2 is the domain and process used as a conceptual framework to identify the existing conditions of an institution's activities that use Information Technology

in business process management. Several researchers discuss the implementation of IT in companies based on the principles of IT Governance. [34] argues that the benefits of IT governance are ensuring that IT aligns with the company and realizes the promised blessings of implementing IT. In addition, the use of IT increases the opportunity to maximize profits with responsible use of resources. However, there are several problems in determining the direction of IT governance, namely matters relating to strategic alignment, value delivery, risk management, resource management, and performance measurement. However, vertical harmonization between achieving a company's business objectives must be integrated with decision-making mechanisms [35].

Studies on information technology audits using COBIT 4.0 in 2015-2020 are minimal in quantity compared to the COBIT 4.1 conceptual framework. However, the results of previous studies can be classified based on the institution's domain and process, institution, and existing condition in terms of maturity level. COBIT 4.0 in Information Technology audits is more dominant in companies' DS and ME domains [35], [36]. In addition, maturity levels are at levels two and three, i.e., repeatable and assignable (levels 2 and 3) [37], [38]. Based on the COBIT 4.0 conceptual framework, the DS and ME aspects need to be increased to a regulated and optimized level (Levels 4 & 5). It is different from [39], which examines the domain of OD in educational institutions, with the maturity level at the regulated level—and optimized (levels 4 and 5). Furthermore, [34] examines the domains of OD and AI in companies, but the maturity level is at the repeatable and manageable or measurable level (levels 2 and 4). It shows that the implementation of Information Technology using COBIT 4.0 is contextual, according to the institution's characteristics (profit and non-profit).

3.2 COBIT 4.1 Framework

In 2015, COBIT 4.1 was adopted as a conceptual framework to measure the maturity level of IT implementation in companies based on four domains, namely PO, DS, AI, and ME [40], [41]. In addition, several researchers only studied three PO domains, DS and AI [42], two domains, namely PO and ME [43], and even one domain, namely PO [44] and DS domain [45]. he maturity level of IT implementation is at different levels, namely level 2 or can be repeated [40], [42], level 3 [40], [43]–[45], dan level 4 [41].

Apart from companies, educational institutions are also popular case studies among academics. Previous research on information technology audits using the COBIT 4.1 conceptual framework in educational institutions is diverse [46]–[50]. The discussion of domains in educational institutions is very diverse, as are researchers who study four domains, namely PO, DS, AI, and ME [47], three domains, namely PO, DS, and AI [50], and one domain namely DS [48], [49]. used on the results of the analysis of maturity levels in educational institutions, there

are three institutions with existing conditions at level 2 or can be repeated [46], [47], [49], and level 3 or regulated [48], [50]. In 2015, only one study addressed four domains, namely PO, DS, AI, and ME, in health institutions with maturity levels at levels 2 and 3, i.e., repeatable and manageable [51].

In 2016, the popularity of academic studies related to COBIT 4.1 in companies, government institutions, and education was quite balanced in terms of quantity. There are three previous studies with case studies in companies [52]–[54]. However, not all domains (PO, DS, AI, ME) in the COBIT 4.1 concept framework are explicitly discussed. [52] discusses the parts of PO, DS, AI, and ME. However, [54] only discussed the PO and AI fields. Meanwhile, [53] only discussed the DS domain. The maturity level of the study results of various cases in the company is at level 2 (initialization).

In implementing COBIT 4.1 in government institutions, [55] discuss four domains (PO, DS, AI, and ME). In addition, two previous studies were limited to examining two fields. [56] studied the DS and AI domains. Meanwhile, [55] looked at the DS and ME domains. Meanwhile, [57] only studied one part, namely PO. Based on the maturity level of IT implementation in government institutions, there is one research result that shows the existing conditions at levels 3 and 4 (defined and regulated) [56] while the other three are at level 2 (repeatable) [57]–[59].

In 2017, the use of COBIT 4.1 as a conceptual framework for information technology audits was more dominant in educational institutions [60]–[63] and companies [64]–[66]. Only a few studies in government institutions [67], [68], and health institutions [69]. On the other hand, the DS domain is dominantly used as the focus of the study to measure the maturity level of information technology implementation [70]–[72]. Meanwhile, the maturity level is dominated by level 2 (can be repeated) [73]–[79].

In 2018, studies on the implementation of COBIT 4.1 were more dominant in companies [80]–[86] compared to government institutions [87]–[91]. In addition, the DS domain has become a famous study to identify the maturity level of Information Technology implementation [92]–[96]. Meanwhile, the most dominant maturity levels in 2018 were at levels two and three (can be repeated and set).

In 2019, research on the implementation of COBIT 4.1 was more dominant in government and educational institutions. Several previous studies in government institutions specifically examined the domains of OD and AI [97]–[103]. Meanwhile, research on COBIT 4.1 in educational institutions primarily discusses the DS and ME domains [104]–[111]. Only a few studies have examined COBIT 4.1 in companies and healthcare institutions [112]–[116]. Meanwhile, the maturity

level of information technology implementation is dominated by levels 1 and 2 (initialization and repeatable).

In 2020, research on COBIT 4.1 in educational institutions concerned the PO and DS domains [117], [118]. Meanwhile, studies on COBIT 4.1 in companies can be observed from the PO and AI domains [119], [120]. Meanwhile, studies on implementing the COBIT 4.1 conceptual framework in health institutions can be considered based on the PO, DS, and AI domains [121], [122]. The maturity level of IT implementation in each agency is very diverse, some are at level 2 (can be repeated) [119], [121], level 3 (defined) [118], [120], [122] and level 3 (set) [117].

Based on previous research descriptions regarding using the COBIT 4.1 conceptual framework from 2015-to 2020, the most dominant agencies studied are government agencies and companies, while education and health institutions still need to be improved. In addition, the most checked domains are PO and DS, according to case studies in each institution. Meanwhile, the maturity level of information technology implementation is more dominant at level 2 (can be repeated) and level 3 (set).

4. CONCLUSION

Based on a literature study on the COBIT 4.0 and 4.1 concept frameworks in information technology audits in Indonesia from 2015-to 2020, the most dominant institutions studied by previous researchers were companies and governments. Meanwhile, the domains and processes most studied were OD and DS. The maturity level of IT implementation is dominant at levels 2 and 3 (repeatable, defined, and measurable). Meanwhile, educational and health institutions are still very minimal. Therefore, this literature study recommends that studies of educational and health institutions be improved, especially in analyzing the domains and processes of OD, DS, AI, and ME and measuring the maturity level of IT implementation using the COBIT concept framework. The following recommendation is to use the COBIT 5.0 conceptual framework to be compared with COBIT 4.0/4.1 to analyze differences in facilities in measuring the maturity level of IT implementation in various institutions.

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