Implementation of COBIT 2019 Framework in Governance of Computer-Based Test (CBT) Examination System at SMK Muhammadiyah 10 Kisaran

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Abstract

This study aims to analyze the current capability level of CBT system IT governance, identify gaps, and design an improvement plan using COBIT 2019 at SMK Muhammadiyah 10 Kisaran. Using qualitative method with case study approach, data were collected through interviews with six key informants, observation, and documentation study. Results show that governance capability levels are very low: APO12 and MEA03 at Level 0 (Incomplete); APO13, BAI03, DSS02, and DSS06 at Level 1 (Performed). Significant gaps exist in policy documentation, service management, and performance monitoring. A prioritized improvement plan was designed focusing on: (1) forming an IT Governance Team with basic security policies; (2) developing standardized CBT SOPs; and (3) implementing an online incident reporting form. The study concludes that COBIT 2019 can be effectively adapted for small-scale educational organizations, providing a realistic roadmap from ad-hoc to managed governance.

***Keywords**:* COBIT 2019, IT Governance, Computer Based Test (CBT), Vocational High School, IT Governance Framework, Capability Level

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Introduction

The era of the Industrial Revolution 4.0 and Society 5.0 has driven massive digital transformation across various sectors of life, including education. Information Technology (IT) is no longer viewed merely as a supporting tool but has become the backbone of modernization and quality improvement in educational services. One concrete manifestation of digital transformation in educational assessment is the implementation of computer-based testing, known as Computer-Based Test (CBT) [1].

CBT systems offer several transformational advantages compared to conventional paperbased testing methods, including time efficiency in scoring and grade processing, high assessment accuracy by eliminating human error factors, long-term operational cost savings, flexibility in question presentation, and the ability to conduct real-time examinations with immediately available results [2]. Furthermore, CBT also plays a role in familiarizing students with digital examination environments, aligning with the computer-based national examinations implemented by the government.

SMK Muhammadiyah 10 Kisaran, a vocational secondary education institution focused on preparing skilled workforce ready to compete in the industrial world, has initiated CBT system implementation since the 2021/2022 academic year. However, preliminary observations and informal interviews with system administrators revealed significant operational challenges: (1) frequent technical disruptions to servers or network infrastructure during examinations causing downtime; (2) absence of structured and scheduled backup and recovery procedures; (3) examination procedures that remain ad-hoc and heavily dependent on a single IT coordinator, creating a single point of failure; (4) lack of adequate technical training for supervising teachers; and (5) data security vulnerabilities [3].

These problems indicate fundamental weaknesses in IT governance and management. According to Weill and Ross [4], IT governance is defined as a framework specifying decisionmaking rights and accountability mechanisms to encourage desired behavior in IT utilization. Without proper IT governance, technology investments risk failing to deliver optimal value and may even become sources of loss due to prolonged downtime, critical data loss, security breaches, and user dissatisfaction [5].

To assess, manage, and improve IT governance systematically, a comprehensive, standardized, and internationally recognized framework is required. COBIT (Control Objectives for Information and Related Technologies) 2019 is an updated framework designed to help organizations create, implement, monitor, and improve governance over information technology and its assets [6]. COBIT 2019's key advantage lies in its generic, flexible, and customizable nature based on each organization's unique context, including non-profit and small-to-medium-sized organizations like schools [7].

Several previous academic studies have applied the COBIT framework in educational settings. For instance, Prasetyo and Rosiyadi [8] analyzed e-learning system governance at a university using COBIT 5, while Siswanto and Kurniawan [9] designed governance for online examination systems in secondary schools. However, in-depth and specific exploration of COBIT 2019 implementation—considering design factors and focusing on CBT systems in Vocational High Schools—remains relatively limited.

Based on the above description, this research aims to answer the need for a structured IT governance approach for the CBT system at SMK Muhammadiyah 10 Kisaran. Specifically, this study seeks to: (1) analyze the current capability level of CBT system IT governance based on key domains in COBIT 2019; (2) identify gaps between actual practices and expected standards; and (3) design a prioritized, realistic, and contextual improvement pl.

Literature Review A. IT Governance Concept

IT Governance is an integral part of corporate governance that specifically focuses on managing IT resources to support organizational goal achievement [5]. Weill and Ross [4] define it as a framework that determines decision-making rights and accountability mechanisms to encourage desired behavior in IT utilization. In non-profit organizations like schools, IT governance is crucial to ensure that IT investments and operations generate optimal value through improved quality of educational processes.

The main principles of IT governance include: (1) Strategic Alignment between IT goals and organizational goals; (2) Value Delivery ensuring IT provides tangible benefits; (3) Risk Management over IT assets and operations; (4) Resource Management; and (5) Performance Measurement for continuous evaluation [10].

B. COBIT 2019 Framework

COBIT 2019 is the latest IT governance and management framework released by ISACA, designed to be comprehensive, flexible, and customizable according to organizational context [6]. The core components of COBIT 2019 include:

1. Governance System Principles: Six principles: (a) providing value for stakeholders; (b) holistic approach; (c) dynamic framework; (d) separation of governance from management; (e) tailored to organizational needs; and (f) end-to-end governance system.
2. Governance and Management Objectives: 40 objectives grouped into two categories:
   a. EDM (Evaluate, Direct, Monitor): 5 governance objectives
   b. Management Objectives: APO (13 objectives), BAI (10 objectives), DSS (6 objectives), MEA (6 objectives)
   c. Design Factors: Key innovation enabling customization. Factors such as Enterprise Strategy, Operating Model, Organization Size, and Maturity Model help organizations select and prioritize the most relevant COBIT objectives [7].
3. Process Capability Model: Adopts a 0-5 scale from CMMI: Level 0 (Incomplete), Level 1 (Performed), Level 2 (Managed), Level 3 (Established), Level 4 (Predictable), Level 5 (Optimizing).

C. Computer-Based Test (CBT) System

CBT is an assessment system where question presentation, participant interaction, and answer evaluation are conducted entirely through computer devices [11]. CBT implementation transforms the paradigm from paper-based to digital assessment, offering advantages in scoring efficiency, accuracy, long-term costs, and multimedia question capabilities.

However, implementation in schools faces challenges such as limited infrastructure readiness, dependence on specific technical personnel, lack of standard operating procedures, and risks to data security and system availability [2].

D. Previous Relevant Research

Several previous studies relevant to this research include:

1. Prasetyo & Rosiyadi [8]: E-learning governance analysis using COBIT 5 at a university,
2. Siswanto & Kurniawan [9]: IT governance design for online examination systems in secondary schools using COBIT 5,
3. Febriyanto et al. [12]: COBIT 2019 implementation for digital library system governance audit,
4. Santoso et al. [13]: COBIT 5 application to improve information security for student grade data.

E. Research Gap

Based on the literature review, research gaps addressed by this study are: (1) limited application of COBIT 2019 with design factors in Vocational High School contexts; (2) deeper focus on DSS domain processes directly related to daily CBT operational reliability; and (3) explicit connection between operational CBT challenges and formal governance framework solutions.

Research Methodology

This research is a qualitative study using a single intrinsic case study approach [11]. It was conducted at SMK Muhammadiyah 10 Kisaran, Indonesia, from July to October 2025. The population includes all stakeholders involved with the CBT system. Using purposive and snowball sampling [12], 6 (six) key informants were selected: (IK-1) Head Master, (IK-2) Vice Principal for Curriculum, (IK-3) IT Coordinator, (IK-4 & IK-5) Subject Teachers, and (IK-6) Academic Administration Staff.

Data was collected using triangulation of sources and methods [13]:

1) In-depth semi-structured interviews guided by a protocol based on selected COBIT 2019 processes (APO12, APO13, BAI03, DSS02, DSS06, MEA03).
2) Direct non-participant observation of the infrastructure, exam execution, and user interaction.
3) Documentation study of technical specs, schedules, and any existing records.

Data analysis followed the interactive model by Miles, Huberman, & Saldaña [14]: data reduction (transcription, coding, categorization by COBIT process), data display (narrative, matrices, tables), and conclusion drawing/verification (triangulation, member checking). The capability level for each process was determined by comparing evidence against CMMI attributes [9], and a gap analysis was performed by comparing current practices against COBIT 2019 base practices [5].

Results

Profile and Current State

The CBT system at SMK Muhammadiyah 10 Kisaran uses a local server, 30 client PCs, and "Bimasoft" application. The business process is simple: IT Coordinator prepares system (inputting questions manually from .doc files) → Exam Conducted → Results exported to Excel for teachers. No formal procedures or policies exist.

Capability Level Assessment

Table 1 shows the assessment results for the six selected COBIT 2019 processes.

Table 1. Capability Level Assessment of CBT System Governance

No	COBIT Process	Capability Level	Key Evidence Summary
1	APO12 (Manage Risk)	0 (Incomplete)	No formal risk identification. Risks addressed only reactively. No risk register. (IK-1: "We solve problems when they come.")
2	APO13 (Manage Security)	1 (Performed)	Password shared. Manual, unscheduled backups (1-2 months) on HDD next to server. No tested restore. No written policy.
3	BAI03 (Manage Solutions ID)	1 (Performed)	Software chosen based on peer recommendation. No requirements analysis. Installation by trialand-error.

4	DSS02 (Manage Service Requests)	1 (Performed)	Incident handling reactive via WhatsApp. No logging, no response time. (IK-3: "No records, I just fix it myself.")
5	DSS06 (Manage Business Controls)	1 (Performed)	Exam procedures communicated orally in 5-minute briefing. No written SOP. (IK-4: "If error, contact [IK-3] directly.")
6	MEA03 (Monitor Compliance)	0 (Incomplete)	No system performance monitoring. Evaluation based on "whether exam finished." No user satisfaction surveys. (IK-2: "If it runs, it's good.")



Figure 1. Analyzed COBIT 2019 Process Capability Levels

Gap Analysis: A significant gap exists between current practices and COBIT 2019 base practices across all processes. The most critical gaps are: (1) absence of documented policies/SOPs, (2) unstructured service management, and (3) no performance monitoring mechanisms.

Improvement Plan: Leveraging COBIT 2019 design factors (small size, limited resources [5]), a prioritized improvement plan was designed to target capability Level 2 (Managed).

Table 2. Prioritized Improvement Plan (Adjusted for School Context)

Priority	COBIT Process	Improvement Action	Expected Outcome & Target Level
HIGH	APO13 & APO12	1. Form simple IT Governance Team. 2. Draft basic IT Security Policy & Simple Contingency Plan. 3. Implement **automated weekly backup** and test restore.	Level 2 (Managed)
HIGH	DSS06	1. Develop comprehensive **CBT Exam SOP** (preparation, execution, post-exam). 2. Conduct SOP briefing/proctoring training for all potential proctors.	Level 2 (Managed)

MEDIUM	DSS02	1. Implement simple incident log (e.g., Google Form). 2. Set informal SLA: max 30-minute response for critical incidents during exam.	Level 2 (Managed)
LOW	MEA03 & BAI03	1. Develop short user satisfaction survey (Google Form). 2. Create simple checklist for future software requirements analysis.	Level 1 → 2

Discussion

The findings confirm Propositions 1 & 2, showing very low capability (Level 0/1) and significant gaps, consistent with other studies in small educational organizations [6][7]. The diagnosis reveals that technical complaints are symptoms of weak governance processes (e.g., DSS02 for incident management). The innovation of this study is using Design Factors to create a realistic plan (Proposition 3), avoiding expensive or complex solutions by recommending tools like Google Forms and open-source backup software. The proposed actions directly address gaps (Proposition 4), aiming to improve reliability, security, and ultimately, the value of the CBT system for the school.

Conclusion

This research concludes that the IT governance capability level for the CBT system at SMK Muhammadiyah 10 Kisaran is very low (Level 0-1) across all assessed processes (APO12, APO13, BAI03, DSS02, DSS06, MEA03). Significant gaps exist compared to COBIT 2019 standards, particularly in policy documentation, service management, and monitoring. Consequently, a realistic, prioritized improvement plan was designed using COBIT 2019 design factors, focusing on achieving Level 2 (Managed) through practical actions like forming a small IT team, creating basic SOPs, and implementing an automated backup schedule and an online incident log. This study demonstrates that COBIT 2019 is adaptable for small educational institutions. The main limitation is that this research is only an analysis and design phase; implementation and evaluation were not conducted. The primary implication is a clear, actionable roadmap for the school. Future research should perform action research to implement and validate the effectiveness of this improvement plan, and further develop simplified IT governance models for schools.

References

[1] P. Weill and J. W. Ross, IT Governance: How Top Performers Manage IT Decision Rights for Superior Results. Boston, MA, USA: Harvard Business School Press, 2004.

[2] O. Gamayunova and A. Khomutenko, “Advantages and disadvantages of computer-based testing,” E3S Web of Conferences, vol. 166, p. 10012, 2020, doi: 10.1051/e3sconf/202016610012.

[3] S. De Haes and W. Van Grembergen, Enterprise Governance of Information Technology: Achieving Alignment and Value, Featuring COBIT 5, 2nd ed. Springer, 2015.

[4] ISACA, COBIT 2019 Framework: Introduction and Methodology. Schaumburg, IL, USA: ISACA, 2018.

[5] ISACA, COBIT 2019 Design Guide: Designing an Information and Technology Governance Solution. Schaumburg, IL, USA: ISACA, 2019.

[6] A. Prasetyo and D. Rosiyadi, “Analisis tata kelola TI menggunakan framework COBIT 5 pada sistem e-learning (Studi kasus: Universitas X),” Jurnal Teknologi Informasi dan Ilmu Komputer, vol. 7, no. 2, pp. 245–254, 2020.
[7] A. Siswanto and Y. Kurniawan, “Perancangan tata kelola TI untuk sistem ujian online berbasis COBIT 5 di sekolah menengah,” Jurnal Edukasi dan Penelitian Informatika, vol. 7, no. 1, pp. 87–94, 2021.
[8] G. L. Lunardi, A. C. G. Maçada, and J. L. Becker, “The impact of IT governance on organizational performance: A study in Brazilian banks,” Journal of Information Systems, vol. 28, no. 2, pp. 1–22, 2014.
[9] CMMI Institute, CMMI for Development, Version 2.0. CMMI Institute, 2018.
[10] D. Seo and J. Huh, “Computer-based testing: A comprehensive review of the literature,” Journal of Educational Technology Systems, vol. 47, no. 3, pp. 332–351, 2019.
[11] R. K. Yin, Case Study Research and Applications: Design and Methods, 6th ed. SAGE Publications, 2018.
[12] M. Q. Patton, Qualitative Research & Evaluation Methods, 4th ed. SAGE Publications, 2015.
[13] J. W. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 4th ed. SAGE Publications, 2014.
[14] M. B. Miles, A. M. Huberman, and J. Saldaña, Qualitative Data Analysis: A Methods Sourcebook, 3rd ed. SAGE Publications, 2014.