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RESEARCH ARTICLE

Proposed Business Process Management (BPM) Tools for Optimizing Business Process Management at PT Hutama Karya Infrastruktur

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KEYWORDS
Business Process Management; Digital Transformation; Infrastructure Enterprise; Process Governance; SMART Method

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ABSTRACT
This study aims to develop and apply a governance-oriented Business Process Management (BPM) tool selection framework for PT Hutama Karya Infrastruktur, a project-based infrastructure enterprise undergoing digital transformation in Indonesia. A mixed-methods design was employed by combining internal gap analysis, Business Model Canvas analysis, organizational document review, semi-structured interviews, Value-Focused Thinking, Focus Group Discussions, and the Simple Multi-Attribute Rating Technique (SMART). Interview data were analyzed using thematic content analysis supported by ATLAS.ti to derive evaluation criteria, while SMART analysis was used to compare four BPM tool alternatives: ARIS Express, Enterprise Architect Sparx, SAP Signavio, and Bizagi. Sensitivity analysis was conducted to test the robustness of the ranking results. The study identified six evaluation criteria: Cost, System Integration, System Security, Ease of Use, Feature Suitability, and Post-Implementation Support. Feature Suitability and System Security emerged as the most important criteria, followed by System Integration and Post-Implementation Support. The SMART results indicate that Enterprise Architect Sparx achieved the highest aggregate score and remained the top-ranked alternative across different sensitivity scenarios. This study contributes to BPM and digital transformation literature by positioning BPM tool selection as a governance-oriented strategic decision rather than a purely technical software evaluation. The proposed framework offers a structured decision-making approach for infrastructure enterprises, state-owned enterprise subsidiaries, and project-based organizations in emerging economies.

1. INTRODUCTION

The acceleration of Industry 4.0 has intensified the need for organizations to redesign how business processes are documented, integrated, monitored, and governed. Digital technologies such as the Internet of Things, artificial intelligence, big data analytics, and enterprise information systems have reshaped organizational operations by enabling greater connectivity, process visibility, and data-driven decision-making (Schumacher et al., 2016; Vial, 2019; Asrol et al., 2023). However, digital transformation is not merely a matter of adopting technological tools. It also requires organizations to develop process-oriented capabilities that support cross-functional coordination, operational accountability, and continuous improvement, particularly in industries characterized by complex workflows and multiple stakeholder dependencies (Baiyere et al., 2020; Kerpedzhiev et al., 2021). In this regard, Business Process Management (BPM) has

become a strategic organizational capability because it enables firms to identify, model, standardize, analyse, improve, and govern business processes in a systematic manner (Dumas et al., 2013; Trkman, 2010; vom Brocke et al., 2014).

The role of BPM tools has become increasingly significant as organizations seek to move beyond manual process documentation toward integrated digital process management. BPM tools allow organizations to model workflows using standardized notations such as Business Process Model and Notation (BPMN), create centralized process repositories, manage process documentation, and support traceability across business functions (Object Management Group, 2013; Zuhaira & Ahmad, 2021). These capabilities are important not only for operational efficiency but also for process governance, as they help organizations maintain documentation control, clarify process ownership, support audit readiness, and improve consistency between formal procedures and actual practices. Prior studies also show that process-oriented digital capabilities can reduce digitalization barriers, strengthen compliance, and improve organizational readiness for digital transformation (Van Looy, 2021; Asrif et al., 2025). In the Indonesian context, BPMN-based process improvement has been shown to support operational redesign and efficiency improvement in logistics companies, indicating the practical relevance of BPM approaches for complex operational sectors (Aritonang & Ciptomulyono, 2024).

This issue is highly relevant to PT Hutama Karya Infrastruktur (HKI), a subsidiary of a state-owned enterprise operating in the toll road construction sector in Indonesia. HKI is facing increasing operational complexity due to its expansion into Public-Private Partnership (PPP) projects and broader business opportunities beyond the Trans Sumatra Toll Road programme. This strategic shift requires more integrated, standardized, and digitally enabled business process management. An internal assessment based on the Indonesia Industry 4.0 Readiness Index (INDI 4.0) indicated several process-related gaps at HKI, including fragmented documentation, limited process integration, and outdated process management practices (Ministry of Industry of the Republic of Indonesia, 2018). Many business processes are still documented manually using separate tools such as Word, Excel, and Visio, which limits traceability, weakens version control, and creates difficulties in maintaining process consistency across departments. An internal gap analysis further revealed that 41 out of 236 Standard Operating Procedures (SOPs), or approximately 17%, were outdated and required revision. SOP updates were generally conducted reactively, either upon requests from Business Process Owners or after exceeding the three-year validity period, creating operational and governance challenges such as redundant procedures, audit difficulties, and inconsistencies between documented procedures and actual practices.

Despite the growing literature on BPM, digital transformation, and BPM tool implementation, several research gaps remain. First, empirical studies on BPM tool selection in infrastructure and construction-related organizations remain limited, especially in emerging economy contexts. Second, existing BPM tool evaluation studies tend to emphasize generic technical capabilities such as modelling, automation, integration, and usability, while governance-related dimensions such as traceability, internal control, documentation accountability, audit readiness, and post-implementation sustainability remain underexplored. Third, limited research integrates Multi-Criteria Decision-Making (MCDM) methods with governance-oriented BPM perspectives in the context of state-owned enterprise subsidiaries and project-based organizations. These gaps are important because BPM tool selection involves multiple

criteria and competing organizational priorities that cannot be adequately assessed through cost or feature comparison alone. In emerging market settings, digital transformation and innovation capability have also been shown to contribute to competitive advantage when supported by organizational alignment and market-oriented capabilities (Sastra et al., 2025), while digital technology adoption in Indonesia has been linked to improved public service efficiency and institutional performance (Yusuf et al., 2025).

To address these gaps, this study develops and applies a governance-oriented BPM tool selection framework using Value-Focused Thinking and the Simple Multi-Attribute Rating Technique (SMART). Value-Focused Thinking is used to identify organizational values and translate stakeholder priorities into relevant evaluation criteria, while SMART is used to evaluate BPM tool alternatives based on weighted criteria and structured scoring (Goodwin & Wright, 2009; Keeney, 1996; Nofriansyah, 2017). Using HKI as an empirical case, this study evaluates four BPM tool alternatives—ARIS Express, Enterprise Architect Sparx, SAP Signavio, and Bizagi—based on six criteria: cost, system integration, system security, ease of use, feature suitability, and post-implementation support. Accordingly, this study addresses two research questions: What criteria are most relevant for selecting a BPM tool in a governance-intensive infrastructure organization? Which BPM tool alternative provides the most suitable value for HKI's operational, technical, and governance requirements? This study contributes to the BPM and digital transformation literature by positioning BPM tool selection as a governance-oriented strategic decision rather than a purely technical evaluation exercise. Practically, the proposed framework offers a structured decision-making approach for infrastructure enterprises, state-owned enterprise subsidiaries, and other project-based organizations in emerging economies seeking to improve process integration, governance quality, and sustainable digital transformation.

2. LITERATURE REVIEW

2.1 Business Process Management and Digital Transformation

Business Process Management (BPM) refers to a systematic approach for identifying, modelling, analysing, improving, and governing organizational processes in order to achieve operational efficiency and strategic alignment (Dumas et al., 2013; Trkman, 2010). In its earlier development, BPM was often associated with process documentation, workflow modelling, and operational standardization. However, the growing complexity of digital transformation has expanded the role of BPM into a strategic organizational capability that supports agility, integration, compliance, and data-driven improvement (vom Brocke et al., 2014; Baiyere et al., 2020). This shift is particularly important because digital transformation requires organizations not only to adopt new technologies, but also to redesign their processes, governance structures, and organizational routines to enable more integrated and responsive operations (Vial, 2019; Van Looy, 2021).

The relationship between BPM and digital transformation has been increasingly emphasized in recent studies. BPM provides the process architecture needed to translate digital technologies into operational value, while digital transformation creates new demands for process visibility, automation, integration, and continuous improvement (Baiyere et al., 2020; Kerpedzhiev et al., 2021). In this sense, BPM functions

as a bridge between technological adoption and organizational capability development. Organizations that lack process-oriented capabilities may adopt digital systems without achieving meaningful integration or performance improvement. Conversely, organizations with mature BPM capabilities are better positioned to align digital tools with strategic objectives, operational requirements, and stakeholder expectations (Van Looy, 2021).

In the context of emerging economies, BPM and digital transformation are especially relevant because many organizations still face fragmented processes, limited integration, and uneven levels of digital maturity. Studies in Indonesia show that digital transformation and innovation capability can improve organizational competitiveness when supported by market orientation and organizational alignment (Sastra et al., 2025). Similarly, digital technology has been shown to improve service efficiency in Indonesian institutional settings, suggesting that digital transformation can contribute to better governance and organizational performance when supported by appropriate implementation mechanisms (Yusuf et al., 2025). These findings indicate that digital transformation should be understood not only as a technological initiative, but also as a process and governance transformation.

2.2 BPM Governance in Project-Based and Infrastructure Organizations

BPM governance refers to the structures, roles, responsibilities, standards, and control mechanisms used to ensure that business processes are designed, maintained, monitored, and improved in alignment with organizational objectives (Jurczuk, 2021; vom Brocke et al., 2014). Strong BPM governance helps organizations clarify process ownership, standardize procedures, ensure documentation consistency, and support process accountability. These functions are particularly important in project-based organizations, where business processes often involve multiple departments, sequential approval flows, external stakeholders, and high levels of operational interdependence.

Infrastructure and construction-related organizations face distinctive BPM challenges because their operations are usually project-based, cross-functional, and governance-intensive. Processes in such organizations often involve procurement, engineering, finance, legal compliance, project control, risk management, and stakeholder coordination. Without integrated process governance, organizations may experience fragmented documentation, overlapping procedures, inconsistent process execution, and weak traceability between formal procedures and actual practices. These challenges may reduce operational efficiency and weaken accountability, especially in organizations that operate under public sector, state-owned enterprise, or Public-Private Partnership environments.

Prior BPM studies have emphasized the importance of process standardization, ownership, and lifecycle management for improving organizational performance (Trkman, 2010; Dumas et al., 2013). However, studies specifically examining BPM governance in infrastructure enterprises and state-owned enterprise subsidiaries remain relatively limited. This gap is important because governance-intensive organizations require BPM not only to improve efficiency, but also to strengthen traceability, internal control, documentation accountability, and audit readiness. In this context, BPM governance becomes a critical foundation for sustainable digital transformation because it ensures that process digitization is accompanied by clear responsibilities, valid documentation, and controlled process changes.

2.3 BPM Tools and Process Improvement

BPM tools are digital applications that support organizations in modelling, analysing, documenting, monitoring, and improving business processes. These tools commonly provide functions such as process modelling, repository management, workflow documentation, simulation, version control, collaboration, and integration with other enterprise systems (Zuhaira & Ahmad, 2021). A key element of BPM tools is their ability to support Business Process Model and Notation (BPMN), a standardized notation that enables organizations to represent business processes in a structured and commonly understood format (Object Management Group, 2013). BPMN helps improve communication among stakeholders because it provides a common visual language for describing workflows, decision points, roles, and process sequences.

The use of BPM tools can support process improvement by increasing visibility, reducing documentation fragmentation, and enabling more systematic process analysis. In the Indonesian logistics sector, for example, BPMN-based process improvement has been used to support operational redesign and improve process efficiency, demonstrating the relevance of model-based process improvement for complex operational environments (Aritonang & Ciptomulyono, 2024). This evidence suggests that BPM tools are not merely documentation instruments, but can also function as enablers of process redesign, operational learning, and organizational improvement.

Nevertheless, BPM tool adoption also presents several challenges. Organizations must ensure that selected tools fit their process complexity, digital maturity, security requirements, user capabilities, integration needs, and long-term implementation capacity. Prior studies on BPM tools often focus on technical capabilities such as process modelling, automation, usability, and system integration (Zuhaira & Ahmad, 2021). While these criteria are important, they may not be sufficient for organizations operating in governance-intensive environments. For such organizations, BPM tools must also support process traceability, access control, audit readiness, documentation governance, and post-implementation sustainability. Therefore, BPM tool selection should be approached as a strategic decision that integrates technical, operational, financial, and governance considerations.

2.4 Multi-Criteria Decision-Making for BPM Tool Selection

BPM tool selection is a multi-criteria decision problem because it requires decision-makers to evaluate several alternatives based on multiple and sometimes conflicting criteria. A tool with strong technical capabilities may involve high implementation costs, while a tool that is easy to use may provide limited integration or governance functionality. Similarly, a low-cost alternative may be attractive in the short term but may not provide sufficient post-implementation support or scalability. These trade-offs indicate that BPM tool selection cannot be adequately addressed through a single criterion such as cost or feature availability.

Multi-Criteria Decision-Making (MCDM) methods provide structured approaches for evaluating alternatives based on weighted criteria and stakeholder preferences. MCDM is useful for technology selection because it allows decision-makers to combine qualitative judgments and quantitative scores in a transparent and systematic manner (Goodwin & Wright, 2009; Ouarhim et al., 2024). Among MCDM approaches, the Simple Multi-Attribute Rating Technique (SMART) is suitable for decision problems that involve

multiple evaluation criteria and require clear, understandable, and practical scoring procedures (Nofriansyah, 2017). SMART enables decision-makers to assign weights to criteria, score alternatives, normalize values, and calculate aggregate performance scores.

In addition to SMART, Value-Focused Thinking provides a useful foundation for developing evaluation criteria because it begins with organizational values and objectives rather than predefined alternatives (Keeney, 1996). This approach is relevant for BPM tool selection because organizations should first clarify what they expect BPM tools to achieve, such as integration, governance support, traceability, usability, security, or long-term sustainability. By combining Value-Focused Thinking and SMART, decision-makers can develop evaluation criteria that are grounded in organizational needs and then assess alternatives through a structured quantitative process. This combination is particularly valuable for governance-intensive organizations because it connects stakeholder priorities with transparent decision analysis.

2.5 Conceptual Framework

Based on the literature, this study conceptualizes BPM tool selection as a governance-oriented and multi-criteria decision process. The framework is built on three main arguments. First, digital transformation requires process-oriented organizational capabilities, and BPM provides the foundation for process standardization, integration, and continuous improvement (Baiyere et al., 2020; Van Looy, 2021). Second, BPM implementation in project-based and governance-intensive organizations requires stronger attention to process governance, including process ownership, documentation control, traceability, internal control alignment, and audit readiness (Jurczuk, 2021; vom Brocke et al., 2014). Third, BPM tool selection involves multiple technical, operational, financial, and governance criteria, making MCDM approaches such as SMART appropriate for supporting structured and transparent decision-making (Goodwin & Wright, 2009; Nofriansyah, 2017).

Within this framework, organizational challenges such as fragmented documentation, limited traceability, manual SOP management, and weak process integration create the need for a more structured BPM approach. These challenges are translated into BPM tool requirements through stakeholder-based criteria development. The criteria are then evaluated using SMART to compare alternative BPM tools based on weighted performance values. The expected outcome is the identification of a BPM tool that supports not only operational efficiency, but also process governance, documentation accountability, system integration, and sustainable digital transformation.

Figure 1 presents the conceptual research framework used in this study. The framework shows how organizational challenges and BPM governance requirements are translated into evaluation criteria and assessed through Value-Focused Thinking and SMART. It also highlights the expected contribution of BPM tool selection to process standardization, improved traceability, governance quality, and digital transformation outcomes in infrastructure organizations.

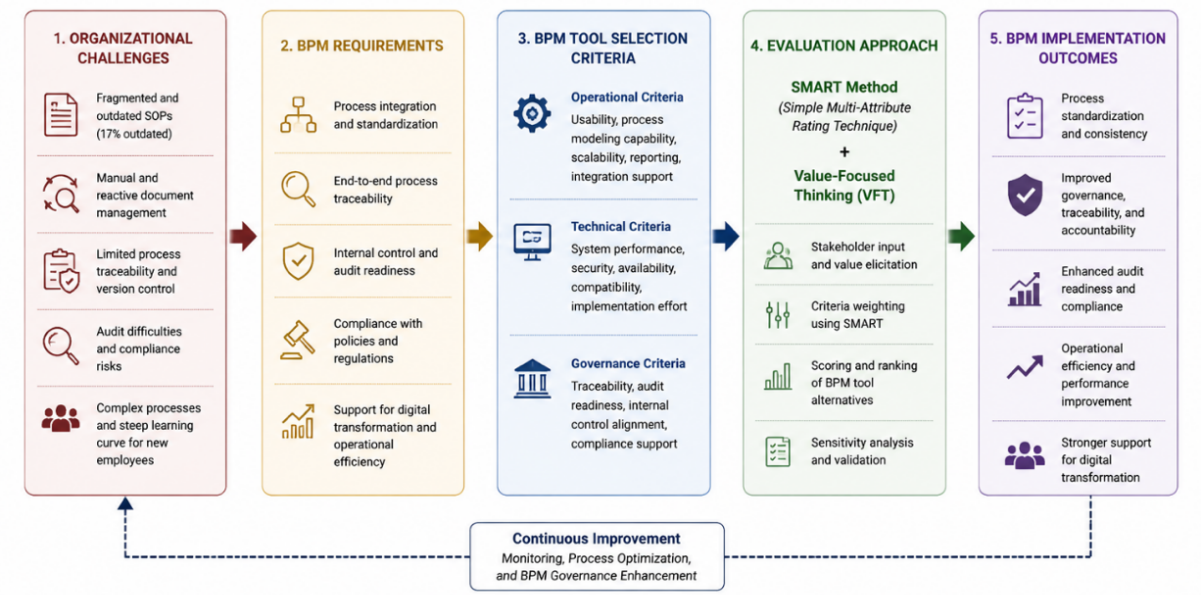

Figure 1. Conceptual Research Framework for Governance-Oriented BPM Tool Selection
Source: Author (2025)

3. METHODOLOGY

This study employed a mixed-methods design to develop and apply a governance-oriented Business Process Management (BPM) tool selection framework at PT Hutama Karya Infrastruktur (HKI). The qualitative phase was used to identify organizational problems, stakeholder values, BPM governance requirements, and evaluation criteria, while the quantitative phase was used to evaluate BPM tool alternatives using the Simple Multi-Attribute Rating Technique (SMART). This design was considered appropriate because BPM tool selection involves both contextual organizational understanding and structured multi-criteria decision-making.

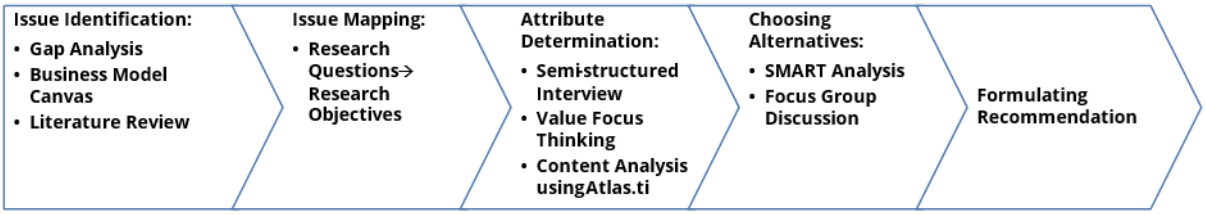

Figure 2. Research Design
Source: Author (2025)

As illustrated in Figure 2, the research was conducted in five stages. First, the current BPM condition at HKI was examined through internal gap analysis, Business Model Canvas analysis, organizational document review, and literature review to identify key process-related problems, including fragmented documentation, limited integration, outdated Standard Operating Procedures (SOPs), weak traceability, and the need for stronger process governance. Second, semi-structured interviews were conducted using a Value-Focused Thinking approach to identify stakeholder values and translate organizational needs into evaluation criteria (Keeney, 1996). Third, BPM tool alternatives were selected based on their compatibility with Business Process Model and Notation (BPMN) standards and their relevance to HKI's operational context. Fourth,

Focus Group Discussions (FGDs) were conducted to validate the criteria, assign criterion weights, and score each alternative. Finally, SMART analysis and sensitivity analysis were performed to determine the most suitable BPM tool and test the robustness of the decision.

Table 1. Data Collection Methods

Approach	Data Collection Methods	Objectives	Stakeholders / Participants
Qualitative	Semi-structured interview → Value Focus Thinking → Content Analysis with ATLAS.ti	Identify the attributes for SMART analysis	- Head of System & IT Departments - System Manager - IT Analyst - System Specialist of PT Hutama Karya (Persero)
Quantitative	Focus Group Discussion (FGD) → SMART	- Determine a weight for each attribute - Assign values to measure the performance of the alternatives on that attribute	- Head of Core Business Department - Head of Supporting Department

Source: Author (2025)

HKI was selected as the case organization because it represents a project-based and governance-intensive infrastructure enterprise undergoing digital transformation. Participants were selected using purposive sampling because the study required information-rich stakeholders with direct knowledge of business process management, system development, organizational governance, and BPM implementation requirements (Patton, 2002). The involvement of technical, operational, and governance-related stakeholders ensured that the evaluation captured multiple organizational perspectives and reduced the dominance of a single functional viewpoint. The semi-structured interviews were developed with reference to ISO/IEC 25010 software quality characteristics to ensure that the evaluation considered functionality, usability, reliability, security, compatibility, maintainability, and related system quality dimensions (International Organization for Standardization, 2023).

Interview data were analyzed using thematic content analysis supported by ATLAS.ti. The coding process followed three stages. First, open coding was used to identify recurring concepts related to BPM challenges, governance requirements, digital transformation needs, system integration, security, usability, feature requirements, cost considerations, and implementation support. Second, axial coding was applied to group related codes into broader categories based on conceptual similarity and organizational relevance. Third, selective coding was used to consolidate these categories into the final evaluation criteria. The coding results were triangulated with organizational documents, relevant literature, ISO/IEC 25010 dimensions, and stakeholder validation during FGDs to strengthen analytical credibility.

Table 2. Example of Coding Process and Criteria Development

Interview Excerpt	Open Code	Category	Final Criterion
"Di HKI nantinya digitalisasi menjadi satu saja, harus integrasi."	System connectivity	Integration requirement	System Integration
"Kita harus memastikan keamanan proteksi data, skalabilitas proses digital di seluruh lini bisnis HKI."	Data protection	Security requirement	System Security
“Prinsip efisiensi tingkat nasional saat ini memengaruhi biaya yang akan kita keluarkan.”	Cost efficiency requirement	Financial consideration	Cost
“Pengguna harus dapat mengoperasikan sistem tanpa pelatihan ekstensif.”	User friendliness	User experience	Ease of Use

Interview Excerpt	Open Code	Category	Final Criterion
"Kita butuh pemodelan BPMN lengkap dan fitur tata kelola proses."	Functional completeness	BPM functionality	Feature Suitability
"Bantuan dari vendor setelah implementasi sangat penting."	Technical support	Implementation support	Post-Implementation Support

Source: Author (2025)

The qualitative analysis produced six evaluation criteria: Cost, System Integration, System Security, Ease of Use, Feature Suitability, and Post-Implementation Support. Cost refers to licensing, implementation, and related expenditure required for BPM tool adoption. System Integration refers to the ability of the tool to connect with existing organizational systems and support cross-functional process integration. System Security refers to access control, role-based authorization, data protection, and secure system environments. Ease of Use refers to user-friendliness, interface clarity, accessibility, and operational simplicity. Feature Suitability refers to the relevance and completeness of BPM functions, including BPMN modelling, repository management, documentation control, simulation, and process governance features. Post-Implementation Support refers to vendor support, documentation, training, technical assistance, and community resources after adoption.

The BPM tool alternatives evaluated in this study were ARIS Express, Enterprise Architect Sparx, SAP Signavio, and Bizagi. These alternatives were selected because they support BPMN-based process modelling and are relevant for business process documentation, repository management, and process improvement activities. During the FGDs, participants assigned weights to each criterion based on its perceived importance and scored each alternative using a 0–100 scale. To reduce subjectivity, the weighting and scoring process was conducted through facilitated group discussions, where participants justified their assessments and reached consensus collaboratively.

The SMART procedure was applied by normalizing criterion weights and calculating the aggregate value of each alternative. The normalized weight was calculated using $Wj = wj / \Sigma wj$, where Wj represents the normalized weight of criterion j, wj represents the original weight, and Σwj represents the total weight. The aggregate value of each alternative was calculated using $Vi = \Sigma(Wj \times Xij)$, where Vi represents the total value of alternative i and Xij represents the performance score of alternative i on criterion j (Goodwin & Wright, 2009; Nofriansyah, 2017). The alternative with the highest aggregate value was identified as the most suitable BPM tool for HKI.

Sensitivity analysis was conducted to assess whether the ranking remained stable under alternative weighting assumptions. Two scenarios were tested: reducing the influence of functional reliability-related criteria and reducing the influence of user empowerment-related criteria. The remaining weights were redistributed proportionally, and the aggregate scores were recalculated. This procedure tested whether the selected BPM tool remained robust under different managerial priority scenarios. Ethical considerations were addressed by reporting participants based on organizational roles rather than personal identities and by using internal organizational data only in aggregate form.

4. RESULTS

4.1 Identification of BPM Tool Evaluation Criteria

The qualitative content analysis generated six evaluation criteria for BPM tool selection: Cost, System Integration, System Security, Ease of Use, Feature Suitability, and Post-Implementation Support. These criteria were derived from stakeholder interviews and validated through Focus Group Discussions (FGDs). The coding results indicate that System Integration appeared as the most frequent concern, followed by Post-Implementation Support, Ease of Use, Feature Suitability, Cost, and System Security. Although System Security had a lower frequency in the coding output, it remained strategically important because stakeholders considered data protection, access control, and governance compliance essential for BPM implementation in a state-owned enterprise subsidiary.

Table 3. Coding Results from Content Analysis (ATLAS.ti Output)

No.	Code/Criteria	Description	Category	Frequency
1	Cost	Consideration of licensing fees and implementation costs	Cost	9
2	System Integration	Ability to integrate with other systems such as ERP, SharePoint, etc.	Benefit	34
3	System Security	Availability of role-based access, user control, and secure environment	Benefit	3
4	Ease of Use (UI & UX)	User-friendliness and simplicity of the interface	Benefit	26
5	Feature Suitability	Completeness and relevance of features such as modeling or simulation	Benefit	16
6	Post-Implementation Support	Availability of support, documentation, training, and community	Benefit	28

Source: Content Analysis ATLAS.ti Output (2025)

The findings show that stakeholders prioritized BPM tools that could support cross-functional integration, long-term implementation sustainability, and operational usability. The prominence of System Integration reflects HKI's need to reduce fragmented business process documentation and improve connectivity across organizational functions. Similarly, the high frequency of Post-Implementation Support indicates that BPM tool adoption is not perceived as a one-time software implementation, but as a continuous process requiring training, technical assistance, documentation, and organizational adaptation. These criteria therefore reflect both technical requirements and governance-oriented concerns in HKI's digital transformation context.

4.2 Criteria Weighting and Alternative Performance Scores

The six criteria were weighted during the FGDs based on their perceived importance to HKI's BPM implementation. Feature Suitability and System Security received the highest original weights, each scoring 90. System Integration and Post-Implementation Support followed with weights of 80, while Cost and Ease of Use each received weights of 70. The total original weight was 480, which was then normalized for SMART analysis. Four BPM tool alternatives were evaluated: ARIS Express, Enterprise Architect Sparx, SAP Signavio, and Bizagi.

Table 4. Criteria Weights and Alternative Performance Scores

Criteria	Original Weight	Normalized Weight	ARIS	EA Sparx	SAP Signavio	Bizagi
Cost	70	0.15	80.5	79.8	0	100

System Integration	80	0.17	60	90	75	70
System Security	90	0.19	60	80	90	60
Feature Suitability	90	0.19	70	90	80	75
Ease of Use	70	0.15	85	75	60	85
Post-Implementation Support	80	0.17	60	90	80	70
Total Weight	480	1.00				

Source: Author (2025)

The weighting structure indicates that HKI placed greater emphasis on functional reliability, governance capability, and long-term implementation sustainability than on short-term usability or cost considerations. Feature Suitability was considered critical because BPM tools must support BPMN-based modelling, process repository management, documentation control, and process governance features. System Security was also highly weighted because BPM tools would manage organizational process data and documentation, requiring role-based access, data protection, and secure system environments. Meanwhile, System Integration and Post-Implementation Support were also considered important because HKI requires BPM tools that can support cross-functional coordination and remain sustainable after implementation.

4.3 SMART-Based Evaluation and Ranking of BPM Tool Alternatives

The SMART calculation was conducted by multiplying the performance score of each alternative by the normalized weight of each criterion. The aggregate values show that Enterprise Architect Sparx achieved the highest score, followed by Bizagi, ARIS, and SAP Signavio. The ranking indicates that EA Sparx provides the strongest overall value across technical, operational, and governance-related dimensions.

Table 5. Summary of BPM Tool Alternative Performance

Alternative	Cost	Aggregate Weighted Value	Rank
Enterprise Architect Sparx (EA Sparx)	Rp743.904.000	86.12	1
Bizagi	Rp434.616.000	77.20	2
ARIS	Rp733.200.000	69.93	3
SAP Signavio	Rp1.964.625.000	67.65	4

Source: Author (2025)

The results show that EA Sparx achieved the highest aggregate weighted value of 86.12. Its superior performance was mainly supported by strong scores in System Integration, Feature Suitability, and Post-Implementation Support, which are among the most important criteria in the evaluation framework. This result indicates that EA Sparx is strongly aligned with HKI's need for integrated process modelling, centralized process documentation, system interoperability, and sustainable BPM implementation.

Bizagi ranked second with an aggregate score of 77.20. Its main strengths were cost efficiency and ease of use, making it a relatively attractive option from a financial and user adoption perspective. However, Bizagi scored lower than EA Sparx in System Integration, System Security, Feature Suitability, and Post-Implementation Support. This suggests that although Bizagi may be suitable for organizations prioritizing affordability and usability, it may provide weaker support for complex and governance-intensive BPM requirements.

ARIS ranked third with an aggregate score of 69.93. ARIS showed relatively good performance in Cost and Ease of Use, but its lower scores in System Integration, System Security, and Post-Implementation Support reduced its overall suitability for HKI's operational context. SAP Signavio ranked fourth with an aggregate score of 67.65.

Although SAP Signavio had the highest score in System Security, its high implementation cost and lower usability score reduced its overall attractiveness within the SMART evaluation. These findings show that BPM tool selection requires balancing multiple criteria because no alternative dominates across all dimensions.

As shown in Figure 3, EA Sparx provides the most balanced position between cost and aggregate performance. While Bizagi offers the lowest cost, its lower aggregate performance indicates a trade-off between affordability and overall capability. SAP Signavio demonstrates strong security capability but has the highest cost and lower overall performance. Therefore, if decision-makers prioritize governance capability, integration, feature completeness, and implementation sustainability, EA Sparx is the most suitable BPM tool alternative for HKI.

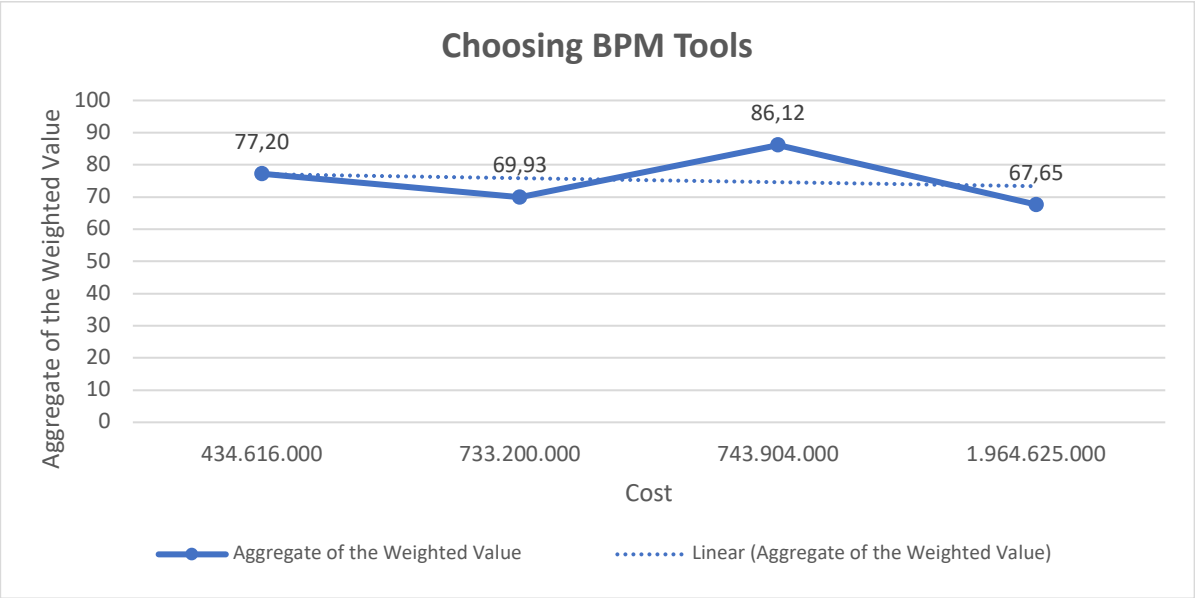

Figure 3. Provisional Decision
Source: Author (2025)

4.4 Sensitivity Analysis

Sensitivity analysis was conducted to evaluate whether the ranking of BPM tool alternatives remained stable under different managerial priority scenarios. Two scenarios were examined. The first scenario reduced the influence of Functional Reliability-related criteria, particularly criteria associated with integration capability, security, feature suitability, and governance-oriented functionality. The second scenario reduced the influence of User Empowerment-related criteria, particularly usability and operational support considerations. The recalculated scores are presented in Table 6.

Table 6. Sensitivity Analysis

Alternative	Weighted Value Functional Reliability = 0	Original Value	Weighted Value User Empowerment = 0
ARIS	72,50	69,93	67,10
Enterprise Architect Sparx (EA Sparx)	84,00	86,12	87,30
SAP Signavio	66,00	67,65	70,50
Bizagi	80,50	77,20	74,80

Source: Author (2025)

The sensitivity analysis confirms that EA Sparx remained the top-ranked alternative across all weighting scenarios. Under the Functional Reliability scenario, EA Sparx obtained a score of 84.00, remaining ahead of Bizagi, ARIS, and SAP Signavio. Under the User Empowerment scenario, EA Sparx increased to 87.30 and continued to outperform all other alternatives. This consistency indicates that the decision is robust and not dependent on a single dominant criterion or weighting assumption.

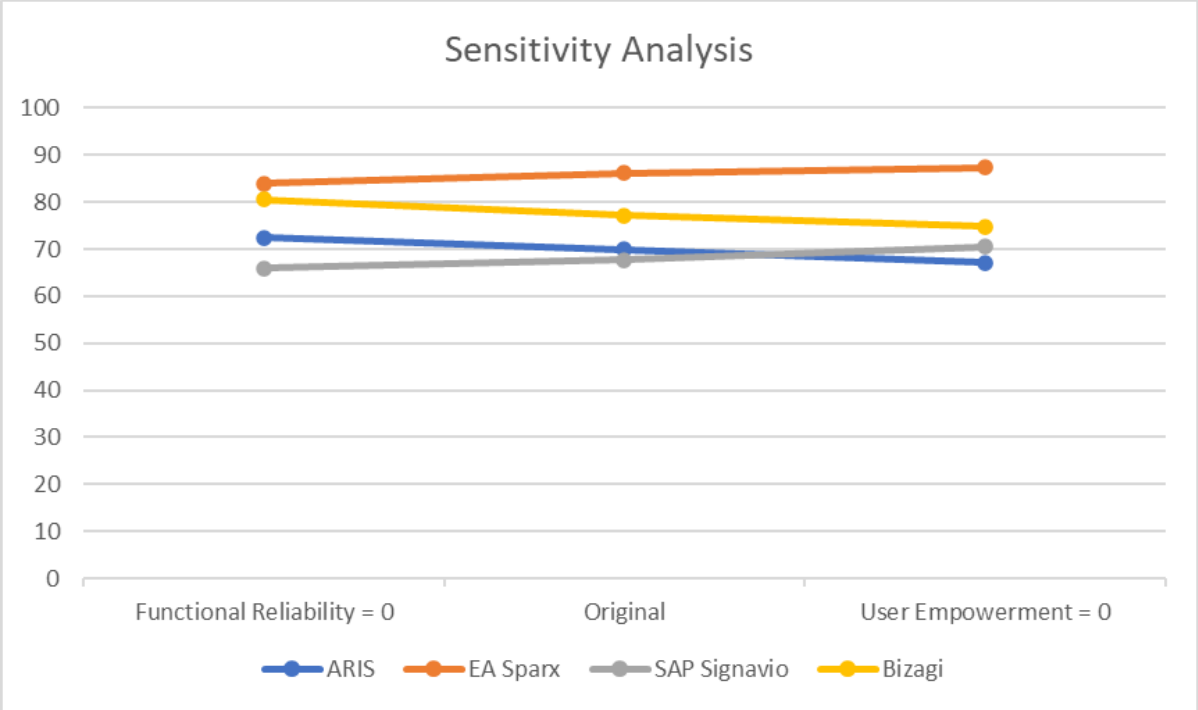

Figure 4. Sensitivity Analysis Chart
Source: Author (2025)

The relatively stable performance of EA Sparx across all scenarios reflects its balanced capabilities across integration, feature suitability, security, governance support, and post-implementation sustainability. In contrast, Bizagi showed stronger sensitivity to changes in weighting assumptions, particularly because its performance depends more heavily on cost and ease of use. SAP Signavio improved under the User Empowerment scenario but did not outperform EA Sparx due to its cost and usability limitations. Overall, the sensitivity analysis strengthens the conclusion that EA Sparx is the most suitable BPM tool alternative for HKI's digital transformation and process governance requirements.

5. DISCUSSION

The findings of this study indicate that BPM tool selection in governance-intensive infrastructure organizations should be understood as a strategic process governance decision rather than merely a software procurement activity. The weighting results show that Feature Suitability, System Security, System Integration, and Post-Implementation Support were prioritized over cost and ease of use. This pattern suggests that HKI's BPM tool requirements are shaped not only by operational efficiency considerations, but also by the need for process standardization, documentation control, traceability, access

security, and long-term implementation sustainability. These findings are consistent with the view that BPM functions as an organizational capability that supports digital transformation by connecting technology adoption with process redesign, governance mechanisms, and organizational routines (Baiyere et al., 2020; Dumas et al., 2013; Van Looy, 2021; vom Brocke et al., 2014).

The selection of Enterprise Architect Sparx as the highest-ranked BPM tool reflects its strong alignment with HKI's operational and governance requirements. EA Sparx achieved the highest aggregate score because it performed strongly in system integration, feature suitability, and post-implementation support, which are critical for organizations dealing with fragmented SOP management, limited version control, and cross-functional process dependencies. In contrast, Bizagi offered stronger cost efficiency and usability, but its lower scores in integration, security, feature suitability, and implementation support indicate weaker alignment with HKI's broader governance needs. SAP Signavio demonstrated strong security capability, but its high cost and lower usability reduced its overall suitability. These trade-offs confirm that BPM tool selection requires balancing multiple dimensions rather than optimizing a single factor such as cost, usability, or technical sophistication (Goodwin & Wright, 2009; Nofriansyah, 2017; Zuhaira & Ahmad, 2021).

From a theoretical perspective, this study contributes to BPM and digital transformation literature by extending the discussion of BPM tool selection toward governance-oriented evaluation. Prior BPM studies have emphasized process modelling, automation, usability, and integration as important BPM tool capabilities (Object Management Group, 2013; Zuhaira & Ahmad, 2021). However, the findings of this study show that governance-related dimensions, including documentation accountability, process traceability, access control, audit readiness, and post-implementation sustainability, are equally important in project-based and state-owned enterprise contexts. This supports the argument that BPM should be viewed not only as a mechanism for efficiency improvement, but also as a governance infrastructure that enables organizations to maintain consistency between documented procedures and actual operational practices (Jurczuk, 2021; Trkman, 2010). In the Indonesian context, the findings also align with evidence that BPMN-based process improvement can support operational redesign in complex sectors and that digital transformation contributes to organizational competitiveness when supported by appropriate organizational capabilities (Aritonang & Ciptomulyono, 2024; Sastra et al., 2025).

Methodologically, the study demonstrates the usefulness of integrating Value-Focused Thinking, qualitative content analysis, and SMART analysis for BPM tool selection. Value-Focused Thinking enabled the evaluation criteria to be grounded in stakeholder values and organizational needs rather than predefined software attributes, while ATLAS.ti-supported content analysis provided a transparent basis for deriving the six evaluation criteria. SMART then transformed these criteria into a structured quantitative decision model, allowing stakeholders to compare alternatives systematically. The sensitivity analysis further strengthened the robustness of the findings by showing that EA Sparx remained the top-ranked alternative under different weighting scenarios. This confirms that the recommendation is not dependent on a single criterion or managerial assumption, but reflects balanced performance across multiple dimensions.

From a managerial perspective, the findings suggest that HKI should position BPM tool adoption as part of a broader digital transformation and process governance

initiative. Selecting EA Sparx should be accompanied by process standardization, centralized repository development, clear process ownership, documentation governance, role-based access control, and periodic SOP review mechanisms. Without these complementary governance arrangements, BPM tool implementation may only digitize existing fragmented practices rather than transform them. For infrastructure enterprises, SOE subsidiaries, and other project-based organizations in emerging economies, this study offers a structured approach for selecting BPM tools that align with operational complexity, governance requirements, and long-term digital transformation objectives. The findings reinforce that digital technology adoption can improve organizational efficiency and institutional performance when supported by process integration, governance alignment, and sustained implementation capability (Kerpedzhiev et al., 2021; Yusuf et al., 2025).

6. CONCLUSION

This study developed and applied a governance-oriented framework for Business Process Management (BPM) tool selection in the context of PT Hutama Karya Infrastruktur, a project-based infrastructure enterprise undergoing digital transformation. By integrating Value-Focused Thinking, qualitative content analysis, Focus Group Discussions, SMART analysis, and sensitivity analysis, the study identified six key evaluation criteria: Cost, System Integration, System Security, Ease of Use, Feature Suitability, and Post-Implementation Support. The findings indicate that Feature Suitability, System Security, System Integration, and Post-Implementation Support are the most important criteria, reflecting the need for BPM tools that support process standardization, documentation control, traceability, integration, and long-term implementation sustainability.

The SMART results show that Enterprise Architect Sparx achieved the highest aggregate score and remained the top-ranked alternative across different sensitivity scenarios. This indicates that EA Sparx provides the most balanced value for HKI's operational, technical, and governance requirements. Theoretically, this study contributes to BPM and digital transformation literature by positioning BPM tool selection as a governance-oriented strategic decision rather than a purely technical software evaluation. Methodologically, the study demonstrates how stakeholder-based criteria development can be integrated with multi-criteria decision-making to support transparent and evidence-based technology selection. Practically, the proposed framework can assist infrastructure enterprises, state-owned enterprise subsidiaries, and other project-based organizations in emerging economies in selecting BPM tools that align with process governance, operational complexity, and digital transformation objectives.

This study has several limitations. The analysis was conducted within a single infrastructure organization, which may limit the generalizability of the findings to other sectors or organizational contexts. In addition, the evaluation relied on stakeholder judgment in assigning criteria weights and alternative scores, although triangulation, facilitated discussions, and sensitivity analysis were used to strengthen the robustness of the results. Future research may extend this study by comparing different Multi-Criteria Decision-Making methods, such as AHP, TOPSIS, or hybrid MCDM models, and by examining post-implementation outcomes after BPM tool adoption. Longitudinal research would also be valuable to assess how BPM tool implementation affects

process performance, user adoption, audit readiness, and organizational digital transformation over time.

Author Contributions

R.D.A: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Project Administration, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing.

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No potential conflict of interest has been reported by the author.

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