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Assessing the Capability of E-Attendance Systems in Local Government Institutions Using COBIT 2019: A Case from Indonesia

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Abstract−This research evaluates the capability level of the E-Attendance system at the General Bureau of the Regional Secretariat of North Sumatra Province using the COBIT 2019 framework. A mixed-method approach was employed, integrating document analysis, interviews, questionnaires, and system log reviews to assess four key governance and management objectives: DSS06 (Manage Business Process Controls), APO13 (Managed Security), APO14 (Managed Data), and MEA01 (Performance and Conformance Monitoring). The results indicate that the current capability levels range between Level 1 (Performed) and Level 2 (Managed), reflecting partially implemented and inconsistently standardized governance practices. Based on organizational policies, regulatory requirements, and operational needs, the target capability level for all assessed domains is defined at Level 3 (Established), where processes are formally documented, standardized, and consistently implemented across organizational units. The gap analysis reveals deficiencies in data governance structures, security control enforcement, and performance monitoring mechanisms. Nevertheless, the findings demonstrate that improvements in process capability significantly enhance data quality dimensions, including completeness, accuracy, consistency, and timeliness. This study contributes to public sector IT governance literature by providing an evidence-based COBIT 2019 capability assessment and proposing a structured improvement roadmap to achieve the defined target capability level and strengthen digital governance maturity.

Keywords: COBIT 2019; E-Attendance; Capability Level; Data Governance; Information Security; Public Sector IT; Digital Transformation

1. INTRODUCTION

Digital transformation has become a fundamental driver in improving efficiency, transparency, and accountability in public sector governance[1]. One of the key domains affected by this transformation is attendance management systems, which serve as the backbone for personnel discipline, payroll accuracy, and operational accountability[2]. The Government of North Sumatra Province, particularly through the General Bureau of the Regional Secretariat, has implemented an electronic attendance (E-Attendance) system utilizing both mobile and web-based applications[3]. This initiative reflects an organizational commitment to digitization and data-driven governance[4]. However, the reliability of such systems depends not only on technological adoption but also on the robustness of process controls, data integrity, and compliance with regulatory standards[5]. The growing reliance on E-Attendance systems highlights the necessity for empirical evaluation of their capability levels to ensure that the system aligns with established governance frameworks and achieves measurable performance outcomes[6].

Recent literature on digital attendance systems in the public sector has primarily focused on technological aspects such as biometric accuracy, geofencing validation, and user adoption[7],[8]. Studies by Kumar et al. (2021) and Rahman et al. (2022) discuss the efficiency gains achieved through biometric attendance systems but often overlook governance and control mechanisms. Meanwhile, research utilizing the COBIT framework remains limited, with most studies employing COBIT 5 or generic maturity assessments without an evidence-based capability analysis[9]. The COBIT 2019 framework, however, provides a refined approach to evaluating the capability of information systems by linking enterprise goals with governance and management objectives through the Goals Cascade[10],[11]. In this context, COBIT 2019's focus on objectives such as DSS06 (Manage Business Process Controls), APO13 (Managed Security), APO14 (Managed Data), and MEA01 (Performance and Conformance Monitoring) becomes particularly relevant. These objectives collectively offer a comprehensive framework for assessing how process capability influences data quality, system reliability, and policy compliance within government institutions[12],[13].

Despite the increasing prevalence of digital attendance solutions, significant challenges remain in ensuring their effectiveness. The E-Attendance system's success depends on accurate, timely, and complete data collection, as well as on secure and traceable processes[14]. Common issues include incomplete records, untimely synchronization, and potential privacy breaches due to excessive access rights or inadequate security controls[15]. From a governance perspective, these deficiencies indicate potential weaknesses in process capability, especially within DSS06, which emphasizes control design and implementation. Similarly, insufficient enforcement of APO13 and APO14 objectives may lead to security vulnerabilities and data management inconsistencies. The absence of MEA01-based monitoring further exacerbates the problem, as it prevents continuous evaluation and improvement of system performance. Therefore, there is an urgent need for systematic capability assessment to bridge these gaps and establish a foundation for continuous improvement[16].

In addressing these challenges, several studies have proposed integrating IT governance frameworks to strengthen control and monitoring mechanisms. Alghamdi and Bach (2020) suggested that COBIT-based assessments can reveal hidden inefficiencies in public sector digital systems, while Pereira et al. (2021) emphasized the importance of aligning

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data governance and information security policies to enhance operational integrity. Nevertheless, few empirical studies have directly applied COBIT 2019 to evaluate E-Attendance systems within regional government contexts. Most assessments remain theoretical or limited to private-sector case studies, leaving a gap in understanding the application of COBIT 2019 in public institutions governed by strict administrative procedures and data protection laws. The lack of localized evidence further limits policymakers' ability to design effective interventions that are both compliant and contextually relevant.

Existing technical research tends to prioritize the precision of biometric tools and geolocation accuracy, while overlooking the governance mechanisms that ensure end-to-end process reliability. Studies focusing solely on technology often neglect essential process components such as access control, audit trail validation, exception handling, and data retention. Furthermore, many existing assessments rely on small sample sizes or single-method approaches, lacking triangulation between documents, interviews, and system logs. This methodological limitation weakens the validity of findings, particularly when assessing data quality attributes such as completeness, consistency, and timeliness. Moreover, risks associated with fraudulent practices such as location spoofing or proxy attendance ("attendance delegation") remain underexplored despite their direct implications for payroll accuracy and administrative discipline. Consequently, the literature reveals a substantial research gap in applying process-oriented governance evaluation frameworks like COBIT 2019 to public sector E-Attendance systems.

Previous research that adopted COBIT frameworks in similar contexts often focused on broad maturity assessments without evidence-backed capability scoring per specific objectives. For instance, applied COBIT 5 to measure IT process maturity but did not connect process capability to data quality outcomes. Similarly, Arifin et al. (2022) evaluated municipal e-government services but failed to translate COBIT objectives into actionable performance indicators. In contrast, COBIT 2019 emphasizes evidence-based measurement and domain interlinkages, enabling more precise capability mapping. Applying this framework to the E-Attendance system of the General Bureau of North Sumatra's Regional Secretariat provides an opportunity to uncover relationships between governance capability, data quality, and operational efficiency. Specifically, DSS06 and APO13/14 domains offer insights into how well process controls, data management, and security practices are institutionalized, while MEA01 facilitates ongoing monitoring and improvement.

A focused capability evaluation not only identifies technical or procedural weaknesses but also supports the formulation of targeted improvement initiatives[17]. For example, establishing role-based access control (RBAC), device binding, and audit trail monitoring can mitigate fraud and enhance data integrity. Similarly, defining key data quality indicators completeness, accuracy, consistency, and timeliness enables quantifiable measurement of process performance. Such structured interventions align with COBIT 2019's principle of continuous governance improvement and provide a roadmap for achieving higher capability levels (≥2 Managed, ≥3 Established). Moreover, by operationalizing the Goals Cascade, the study links strategic objectives such as employee accountability and payroll transparency with measurable IT process improvements, thus bridging the gap between policy goals and technical execution.[18]

The literature closely related to COBIT-based assessments in digital attendance systems consistently underscores the need for contextual adaptation in government environments[19]. According to Siahaan et al. (2023), the absence of domain-specific guidelines limits the practical application of COBIT 2019 in provincial and municipal administrations. Furthermore, empirical evidence connecting governance capability to data quality and operational compliance is still scarce. While some studies propose conceptual frameworks, few provide validated, data-driven evaluations within the context of local regulations and bureaucratic structures. This gap highlights the importance of developing an evidence-based, contextually adapted assessment model that captures both governance and operational dimensions of E-Attendance systems[20].

Therefore, this study aims to assess the capability level of the E-Attendance application at the General Bureau of the Regional Secretariat of North Sumatra Province using COBIT 2019, focusing on key objectives DSS06 (Manage Business Process Controls), APO13 (Managed Security), APO14 (Managed Data), and MEA01 (Performance and Conformance Monitoring). The research seeks to identify control gaps, assess data quality dimensions, and propose structured improvement initiatives such as policies, standard operating procedures (SOPs), access control matrices, key performance indicators (KPIs), and audit trail mechanisms. The study's novelty lies in its evidence-based approach combining document analysis, interviews, and system log examination to establish capability levels and their relationship with data quality and process performance. By doing so, it contributes both theoretically by extending COBIT 2019's application in the public sector and practically, by providing an actionable roadmap for enhancing data reliability, security, and compliance within government digital attendance systems.

This research contributes both theoretically and practically. Theoretically, this research expands the application of the COBIT 2019 framework in the public sector context by emphasizing evidence-based capability level measurements in e-attendance systems, which are still relatively limited in previous literature. This research also strengthens understanding of the relationship between IT governance process capabilities and data quality dimensions, particularly in the context of process control, information security, data management, and performance monitoring. Practically, the results of this research provide evaluative guidance and a capability improvement roadmap that can be used by government agencies to strengthen the governance of digital attendance systems, through concrete recommendations in the form of policy development, standard operating procedures (SOPs), implementation of role-based access control, key performance indicators (KPIs), and audit trail mechanisms to improve system reliability, security, and compliance.

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2. RESEARCH METHODOLOGY

2.1 Research Stages

This study employs a mixed-method design with a convergent parallel strategy to assess the capability level of the E-Attendance application at the General Bureau of the Regional Secretariat of North Sumatra Province. The design integrates qualitative and quantitative data collected simultaneously to provide a comprehensive and validated evaluation of process capability under the COBIT 2019 framework. The mixed-method approach enables triangulation between documentary evidence, user and administrator perceptions, and system log data, strengthening the robustness of the findings. The use of a convergent strategy ensures that both qualitative and quantitative insights complement each other in identifying gaps, strengths, and improvement priorities in the E-Attendance process.

2.2 Unit of Analysis and Research Scope

The unit of analysis is the information technology governance and service management processes directly supporting the E-Attendance application within the General Bureau. The research focuses on management and governance objectives from COBIT 2019, particularly DSS06 (Manage Business Process Controls), APO13 (Managed Security), APO14 (Managed Data), and MEA01 (Performance and Conformance Monitoring)[12]. These objectives are relevant for evaluating the reliability, data integrity, and performance monitoring of E-Attendance. The scope includes evaluating documentation, operational procedures, system architecture, application modules, service requests, change logs, audit trails, and performance reports. The study also considers the interaction between policy, operational procedures, and user behavior to assess end-to-end governance maturity.

2.3 Data Sources and Collection Techniques

Data were collected through multiple complementary methods: observation, documentation review, interviews, and surveys. Primary data were obtained through semi-structured interviews with key stakeholders, including application administrators, IT analysts, HR officers, and internal auditors. These interviews explored practical experiences, perceived control gaps, and compliance challenges. Quantitative data were gathered using structured questionnaires based on COBIT 2019 process attributes (PA1–PA5), employing a four-point scale of achievement (Not Achieved, Partially Achieved, Largely Achieved, Fully Achieved). The quantitative component captures measurable perceptions of process performance across the selected COBIT domains. Secondary data were obtained from internal documents such as standard operating procedures (SOPs), service level agreements (SLAs), operation level agreements (OLAs), IT planning and budgeting documents, incident and change logs, internal audit reports, and employee attendance data. These documents serve as evidence for assessing process capability and compliance with COBIT 2019's governance and management objectives. Visual data such as application interface screenshots, process flow diagrams, and system dashboards were analyzed to contextualize process execution and monitoring practices.

2.4 Qualitative Analysis Procedure

The qualitative analysis focused on understanding how governance and control processes operate within the E-Attendance application. The analysis began with data preparation, including transcription of interviews, documentation of observations, and organization of artifacts according to COBIT 2019 objectives. The data were then coded using thematic analysis, following open, axial, and selective coding phases. This approach facilitated the extraction of key patterns and insights related to control design, policy implementation, and process monitoring. Each piece of qualitative evidence was mapped to corresponding COBIT process attributes (PA1–PA5) to determine the extent of compliance with expected practices. Themes such as control adequacy, risk handling, data quality management, and monitoring effectiveness were analyzed and cross-referenced with quantitative findings. To ensure credibility and dependability, member checking was conducted with selected participants to verify interpretations, while triangulation across sources (documents, interviews, and system logs) ensured data validity.

2.5 Quantitative Analysis and Capability Measurement

Quantitative analysis followed the COBIT 2019 capability assessment model, which evaluates each process based on performance attributes (PA1–PA5). Responses from questionnaires were normalized and scored according to the four-point achievement scale: Not Achieved (0–15%), Partially Achieved (15–50%), Largely Achieved (50–85%), and Fully Achieved (85–100%). These scores were aggregated to determine the capability level of each domain (0–5). The process capability level represents the maturity of process implementation, documentation, and continuous improvement mechanisms[21]. 1rioritized improvement initiatives. These included policy revisions, SOP updates, training programs, and implementation of key controls such as role-based access control (RBAC), device binding, and liveness detection.

2.7 Ethical Considerations and Data Validity

Ethical standards were maintained throughout the research process. All participants provided informed consent prior to interviews and surveys, and confidentiality was guaranteed by anonymizing responses and sensitive data. Ethical approval for the study was obtained from the affiliated institution's review board[23]. Data validity was enhanced through

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triangulation, audit trails, and peer review of coding and interpretation processes. The audit trail documented every analytic decision, ensuring transparency and reproducibility of results.

2.8 Summary of Methodological Framework

Figure 1 presents the methodological framework summarizing the integrated mixed-method approach used in this study. The framework illustrates how qualitative and quantitative components were executed concurrently and integrated during the analysis stage to ensure comprehensive assessment of process capability. The framework also aligns with COBIT 2019's life cycle of governance improvement, emphasizing feedback loops from assessment to intervention design.

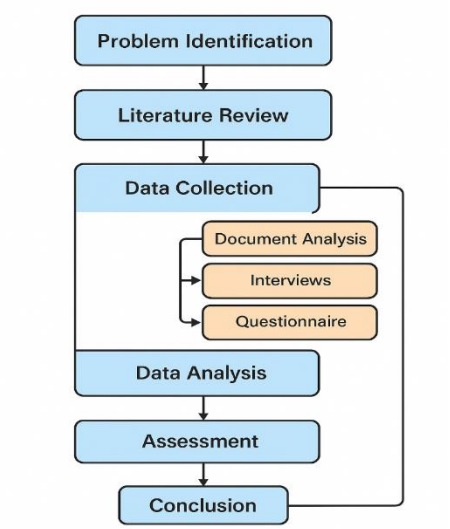

Figure 1. Research Methodology Framework for Capability Level Assessment using COBIT 2019

The methodology thus provides a structured and rigorous pathway for evaluating the E-Attendance application's capability level. Through systematic data collection, evidence-based analysis, and integration of findings, this approach enables the identification of actionable insights for governance enhancement and digital system improvement within the public sector.

3. RESULT AND DISCUSSION

3.1 Capability Profile of E-Attendance Processes

The capability assessment of the E-Attendance application was conducted by analyzing the alignment of current practices with COBIT 2019 objectives. Based on the evaluation, the E-Attendance process achieved varying capability levels across four domains: DSS06 (Manage Business Process Controls), APO13 (Managed Security), APO14 (Managed Data), and MEA01 (Performance and Conformance Monitoring). These domains represent the core governance and management areas influencing operational integrity, data security, and performance monitoring.

The analysis of documentary evidence, system logs, interviews, and questionnaire responses indicated that DSS06 attained an approximate Level 2 (Managed), signifying partial standardization of control mechanisms. The attendance recording process, including check-in and check-out logs, was functional and partially supported by established standard operating procedures (SOPs). However, gaps were observed in exception handling, such as off-site attendance, weak signal areas, and work-from-home scenarios. The absence of comprehensive maker-checker mechanisms and segregation of duties further limited the system's process reliability. These findings suggest that while the process is functionally operational, it has not yet achieved consistent institutionalization across organizational units.

For APO13, which addresses managed security, the system demonstrated a capability level between Level 1 (Performed) and Level 2 (Managed). The presence of basic authentication controls indicates initial implementation, yet technical security mechanisms such as device binding, geofence validation, and liveness detection have not been uniformly applied. The current configuration allows for potential security loopholes that may lead to unauthorized access or identity spoofing. The results show that although security policies exist, the absence of systematic enforcement and monitoring prevents full realization of COBIT's managed security expectations.

The APO14 (Managed Data) domain was assessed at Level 1 (Performed). The data management process operates effectively but lacks standardized governance structures such as defined data ownership, stewardship roles, and formalized data dictionaries. Furthermore, procedures for data reconciliation, archival, and retention remain inconsistent across platforms. This insufficiency affects the completeness, consistency, and timeliness of attendance data, which are critical for accurate payroll processing and policy compliance.

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In contrast, MEA01 (Performance and Conformance Monitoring) recorded a capability level of approximately Level 1 (Performed). While periodic performance reports are produced, the absence of formalized key performance indicators (KPIs), dashboards, and continuous monitoring mechanisms undermines the ability to track data quality and control effectiveness over time. Without structured monitoring, performance deviations and compliance issues may go unnoticed, resulting in delayed corrective actions.

Table 1. Capability Level Assessment of E-Attendance Processes Based on COBIT 2019

Domain	Objective	Description	Capability Level
DSS06	Manage Business Process Controls	Functional attendance recording, partial SOP coverage, missing maker-checker & SoD controls	Level 2 (Managed)
APO13	Managed Security	Existing authentication, limited technical controls, incomplete enforcement	Level 1–2 (Performed–Managed)
APO14	Managed Data	Operational data flow, missing governance roles, inconsistent reconciliation	Level 1 (Performed)
MEA01	Performance and Conformance Monitoring	Basic reporting, absent KPIs and dashboards	Level 1 (Performed)

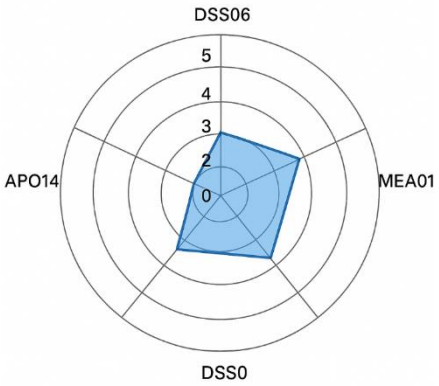

Figure 2. Capability Radar for E-Attendance Process Domains

The capability radar (Figure 2) illustrates that DSS06 leads with the highest capability, while APO14 and MEA01 remain at foundational levels. The results highlight an overall moderate governance posture that supports daily operations but requires significant enhancement to achieve higher maturity

3.2 Data Quality and Operational Risks

The evaluation of data quality revealed strengths in basic completeness and accuracy but weaknesses in consistency and timeliness. Attendance records captured through the mobile and web interfaces are generally accurate during normal operating conditions but decline in reliability when external factors such as poor connectivity or manual corrections intervene. The root causes include inadequate validation of location data and delayed synchronization between mobile and central databases.

Data completeness was found to be satisfactory in regular attendance scenarios but inconsistent during official travel or remote work. Without a standardized mechanism for off-site attendance logging, employees rely on manual submissions that compromise traceability. Accuracy and validity metrics also showed variability; although geotag and timestamp data were present, they were not consistently verified against official office boundaries (geofences). This created opportunities for potential fraud, such as false location reporting or proxy attendance.

Data consistency across platforms was another area of concern. Discrepancies were identified between user-facing data and aggregated management reports, particularly when manual edits were performed. These inconsistencies highlight the need for version control mechanisms and audit trails that capture modification histories. Timeliness issues were also evident in data synchronization delays, especially in areas with unstable internet connectivity. The absence of standardized retry and reconciliation policies resulted in missing or late entries that complicated payroll processing.

3.3 Key Control Findings per Domain

In the DSS06 domain, evidence indicated that while incident management and core attendance processes were defined, the controls governing exceptions, segregation of duties, and corrective actions remained underdeveloped. The partial availability of SOPs provided a foundation for process control, but their inconsistent enforcement across departments prevented systematic improvement. The lack of standardized procedures for handling exceptions such as on-duty assignments or system outages undermines the reliability of the process.

In APO13, the analysis revealed partial adherence to managed security principles. Authentication mechanisms exist, but advanced features like role-based access control (RBAC) and device-level validation were absent.

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Consequently, the risk of unauthorized access and data privacy breaches remains. Security policies addressing data classification, access privileges, and incident response were identified but not operationalized through technical or procedural enforcement.

The APO14 domain exposed significant gaps in data management governance. Although operational data flows are in place, there is no designated data owner or steward responsible for maintaining data accuracy and completeness. The lack of a data dictionary or metadata standards further complicates cross-system reconciliation. As a result, inconsistencies between mobile and web platforms persist. Data retention and archival practices were also informal, increasing risks related to compliance and auditability.

MEA01 displayed the weakest performance among the domains. Performance monitoring occurs through routine reports, yet these are largely descriptive and lack defined KPIs or thresholds for evaluation. The absence of a centralized dashboard prevents real-time tracking of anomalies or compliance violations. Without a systematic review mechanism, organizational learning and continuous improvement are limited

3.4 KPI Design and Preliminary Metrics

To strengthen MEA01 and enhance monitoring, a set of proposed KPIs was developed based on the research findings. These KPIs serve as quantitative measures of data quality and process reliability.

Table 2. Proposed Key Performance Indicators (KPIs) for E-Attendance Monitoring

Indicator	Definition	Purpose	Target (Pilot)
Exception Rate	Percentage of correction requests over total attendance records	Evaluates data accuracy and control effectiveness	<5%
On-Time Submission	Attendance records submitted within defined time window	Measures process timeliness	>95%
Data Reconciliation Match	Match rate between mobile and web attendance data	Measures data consistency	>98%
Fraud Indicators	Detection rate of duplicate coordinates or devices	Evaluates security and anti-fraud control	<2%
SLA Compliance	Percentage of incidents resolved within defined time	Measures service performance	>90%
Audit Trail Reviewed	Proportion of logs audited monthly	Assesses governance oversight	100%

3.5 Discussion

The assessment results demonstrate that while the E-Attendance application has reached an operationally functional state, its governance maturity remains limited. The capability levels identified align with findings in public sector digital transformation research, which often reveal partial adoption of IT governance frameworks. Studies on digital attendance systems indicate that functionality tends to precede governance maturity, as organizations initially prioritize system deployment over process control (Kumar et al., 2021; Alghamdi & Bach, 2020). The E-Attendance system's Level 1–2 capability range therefore reflects an early institutionalization stage where practices are performed but not yet fully standardized or continuously monitored. The DSS06 findings highlight the importance of formalizing process control mechanisms. The absence of standardized exception handling and segregation of duties creates operational vulnerabilities that can affect data reliability and compliance. This is consistent with Pereira et al. (2021), who emphasized that structured governance practices such as maker-checker validation and audit trail enforcement enhance process accountability and reduce operational risks. The relatively low scores in APO13 and APO14 indicate that data management and security governance require targeted improvement. Weaknesses in these domains mirror challenges reported in earlier studies where security controls and data governance frameworks were not fully integrated into operational processes (Nogueira et al., 0; Arifin et al., 2022). In the E-Attendance context, implementing RBAC, device binding, and liveness detection would significantly reduce fraud risks, while defining data ownership roles and implementing retention policies would improve data integrity.

The relationship between capability levels and data quality was evident in the empirical results. Systems with higher DSS06 and APO13/14 scores demonstrated lower exception rates and higher data timeliness. This aligns with the hypothesis that process capability exerts a causal influence on data quality. As COBIT 2019 suggests, mature processes ensure that data inputs and controls are consistent, verified, and auditable. The triangulated findings from interviews, document reviews, and system logs confirmed that governance capability mediates the relationship between process design and data outcomes. In particular, DSS06 and APO14 directly affect the completeness and accuracy of attendance records, while APO13 influences consistency through security enforcement and access control. The absence of effective monitoring under MEA01 weakens the feedback loop required for continuous improvement. Without performance indicators or dashboard-based oversight, deviations in data quality cannot be detected promptly. This observation supports the notion that performance monitoring functions as a moderating factor in maintaining and improving process capability. Therefore, enhancing MEA01 through automated dashboards and routine KPI reviews is essential for sustaining data reliability.

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The study's findings have practical implications for public sector IT governance. The observed gaps underscore the need for institutionalizing COBIT 2019 principles beyond compliance into everyday practice. The adoption of quick-win strategies such as defining RACI matrices, enforcing access control policies, and standardizing audit trail reviews could rapidly elevate capability levels from Managed to Established. Moreover, the integration of data governance policies within APO14 and security frameworks under APO13 can ensure alignment with national regulations on data protection and transparency. From a managerial standpoint, introducing periodic capability assessments can serve as a continuous improvement mechanism. Aligning system objectives with broader organizational goals, as guided by COBIT's Goals Cascade, will strengthen the link between operational controls and strategic outcomes such as payroll accuracy and employee accountability. This institutionalization of feedback-based governance can transform digital attendance systems from operational tools into strategic enablers of administrative efficiency.

Although the current assessment provides valuable insights, it remains limited by the qualitative nature of capability scoring and the restricted scope of pilot data. Future studies could expand by incorporating longitudinal data to evaluate changes over time following the implementation of recommended interventions. Moreover, integrating quantitative analytics into MEA01 dashboards could enhance the precision of monitoring and foster data-driven governance maturity. The expansion of COBIT 2019-based assessments to other government departments could further validate the framework's applicability across varying operational contexts and regulatory environments.

4. CONCLUSION

This study assessed the capability level of the E-Attendance system implemented by the General Bureau of the Regional Secretariat of North Sumatra Province using the COBIT 2019 framework. The analysis revealed that the E-Attendance process operates effectively but remains at an early stage of governance maturity, with capability levels ranging from Level 1 to Level 2 across DSS06, APO13, APO14, and MEA01 domains. Key weaknesses were identified in data governance, security enforcement, and continuous monitoring. Despite these gaps, the system demonstrates foundational control structures that can be strengthened through standardized policies, role-based access, and performance dashboards. The research confirms that higher process capability directly enhances data quality dimensions such as completeness, accuracy, consistency, and timeliness. Strengthening governance maturity within these domains will not only improve system reliability but also reinforce compliance and accountability in public sector digital management. The study contributes to the growing body of knowledge on IT governance in government settings by providing empirical evidence on the application of COBIT 2019 in assessing and improving e-government systems. Future research should focus on longitudinal evaluations of post-implementation outcomes and the scalability of capability enhancement across other administrative functions.

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