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Prioritizing Governance of the COBIT 2019 DSS02 Domain Based on Incident Management Data

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Abstract: Information technology (IT) governance plays a crucial role in ensuring service quality, and COBIT 2019 provides a structured framework for incident management through the DSS02 domain. However, DSS02 implementation is commonly evaluated using surveys or capability assessments that are subjective, difficult to reproduce, and challenging to verify independently, despite the availability of detailed operational event logs in IT service management platforms. This study proposes an event-log-based approach to identify governance improvement priorities within the COBIT 2019 DSS02 domain. Five operational indicators were developed, namely the Process Complexity Index (PCI), Operational Interaction Index (OII), Reassignment Indicator (RI), Reopened Incident Indicator (RII), and Delay Severity Index (DSI). These indicators were mapped to DSS02 subprocesses and integrated into a Governance Priority Score (GPS), which was evaluated using local sensitivity analysis and Spearman correlation analysis on a ServiceNow event log containing 141,707 events and 24,918 incidents. The results identified DSS02.04 (Investigate, Diagnose and Resolve) as the highest governance priority (GPS = 5.06), followed by DSS02.02 (4.27) and DSS02.03 (1.14). Sensitivity analysis showed that moderate (±10%) changes in indicator weights did not alter the priority ranking, while correlation analysis revealed a strong relationship between reassignment frequency and incident modification activity ($\rho = 0.67$). The proposed approach provides an objective, reproducible, and auditable data-driven prioritization mechanism that complements conventional survey-based governance assessment using operational event logs.

Keywords: COBIT 2019; data-driven governance; DSS02; event log; incident management; operational indicators

INTRODUCTION

Managing IT service incidents is a critical operational activity that directly affects the quality of an organization's services. COBIT 2019 designates the DSS02 domain as the governance framework that oversees the incident-handling life cycle, from logging and classification through to investigation, resolution, and service closure (ISACA, 2018). Although this framework has been widely adopted, compliance with DSS02 is still commonly assessed through survey- or interview-based maturity evaluations that are subjective and difficult to reproduce (De Haes et al., 2020; Huygh & De Haes, 2019).

IT service management platforms such as ServiceNow automatically generate event logs that capture every operational activity across the incident life cycle. These event logs provide detailed and objective execution traces that can be analyzed using process mining techniques to identify process behavior, bottlenecks, waiting times, and operational deviations. Consequently, event logs have become an increasingly valuable source of empirical evidence for organizational decision-making and governance evaluation. However, despite these advances, the use of event logs for governance prioritization within the COBIT framework remains very limited (Ali et al., 2025; Kouzari et al., 2023; Peralta et al., 2025). Such data offer considerable potential as a source of empirical evidence for more objective governance evaluation (van der Aalst, 2016). Yet the use of event logs for governance prioritization within the COBIT framework remains very limited in the existing literature (Garcia et al., 2019a; Kouzari et al., 2023).

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Beyond their subjectivity, survey- and interview-based governance assessments also provide limited reproducibility because their findings cannot be independently reconstructed from operational evidence. Recent studies on IT governance and data governance therefore emphasize the importance of objective, data-driven evidence for supporting organizational decision-making (Bernardo et al., 2024; Caluwe et al., 2024; Naguib et al., 2024).

This study develops an event-log-based approach for analyzing improvement priorities in the COBIT 2019 DSS02 domain through five operational indicators that are integrated into a Governance Priority Score (GPS). The study makes three main contributions. First, it formulates five operational governance indicators that can be computed directly from event logs without requiring any external data. Second, it introduces the GPS as a data-driven prioritization mechanism for quantifying governance priorities derived from operational event logs. Third, the proposed prioritization mechanism is evaluated through sensitivity analysis, correlation analysis, and empirical application to a large publicly available incident management dataset. Taken together, these contributions are intended to complement governance evaluation methods that have so far been dominated by qualitative judgment.

Existing studies have primarily used event logs for operational objectives such as performance prediction, conformance analysis, and process optimization. Their use as quantitative evidence for governance prioritization within the COBIT framework has received considerably less attention. Prior work on the same incident management dataset has largely focused on predicting SLA compliance using machine learning and SHAP-based explainability analysis (Caturkusuma et al., 2025). Such approaches answer the question of whether a given incident will meet its SLA, but they do not address the more fundamental governance question of which part of the incident-handling process most requires governance improvement according to COBIT 2019, and how strongly it should be prioritized in quantitative terms. This gap is the central focus of the present study: translating operational event-log data into governance indicators and priority scores that are explicitly mapped to the DSS02 subprocesses.

LITERATURE REVIEW

COBIT 2019 and the DSS02 Domain

COBIT 2019 is an IT governance and management framework developed by ISACA and widely adopted to support organizational IT governance (ISACA, 2018, 2019). Within this framework, the DSS02 domain governs the incident management lifecycle, including incident recording, classification, allocation, investigation, resolution, and closure. Although COBIT has been widely adopted, recent studies continue to rely primarily on interviews, questionnaires, and capability-level assessments, resulting in governance evaluations that remain subjective and difficult to reproduce (De Haes et al., 2020; Huygh & De Haes, 2019; Karo Karo & Faza, 2023; Kevin & Setiawan, 2024; Mangoki et al., 2024; Rosid et al., 2025; Tangka & Lompoliu, 2023).

Process Mining and Event Logs in IT Services

Process mining utilizes event logs to discover, analyze, and improve business processes (van der Aalst, 2016). Recent studies have applied process mining to identify operational bottlenecks, detect process deviations, perform conformance checking, quantify waiting times, and support incident management decisions (Ali et al., 2025; Garcia et al., 2019b; Kouzari et al., 2023; Marin-Castro et al., 2024; Meyer et al., 2024; Peralta et al., 2025; Raptaki et al., 2024; Tong-Ern et al., 2024). Despite these advances, their primary focus remains operational performance rather than governance evaluation.

Data-Driven Indicators for Governance Evaluation

Recent studies have demonstrated that operational event logs can support evidence-based governance evaluation through prediction models, process-complexity measures, ticket reassignment analysis, and structured capability assessment (Bernardo et al., 2024; Caturkusuma et al., 2025; Hardjadinata & Wiratama, 2023; Mulyana et al., 2024; Naguib et al., 2024; Schad et al., 2022; Vidgof et al., 2023). However, none of these studies explicitly maps operational indicators to COBIT 2019 DSS02 subprocesses or integrates them into a governance prioritization mechanism. This study addresses that gap by introducing the Governance Priority Score (GPS) as a data-driven prioritization mechanism.

Research Gap and Positioning

Positioning this study against prior work clarifies both the gap it addresses and the specific contribution it offers. Table 1 contrasts the present approach with related studies that employ comparable evaluation methods in the IT service management context, characterized along four dimensions: evaluation approach, data source, governing framework, and degree of quantification.

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Table 1. Comparison with Previous Studies

Study	Evaluation Approach	Data	Framework	Quantitative
De Haes et al. (2020)	Maturity survey	Primary	COBIT	Partial
Huygh & De Haes (2019)	Maturity-level assessment	Primary	COBIT	Partial
Kouzari et al. (2023)	Process mining, conformance	Event log	ITSM	Yes
Garcia et al. (2019a)	Process discovery	Event log	ITSM	Yes
Caturkusuma et al. (2025)	Resolution-time prediction	Event log	ITSM	Yes
This study	**Governance indicators + GPS**	**Event log**	**COBIT DSS02**	**Yes**

As summarized in Table 1, previous studies can generally be classified into two research streams. COBIT-based studies provide a governance framework but primarily rely on subjective capability assessments, whereas event-log-based studies employ quantitative operational analysis without explicitly addressing governance priorities. Consequently, no previous work integrates operational event-log evidence into a quantitative governance prioritization framework aligned with COBIT 2019 DSS02.

This study addresses this gap by introducing a data-driven prioritization mechanism that maps operational event-log indicators directly to DSS02 subprocesses through the Governance Priority Score (GPS). Rather than proposing a new process mining algorithm, the study demonstrates how operational evidence can be transformed into governance-oriented decision support within the COBIT 2019 framework.

METHOD

Research Design

This study adopts a quantitative, event-log-based approach to derive governance priorities within the COBIT 2019 DSS02 domain. As illustrated in Figure 1, the methodology consists of sequential stages comprising data preparation, statistical analysis, governance-indicator computation, DSS02 mapping, and GPS calculation to identify governance improvement priorities.

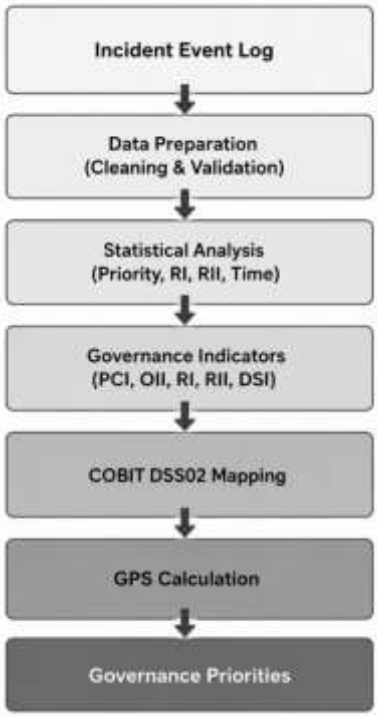

Fig. 1 Research Stages

Research Dataset

The ServiceNow Incident Event Log (Kaggle: bachrr/helpdesk) was used as the experimental dataset. Originally published by Amaral et al. (2018), it has also been employed in previous ITSM studies (Caturkusuma et al., 2025), supporting its suitability for governance-oriented analysis. The overall characteristics of the dataset are summarized in Table 2.

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Table 2. Dataset Characteristics

Characteristic	Value
Initial number of events	141,712
Valid events (after cleaning)	141,707
Number of incidents (unique cases)	24,918
Number of process activities	8
Number of process variants	2,079

After removing five invalid events labeled "-100", the final dataset consisted of 141,707 valid events representing 24,918 incidents. Although only eight process activities were identified, the log contained 2,079 process variants, indicating considerable behavioral variability.

Developing the Operational Governance Indicators

Five operational governance indicators were developed based on their conceptual correspondence with the COBIT 2019 DSS02 subprocesses. All indicators are computed directly from standard event-log attributes without requiring external information, enabling straightforward replication across comparable IT service management (ITSM) systems (Augusto et al., 2019).

The Process Complexity Index (PCI) measures the diversity of process paths relative to the number of available activities, while the Operational Interaction Index (OII) measures the average operational interaction per incident. These indicators represent the process complexity and interaction intensity associated with DSS02.02 (Record, Classify and Prioritize Incidents).

$$PCI = \frac{V}{A} \tag{1}$$

$$OII = \frac{E}{I} \tag{2}$$

where Vdenotes the number of process variants, $A$the number of activities, $E$the total number of recorded events, and $I$the total number of incidents.

To represent failure-related events consistently, a generic Binary Indicator (BI) is introduced in Equation (3). The indicator is applied to two operational conditions: High Reassignment (HR), where x_k is the reassignment count with a threshold of $\tau = 3$, and Reopened Incident (RII), where x_k is the reopen count with a threshold of $\tau = 0$. The Delay Severity Index (DSI), defined in Equation (4), measures the normalized delay severity of each process transition.

$$BI_k = \begin{cases} 1, & x_k > \tau \\ 0, & otherwise \end{cases} \tag{3}$$

$$DSI_i = \frac{\text{Delay}_i}{\text{Delay}_{\max}} \times 100 \tag{4}$$

The governance mapping of the proposed indicators follows the DSS02 subprocesses. PCI and OII are associated with DSS02.02, HR represents the effectiveness of incident allocation and escalation in DSS02.03, whereas RII and DSI capture investigation, diagnosis, and resolution performance in DSS02.04. This mapping forms the basis for the subsequent Governance Priority Score (GPS) calculation.

Governance Priority Score (GPS)

The Governance Priority Score (GPS) integrates the normalized indicators associated with each DSS02 subprocess into a single priority score on a 0–10 scale. Before aggregation, all indicators are normalized to ensure comparability across different measurement units. The GPS for subprocess j is calculated using Equation (5).

$$GPS_j = \left(\frac{\sum_{i=1}^{n_j} NI_{i_j}}{n_j} \right) \times 10 \tag{5}$$

where NI_{i_j} denotes the normalized value of indicator $i$for subprocess j, and n_j represents the number of indicators mapped to that subprocess.

Indicator normalization is performed according to their respective measurement ranges. PCI is normalized over the interval [1,500], OII over [1,15], HR and RII as proportions within [0,1], and DSI by dividing its 0–100 scale by 100. An equal-weight aggregation is then applied to obtain the final GPS for each DSS02 subprocess.

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Table 3 summarizes the correspondence between the proposed operational indicators and the COBIT 2019 DSS02 subprocesses. This mapping establishes the indicator grouping used in the subsequent GPS calculation.

Table 3. Mapping of Indicators to DSS02 Subprocesses

DSS02 Subprocess	Indicator	Governance Focus
DSS02.02	PCI, OII	Incident classification and prioritization
DSS02.03	RI / HR	Incident allocation and escalation
DSS02.04	RII, DSI	Incident investigation, diagnosis, and resolution

RESULT

Statistical Characteristics of the Dataset

Before computing the governance indicators, a descriptive statistical analysis was carried out to understand the dataset's operational characteristics in full. The analysis examines four aspects of the 24,918 incidents: the distribution of priority and impact, the frequency of reassignment, the occurrence of reopened incidents, and the resolution time. The dataset is dominated by routine incidents, with 94.2% classified as Moderate priority and 95.3% having Medium impact, indicating that governance issues arise primarily from operational behavior rather than incident criticality.

More than half of the incidents (54.4%) were resolved without reassignment, whereas 11.4% experienced three or more reassignments, indicating recurring routing inefficiencies. In contrast, reopen events occurred much less frequently, with only 1.1% of incidents being reopened. The reassignment distribution is further illustrated in Figure 2, where the rapid decline in incident frequency after the first reassignment highlights the long-tail behavior of reassignment activity.

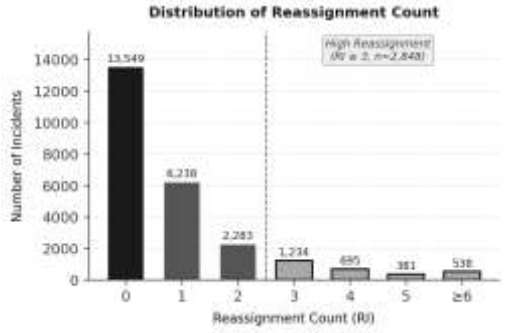

Fig. 2 Distribution of Reassignment Count (Histogram)

The resolution-time behavior of the dataset is reported in Table 4.

Table 4. Descriptive Statistics of Resolution Time (opened_at → resolved_at)

Statistic	Value (Hours)	Category Distribution
Mean	161.45	<1 day: 12,033 (51.7%)
Median	21.98	1–3 days: 3,023 (13.0%)
Standard Deviation	432.10	3–7 days: 2,907 (12.5%)
25th Percentile (Q1)	0.42	7–30 days: 4,211 (18.1%)
75th Percentile (Q3)	147.38	>30 days: 1,079 (4.6%)
Maximum Value	4,992.60	(valid n = 23,253)

As Table 4 indicates, the large gap between the mean (161.45 hours) and the median (21.98 hours) reveals a strongly right-skewed distribution that is driven by a number of incidents with very long resolution times. While 51.7% of incidents are resolved in less than a day, 4.6% take more than 30 days—pointing to a class of problematic incidents that warrants particular governance attention. The spread and the presence of extreme outliers are further depicted in the boxplot shown in Figure 3.

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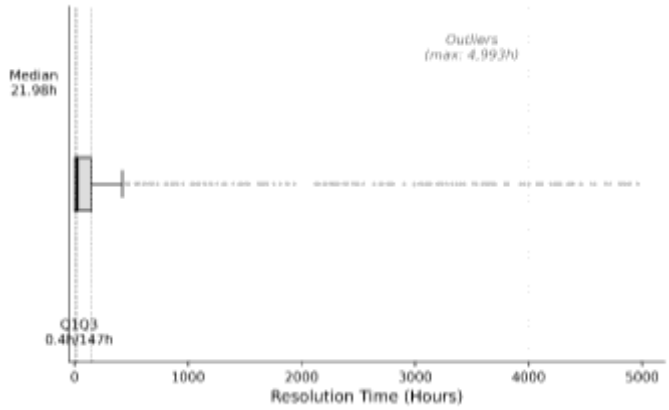

Fig. 3 Boxplot of Incident Resolution Time

Figure 3 shows a highly right-skewed resolution-time distribution with a median of 21.98 hours and extreme outliers reaching 4,992.6 hours.

Governance Indicator Profile

The governance indicators jointly characterize the structural complexity and temporal performance of the incident-handling process. Table 5 consolidates the five indicators—their defining formulas, raw values, normalized values, and the DSS02 subprocess to which each is mapped.

Table 5. Governance Indicator Profile

Indicator	Formula	Raw Value	Normalized	DSS02
PCI	V / A	259.88	0.52	DSS02.02
OII	E / I	5.69	0.34	DSS02.02
RI	HR proportion	0.114	0.11	DSS02.03
RII	Reopened proportion	0.011	0.01	DSS02.04
DSI	Max delay severity	100	1.00	DSS02.04

As Table 5 shows, the PCI reaches 259.88—obtained from 2,079 process variants over only eight activities (V / A)—indicating substantial procedural inconsistency, while the OII of 5.69 (E / I) means each incident involves nearly six operational interactions before resolution. Together these place a considerable control burden on the classification and prioritization activities governed by DSS02.02. After normalization to a common 0–1 range, DSI attains the maximum value of 1.00 and PCI the second highest at 0.52, whereas RII registers the lowest at 0.01. The contrast is informative: although DSI and RII are both mapped to DSS02.04, they capture markedly different facets of governance performance—the severity of operational delay versus the frequency of resolution failure. This normalized profile is visualized in Figure 4.

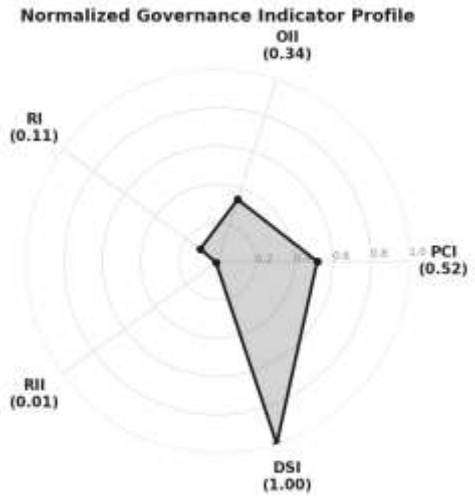

Fig. 4 Radar Chart of the Normalized Indicator Profile by DSS02 Subprocess

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Delay Severity Index

While PCI and OII describe the structural side of the process, the Delay Severity Index (DSI) captures its temporal performance by quantifying the severity of delay at each critical activity state. The corresponding values are presented in Table 6.

Table 6. Delay Severity Index per Critical Activity State

State / Transition	Average Delay (Hours)	DSI
Awaiting Vendor	450.04	100
Awaiting Problem	218.99	49
Resolved → Closed	147.52	33

The most severe delay occurs at the Awaiting Vendor state (450.04 hours, DSI = 100), followed by Awaiting Problem (218.99 hours, DSI = 49) and the Resolved → Closed transition (147.52 hours, DSI = 33). As Table 6 indicates, the largest bottlenecks concentrate in states that depend on external vendors and problem investigation—parties and diagnostic steps beyond the front-line team's immediate control. Even the closing stage contributes a non-trivial delay, showing that inefficiencies persist throughout the later phases of the incident life cycle rather than at a single point.

Governance Priority Score and the Priority Matrix

The final stage integrates the indicators into a single, comparable measure of governance priority for each subprocess. Using the normalized values from Table 5, the Governance Priority Score (GPS) is computed per DSS02 subprocess according to Equation (5), which averages the normalized indicators mapped to that subprocess and rescales the result to a 0–10 range. The complete mapping of indicators to subprocesses, together with the resulting GPS values and the priority levels derived from them, is presented in Table 7.

Table 7. Governance Priority Matrix

Indicator	DSS02.02	DSS02.03	DSS02.04	Norm. Value
PCI	✓			0.52
OII	✓			0.34
RI / HR		✓		0.11
RII			✓	0.01
DSI			✓	1.00
GPS	**4.27**	**1.14**	**5.06**	
Priority	Medium	Low	**High**	

Reading down the GPS row of Table 7, DSS02.04 obtains the highest score (5.06), followed by DSS02.02 (4.27) and DSS02.03 (1.14), classified as High, Medium, and Low priority respectively. The ordering is revealing: DSS02.04 ranks first despite being driven by indicators at opposite extremes of the normalized scale—the very high DSI (1.00) and the very low RII (0.01)—demonstrating that a single indicator with severe operational impact can dominate a subprocess's priority. DSS02.02 derives its intermediate score from two moderately high indicators (PCI 0.52, OII 0.34), reflecting a balanced but persistent complexity burden, while DSS02.03 ranks lowest on the strength of a single low-valued indicator.

Table 8. Sensitivity Analysis of Governance Priority Score under Alternative Weighting Scenarios

DSS02 Subprocess	Equal Weight	Indicator-1 +10%	Indicator-2 +10%	Rank Stability
DSS02.02	4.27	4.36	4.18	✓ Stable
DSS02.03	1.14	1.14	1.14	✓ Stable
DSS02.04	5.06	4.56	5.56	✓ Stable

Indicator-1 and Indicator-2 refer to the first and second governance indicators within each DSS02 subprocess. Weight adjustments of ±10% were applied to evaluate the sensitivity of the Governance Priority Score (GPS).

To evaluate the influence of indicator weighting on the proposed Governance Priority Score (GPS), a local sensitivity analysis was conducted by modifying the within-subprocess weights by ±10% while maintaining the total weight equal to one. As shown in Table 8, the absolute GPS values changed slightly following the weight adjustment. However, the relative ranking of the DSS02 subprocesses remained unchanged across all scenarios. DSS02.04 consistently obtained the highest governance priority, followed by DSS02.02 and DSS02.03. These

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results indicate that the proposed prioritization mechanism is locally stable with respect to moderate variations in indicator weighting and is therefore not solely dependent on the equal-weight assumption adopted in this study.

The effects of the alternative weighting scenarios on the three DSS02 subprocesses are visualized in Figure 5.

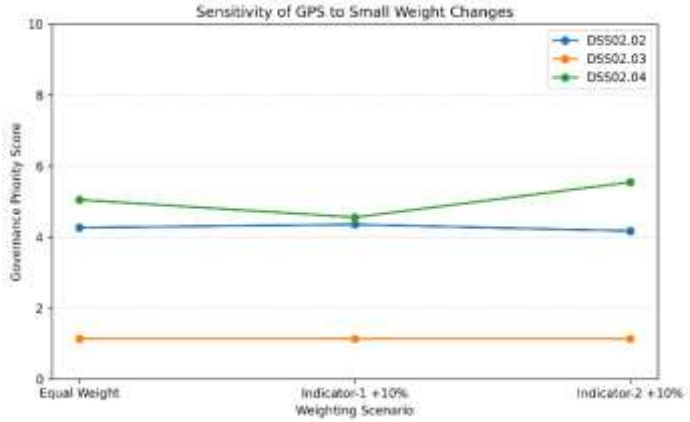

Fig. 5 Sensitivity of Governance Priority Scores under Small Indicator Weight Changes

Figure 5 shows that although the magnitude of the GPS changes under alternative weighting scenarios, the relative ordering of governance priorities remains unchanged. This indicates that moderate adjustments to indicator importance do not alter the managerial conclusions derived from the proposed GPS.

Correlation Analysis of Operational Governance Indicators

The incident-level relationships among the selected operational variables are presented in Figure 6.

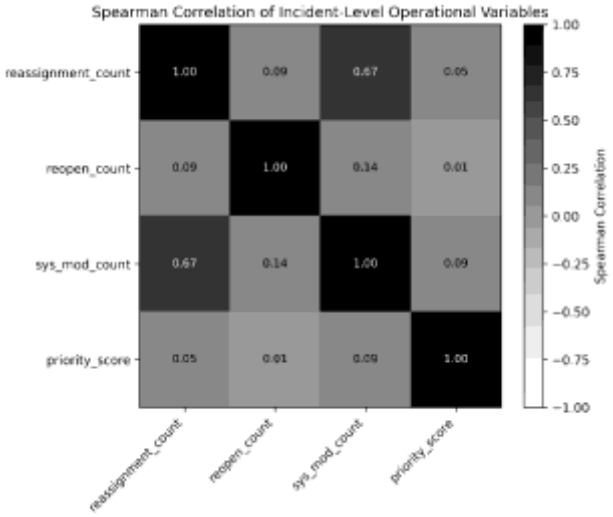

Fig. 6 Spearman Correlation Matrix of Incident-Level Operational Variables

Spearman correlation analysis was performed to examine the empirical relationships among the incident-level operational indicators used in this study. As illustrated in Figure 6, the strongest association was observed between reassignment_count and sys_mod_count ($\rho = 0.67$), indicating that incidents requiring repeated reassignment generally involve more operational modifications during their lifecycle. In contrast, reopen_count showed only weak correlations with the remaining variables ($\rho < 0.15$), suggesting that incident reopening represents a distinct operational phenomenon rather than merely a consequence of reassignment frequency.

DISCUSSIONS

DSS02.04 as the Top Priority: Convergence of RII and DSI

DSS02.04 obtained the highest GPS (5.06), primarily driven by the combination of a high Delay Severity Index (DSI = 100) and the occurrence of 275 reopened incidents. These findings indicate that governance improvement should focus on strengthening incident verification, vendor SLA management, and standardized root cause analysis within the investigation and resolution process (ISACA, 2018; Kouzari et al., 2023).

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DSS02.02: Process Complexity as a Governance Risk

DSS02.02 ranked second (GPS = 4.27), reflecting substantial process complexity (PCI = 259.88) and operational interaction (OII = 5.69). Combined with the heavy concentration of Moderate-priority incidents (94.2%), these findings suggest opportunities to improve incident classification consistency and prioritization accuracy (Vidgof et al., 2023).

DSS02.03: Allocation as a Latent Risk

Although DSS02.03 obtained the lowest GPS (1.14), 11.4% of incidents experienced High Reassignment, indicating that a relatively small subset of incidents repeatedly circulated among resolver groups. Improving routing accuracy and escalation criteria could reduce unnecessary reassignment and contribute to shorter resolution times (Schad et al., 2022).

GPS as a Data-Driven Prioritization Mechanism

The principal contribution of this study is the introduction of GPS as a data-driven prioritization mechanism that transforms operational event-log evidence into governance priorities aligned with COBIT 2019 DSS02. Compared with survey-based governance assessment, GPS offers objective, reproducible, and comparable prioritization while requiring only standard event-log attributes. Nevertheless, the equal-weight assumption represents a methodological simplification and should be refined using expert-based weighting approaches in future work.

GPS Validity

The proposed GPS should be interpreted as a data-driven prioritization mechanism rather than a universally validated governance metric. The sensitivity analysis showed that moderate weight changes did not alter the priority ranking, whereas the correlation analysis revealed a strong association between reassignment frequency and incident modification activity ($\rho = 0.67$), supporting the empirical relevance of the selected operational indicators. Together, these findings provide supporting evidence for the internal consistency and local robustness of the proposed framework.

Practical Implications for Organizations

For organizations operating event-log-based ITSM platforms, the proposed indicators can be computed automatically from routine operational data, reducing the need for extensive survey-based governance assessments. GPS can therefore support continuous governance monitoring while providing management with a transparent basis for prioritizing improvement initiatives. The approach also complements recent efforts toward evidence-based ITSM capability improvement (Kristiani & Marcel, 2024).

Threats to Validity

This study has several limitations. First, the analysis was conducted using a single publicly available dataset, limiting external generalizability. Second, the equal-weight aggregation and empirically selected HR threshold may not be appropriate for every organizational context. Although the proposed GPS demonstrated local robustness through sensitivity analysis, its weighting scheme has not yet been validated using expert-based approaches such as AHP or Delphi. Future studies should therefore perform cross-organizational validation and incorporate expert judgment to improve the external validity of the proposed framework (Caluwe et al., 2024; Mangoki et al., 2024).

CONCLUSION

This study proposed an event-log-based, data-driven prioritization mechanism for identifying governance improvement priorities within the COBIT 2019 DSS02 domain. Five operational indicators (PCI, OII, HR, RII, and DSI) were derived directly from standard event-log attributes and integrated into the Governance Priority Score (GPS) to provide a quantitative and reproducible basis for governance prioritization. The empirical evaluation identified DSS02.04 as the highest governance priority, followed by DSS02.02 and DSS02.03, indicating that incident reopening and prolonged vendor-related delays constitute the most critical governance concerns in the analyzed environment.

Additional validation showed that moderate (±10%) changes in indicator weights did not alter the governance priority ranking, while correlation analysis confirmed meaningful empirical relationships among the selected operational indicators, supporting the internal consistency of the proposed framework. The proposed GPS should therefore be interpreted as a data-driven prioritization mechanism rather than a universally validated governance metric. Future research should investigate expert-based weighting methods, such as AHP or Delphi, evaluate the

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framework across multiple organizations, and extend the proposed indicators to the remaining DSS02 subprocesses and related COBIT domains.

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