Coordination, Risk Governance, and Implementation in Indonesia's IKN Megaproject: Integrated Empirical Evidence

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Abstract: Delivering a national megaproject within a complex institutional landscape requires governance mechanisms that can bridge diverse stakeholder expectations while ensuring coherent program execution. This study examines how coordination practices, risk governance, and program implementation interact in shaping performance outcomes within Indonesia's new capital megaproject (IKN). A sequential mixed-methods approach was applied, beginning with a survey of 200 stakeholders across government agencies, consultants, and contractors, followed by qualitative analysis of official progress documentation. The structural findings show that the influence of governance factors is context-dependent: horizontal infrastructure packages rely heavily on inter-organisational coordination, whereas vertical building projects are more sensitive to risk governance. Program implementation emerges as a central mediating process, translating governance actions into measurable project results across all project categories. Complementary qualitative themes highlight persistent challenges—such as funding constraints, land acquisition delays, and technical uncertainties—that reinforce the need for adaptive, collaborative, and communicative program practices. By integrating these insights, the study advances an empirically grounded understanding of how governance interventions can be tailored to differing project environments. The findings offer practical guidance for improving megaproject delivery in developing countries that face similar operational and institutional complexities.

Keywords: Program Governance, Coordination, Risk Management, Stakeholder Engagement, Megaproject Performance

INTRODUCTION

Large-scale public infrastructure programmes in developing countries are often confronted with governance challenges arising from fragmented institutions, multi-actor involvement and uncertain implementation environments. Such complexity has long been recognised in project studies, where megaprojects are viewed as highly interdependent socio-technical systems that require extensive sensemaking, coordination and institutional alignment (Flyvbjerg, 2014; Biesenthal et al., 2018; Geraldi & Söderlund, 2018). Scholars have noted that megaprojects frequently experience coordination difficulties, role ambiguities and instability in decision processes due to behavioural biases, structural fragmentation and multi-level governance pressures (Flyvbjerg et al., 2016; Winch, 2010; Scott, 2014). These challenges are amplified in contexts where regulatory systems, organisational capacities and resource management practices vary across implementing entities (Locatelli et al., 2017; Wang et al., 2022; Denicol et al., 2021). As a result, the performance of megaprojects depends not only on technical capabilities but also on the effectiveness of programme governance in aligning diverse actors toward shared project outcomes (Artto et al., 2009; Müller et al., 2019).

Indonesia's new capital megaproject (IKN) provides a compelling illustration of this complexity. Large national infrastructure programmes typically involve multiple layers of governance and competing institutional logics that must be reconciled throughout planning and implementation (Denicol et al., 2021; Ruuska et al., 2011). The IKN programme similarly consists of hundreds of interdependent work packages spanning ministries, consultants and contractors operating under different mandates, capabilities and organisational cultures. Comparable to findings from megaproject cases such as Hinkley Point C and the Shanghai Expo (Daniel & Daniel, 2019; Hu, 2015), programme success in IKN depends on governance mechanisms capable of managing cross-entity coordination, resource constraints and evolving project risks. Governance needs in developing countries are further shaped by fluctuating funding conditions, administrative

bottlenecks and variations in project delivery maturity (PMI, 2024; Too & Weaver, 2014; Scott, 2014), making programme alignment even more critical.

Existing research on megaproject governance consistently highlights the role of coordination in facilitating information exchange, harmonising decisions and reducing fragmentation across multi-organisational settings (Pellegrinelli, 2011; Ochieng & Price, 2010; Bakker et al., 2016). Coordination failures have been linked to schedule delays, cost escalation and inconsistent policy execution, particularly in multi-firm project systems (Ruuska et al., 2011; Wang et al., 2023). Likewise, risk governance has been recognised as essential for mitigating technical, financial and institutional uncertainties that typically arise in complex programmes (Irimia-Diéguez et al., 2014; ISO 31000, 2018; Hillson, 2022). However, studies also indicate that the salience of governance variables varies by project typology: horizontal infrastructure requires extensive inter-organisational coordination, while vertical building projects are more sensitive to design risks, quality control and compliance requirements (Davies et al., 2016; Kusimo et al., 2019).

Despite these insights, empirical evidence examining how coordination and risk governance interact with programme implementation in developing-country megaprojects remains limited. Prior studies often analyse governance variables in isolation or treat project types homogenously, overlooking differences in uncertainty profiles, interface complexity and stakeholder arrangements (Martinsuo & Hoverfält, 2018; Wang et al., 2023; Denicol et al., 2021). Moreover, programme implementation—conceptualised as the integrative process that translates governance actions into project outcomes—has received comparatively limited empirical attention as a mediating construct in megaproject research (Serra & Kunc, 2015; Zwikael & Huemann, 2023). Addressing these gaps is crucial for strengthening programme governance strategies in environments characterised by institutional plurality and operational uncertainty.

LITERATURE REVIEW

Program Governance in Megaprojects

Programme governance frameworks describe the mechanisms linking strategic intent to project-level execution (Artto et al., 2009; Thiry, 2015). In megaprojects, governance encompasses decision rights, institutional arrangements, reporting structures and mechanisms for aligning diverse stakeholders (Müller, 2017; Too & Weaver, 2014). Studies emphasise that governance must manage evolving interdependencies, behavioural dynamics and institutional pressures that affect delivery performance (Flyvbjerg et al., 2016; Scott, 2014; Denicol et al., 2021). In developing countries, governance is further challenged by fluctuating resource availability, regulatory ambiguity and administrative fragmentation (Wang et al., 2022; Daniel & Daniel, 2019).

In developing-country contexts, programme governance is further shaped by institutional fragmentation, variations in delivery capacity and inconsistency in regulatory enforcement (PMI, 2024; Scott, 2014). These structural conditions reinforce the argument that governance effectiveness depends not only on formal arrangements but also on the quality of interactions among stakeholders. Accordingly, governance is increasingly viewed as an adaptive capability that responds to shifting needs and emerging programme realities (Locatelli et al., 2017; Müller et al., 2019).

The IKN megaproject reflects these characteristics: diverse stakeholders, high technical variability and the need for synchronised decision-making across many packages (Denicol et al., 2021). Thus, governance mechanisms such as coordination and risk governance are essential to achieving programme coherence (Davies et al., 2016).

Stakeholder Coordination in Multi-Entity Infrastructure Environments

Coordination is a foundational pillar of programme governance, serving as the mechanism through which actors exchange information, align procedures and integrate activities (Pellegrinelli, 2011; Too & Weaver, 2014). Studies in large public programmes highlight that coordination challenges often emerge from unclear role boundaries, fragmented information flows and asymmetries in authority structures (Bakker et al., 2016; Aaltonen & Kujala, 2016). These issues tend to be more pronounced in megaproject settings where numerous public and private entities operate under distinct mandates, interface systems and organisational cultures (Ruuska et al., 2011; Denicol et al., 2021).

Coordination is widely recognised as a determinant of programme performance, particularly in multi-entity environments characterised by interdependent tasks and shared responsibilities (Ochieng & Price, 2010; Davis, 2014). Research shows that coordination failures often stem from ambiguous roles, poor information flow and misaligned stakeholder priorities (Aaltonen & Kujala, 2016; Bakker et al., 2016). In multi-firm megaprojects, relational coordination and inter-organisational trust are critical for reducing uncertainty and maintaining implementation alignment (Ruuska et al., 2011; Castelblanco et al., 2024). Horizontal infrastructure projects, in particular, require high-intensity coordination due to shared site access, overlapping scopes and cross-agency dependencies (Davies et al., 2016).

Research also suggests that the degree of coordination required varies according to project typology. Horizontal infrastructure involving utilities, land development and road networks relies heavily on inter-organisational interfaces and requires frequent negotiation of site access, sequencing and resource deployment (Davies et al., 2016). Conversely, vertical building projects tend to rely more on controlled internal workflows yet remain highly sensitive to technical design changes, supply-chain constraints and regulatory compliance requirements (Hu, 2015; Willumsen et al., 2019). These distinctions explain why coordination emerges as a primary driver of implementation success in horizontal works.

Risk Governance in Complex Infrastructure Programmes

Megaprojects are characterised by high levels of uncertainty arising from technical, financial, institutional and socio-political factors (Locatelli et al., 2017). Risk governance extends risk management by emphasising transparency, collective sensemaking and multi-actor decision-making (ISO 31000, 2018; Hillson, 2022). Megaproject risks commonly include institutional, financial, technical and behavioural uncertainties (Flyvbjerg et al., 2016; Irimia-Diéguez et al., 2014). Vertical building projects often face higher exposure to design iteration, quality-control demands and regulatory constraints, which necessitate stronger risk governance structures (Hu, 2015; Kusimo et al., 2019). Good governance is associated with enhanced resilience, effective resource allocation and the capacity to manage emergent risks across delivery stages (Flyvbjerg, 2014; Daniel & Daniel, 2019).

In developing-country contexts, risk governance is frequently challenged by fluctuating budget commitments, procurement complexities, limited technical capacity and policy discontinuities (Scott, 2014; Flyvbjerg et al., 2016). These challenges heighten vulnerability to delays, scope changes and cost overruns. Vertical construction projects—such as governmental office buildings in IKN—are particularly exposed to design risks, regulatory approvals and quality-control requirements, making risk governance a central operational necessity.

Prior research has shown that risk governance contributes not only to minimising disruption but also to enabling resilience and programme adaptability (Flyvbjerg, 2014; Daniel & Daniel, 2019). However, empirical studies comparing the role of risk governance across different infrastructure typologies remain scarce, despite indications that risk exposure profiles differ substantially between horizontal and vertical environments.

Program Implementation as a Mediating Mechanism

Programme implementation serves as the operational conduit through which governance mechanisms influence outcomes (Serra & Kunc, 2015; PMI, 2019). Implementation capability reflects a programme's ability to integrate planning, monitoring, sequencing and resource coordination (Martinsuo & Hoverfält, 2018; Müller et al., 2019). Weak implementation has been associated with under-realised benefits, misalignment across delivery layers and inconsistent performance reporting (Zwikael & Huemann, 2023; Atkinson, 1999). Despite its central role, implementation remains under-examined as a mediating construct in megaproject governance models, particularly in developing-country contexts where institutional and operational constraints are more pronounced (Scott, 2014; Flyvbjerg et al., 2016).

Scholars have long argued that programme implementation acts as a mediating mechanism linking governance structures to performance outcomes, translating governance interventions into measurable delivery results (Martinsuo & Hoverfält, 2018; Müller et al., 2019). However, this mediating role has not been sufficiently tested in developing-country megaprojects, where institutional complexity, fragmented authority structures and uneven delivery capacity complicate the translation from governance intentions to operational execution (Scott, 2014).

Within the IKN programme, implementation processes face challenges related to land acquisition, financial flows, inter-agency coordination and technical sequencing across hundreds of interdependent work packages. These operational realities underscore the importance of examining implementation not merely as an outcome but as a mediating process that links governance mechanisms to project-level performance (Denicol et al., 2021).

Gaps in Existing Research

Although the governance literature recognises the importance of coordination, risk governance and implementation, several gaps remain:

1. There is limited comparative evidence on how governance drivers differ between horizontal and vertical infrastructure projects, despite their distinct technical and organisational characteristics (Davies et al., 2016; Hu, 2015).

2. The mediating role of programme implementation remains under-examined, even though implementation capability is recognised as central to programme theory and value delivery (Martinsuo & Hoverfält, 2018; Müller et al., 2019).

3. Mixed-methods approaches remain scarce in developing-country megaproject studies, particularly those integrating quantitative structural analysis with qualitative insights derived from field conditions (Molina-Azorín & Fetters, 2019).

4. Empirical research within national capital city megaprojects is limited, even though such programmes exhibit heightened institutional complexity and inter-sectoral coordination demands (Denicol et al., 2021).

These gaps underscore the need for an integrated analysis that examines governance mechanisms across different project environments while recognising implementation as a bridging process linking governance to performance.

Gaps in Existing Research

Programme governance literature emphasises that coordination and risk governance shape delivery outcomes through mechanisms that support information exchange, alignment and uncertainty reduction in multi-entity environments (Pellegrinelli, 2011; Irimia-Diéguez et al., 2014; Denicol et al., 2021). Programme implementation is theorised as the bridging process that converts governance decisions into operational

performance (Serra & Kunc, 2015; Martinsuo & Hoverfält, 2018). However, empirical validation of this mediating role remains limited, especially in developing-country megaprojects characterised by institutional fragmentation and heterogeneous delivery capacities (Scott, 2014; Flyvbjerg et al., 2016).

Building on these insights, this study proposes a structural model in which coordination and risk governance influence project performance both directly and indirectly through programme implementation. The model is designed to capture cross-entity dynamics within the IKN megaproject, where hundreds of work packages operate under diverse mandates, technical conditions and regulatory pathways.

1. Research Model

The conceptual model positions:

1.1. Coordination (COO) as a governance driver that enables information sharing, synchronisation and alignment across organisational boundaries, particularly critical for horizontal infrastructure packages (Davies et al., 2016; Ochieng & Price, 2010).

1.2. Risk Governance (RGO) as a governance mechanism that structures transparency, collective judgement and uncertainty mitigation, especially salient in vertical building projects with high design and compliance risks (Hu, 2015; Flyvbjerg et al., 2016).

1.3. Programme Implementation (IMP) as a mediating construct reflecting integration of planning, monitoring, sequencing and resource deployment (Müller et al., 2019; Zwikael & Huemann, 2023).

1.4. Project Performance (PER) as the resulting delivery outcome in terms of coherence, readiness and progress achievement across IKN work packages.

The model acknowledges that governance dynamics may differ across horizontal and vertical project categories due to variations in interface intensity, technical uncertainty and regulatory complexity.

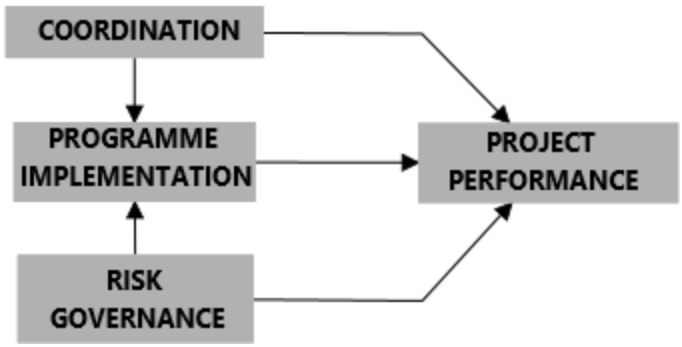

Figure 1. Conceptual Model of Governance–Implementation–Performance Relationships

Figure 1 illustrates the proposed governance model in which coordination and risk governance influence project performance both directly and indirectly through programme implementation. The model also acknowledges potential differences across horizontal and vertical work packages, providing the basis for the subsequent multi-group analysis.

2. Hypotheses Development

2.1. Coordination → Programme Implementation

Effective coordination reduces ambiguity, harmonises field procedures and facilitates multi-agency alignment (Bakker et al., 2016; Aaltonen & Kujala, 2016). H1: Coordination positively influences programme implementation.

2.2. Coordination → Project Performance

Coordination enables efficient execution through shared task sequencing, reduced duplication and improved cross-entity synchronisation (Davies et al., 2016).H2: Coordination positively influences project performance.

2.3. Risk Governance → Programme Implementation

Robust risk governance improves anticipation, detection and management of uncertainties, strengthening integration across work stages (Irimia-Diéguez et al., 2014; Hillson, 2022). H3: Risk governance positively influences programme implementation.

2.4. Risk Governance → Project Performance

Risk governance reduces disruptions, enhances resilience and stabilises delivery trajectories (Locatelli et al., 2017; Daniel & Daniel, 2019). H4: Risk governance positively influences project performance.

2.5. Programme Implementation → Project Performance

Programme implementation acts as the operational pathway through which governance mechanisms materialise into measurable outcomes (Serra & Kunc, 2015; Müller et al., 2019). H5: Programme implementation positively influences project performance.

2.6. Mediating Role of Programme Implementation

Governance mechanisms may exert indirect effects by improving coordination practices, uncertainty handling and procedural alignment at the implementation layer (Martinsuo & Hoverfält, 2018). H6: Programme implementation mediates the relationship between coordination and project performance. H7: Programme implementation mediates the relationship between risk governance and project performance.

2.7. Multi-Group Hypotheses (Horizontal vs Vertical Projects)

Prior evidence suggests that governance mechanisms may vary in influence according to project typology (Davies et al., 2016; Hu, 2015). Horizontal works rely more on inter-organisational coordination, while vertical works are more sensitive to risk governance due to design, quality and regulatory pressures.

Thus:

H8: The effect of coordination on programme implementation differs between horizontal and vertical projects.

H9: The effect of risk governance on programme implementation differs between horizontal and vertical projects.

METHODS

1. Research Design

This study employed a mixed-methods design that integrates quantitative structural modelling with qualitative analysis of field documentation. The quantitative component utilised Partial Least Squares Structural Equation Modelling (PLS-SEM) to examine relationships among coordination, risk governance, programme implementation and project performance. The qualitative component analysed official progress reports, meeting minutes, design documentation and field observations from multiple IKN work packages to contextualise and interpret statistical findings.

Mixed-methods research strengthens explanatory validity by combining numerical patterns with grounded operational insights, consistent with recommended approaches for studying complex programme environments (Molina-Azorín & Fetters, 2019).

2. Sampling and Data Collection

The empirical setting covers the National Capital City (IKN) public infrastructure programme under the Indonesian Ministry of Public Works and Housing (PU–PKP). The quantitative dataset comprised 30 respondents, including Programme Directors, Commitment-Making Officials (PPK), Lead Engineers and Construction Supervisors involved in both horizontal and vertical work packages. Respondents were selected purposively based on their strategic and operational involvement in project delivery.

Data were collected through structured questionnaires distributed during the 2024–2025 implementation phase. Each respondent rated governance and implementation indicators using a five-point Likert scale. To complement survey results, qualitative materials were obtained from the PU–PKP Task Force (Satgas), Manajemen Konstruksi Induk (MKI), contractors, and supervising consultants. These documents provided insights into land acquisition issues, cross-project coordination, sequencing challenges and regulatory processes across the programme.

3. Measurement of Constructs

All constructs were operationalised using validated indicators adapted from prior literature:

- Coordination (COO)

  Indicators reflect information flow, task alignment and inter-organisational synchronisation (Pellegrinelli, 2011; Ochieng & Price, 2010; Aaltonen & Kujala, 2016).

- Risk Governance (RGO)

  Indicators relate to uncertainty identification, risk communication, mitigation responsiveness and multi-actor judgement processes (Irimia-Diéguez et al., 2014; Hillson, 2022; ISO 31000, 2018).

- Programme Implementation (IMP)

  Indicators measure planning integration, monitoring, sequencing, resource deployment and problem resolution (Serra & Kunc, 2015; Martinsuo & Hoverfält, 2018; Müller et al., 2019).

- Project Performance (PER)

  Indicators capture delivery coherence, implementation progress and operational readiness across work packages (Zwikael & Huemann, 2023; Atkinson, 1999).

All items were coded as reflective indicators. Reliability and validity were assessed following recommended PLS-SEM guidelines (Hair et al., 2017).

4. Data Analysis

PLS-SEM Evaluation

PLS-SEM was conducted using SmartPLS 4. Model estimation involved:

- indicator reliability (outer loadings)
- internal consistency reliability (Cronbach's Alpha, Composite Reliability)
- convergent validity (Average Variance Extracted)
- discriminant validity (HTMT ratio)
- multicollinearity assessment (VIF)

The structural model was evaluated by examining:

- path coefficients
- effect sizes (f^2)
- predictive relevance (Q^2)
- coefficient of determination (R^2)
- model fit indices (SRMR)
- PLS Predict for out-of-sample predictive accuracy (Shmueli et al., 2019)

Bootstrapping with 5,000 subsamples was used to assess statistical significance of structural paths and mediation effects.

Mediation Testing

The mediating role of programme implementation was tested using:

- indirect effect significance
- complementary vs competitive mediation
- confidence intervals (bias-corrected)
- variance accounted for (VAF)

This approach aligns with standard mediation procedures recommended in governance and programme management research (Serra & Kunc, 2015; Müller et al., 2019).

Multi-Group Analysis (MGA)

To assess differences between horizontal and vertical project types, non-parametric MGA was conducted. Respondents were categorised based on the primary work package they supervised (e.g., roads, utilities, grading vs. buildings and offices). MGA procedures evaluated:

- path coefficient differences
- significance using Henseler's MGA
- confidence intervals
- group-specific effect sizes

This allowed identification of governance mechanisms that operate differently across varying project typologies (Davies et al., 2016; Hu, 2015).

5. Qualitative Analysis

Qualitative data were analysed using thematic coding to extract patterns related to coordination bottlenecks, risk escalation, sequencing issues and cross-entity interactions. Coding followed Braun & Clarke's (2006) six-step procedure and incorporated audit trail principles to strengthen dependability (Bowen, 2009). The qualitative insights were then integrated with quantitative findings to explain causal mechanisms underlying the structural relationships.

6. Ethical Considerations

All respondents participated voluntarily, and data collection followed standard ethical procedures. Project documents were used with permission from PU–PKP Satgas and MKI. All personal identifiers were removed to maintain confidentiality.

RESULTS

Figures and tables presented in the following sections provide empirical support for both the measurement and structural models. Figure 1 articulates the conceptual relationships proposed in this study, whereas Figure 2 and Tables 1–3 summarise the PLS-SEM results used to validate the model and evaluate its explanatory power.

1. Measurement Model Assessment

All constructs met the reliability and validity thresholds recommended in PLS-SEM. Indicator loadings exceeded the minimum acceptable value of 0.70, while Composite Reliability and Cronbach's Alpha values indicated strong internal consistency. Convergent validity was supported by AVE values above 0.50.

Discriminant validity was established through HTMT ratios, which remained below the recommended threshold. Variance Inflation Factors (VIF) were also within acceptable limits, confirming the absence of multicollinearity.

These results indicate that the measurement model demonstrated adequate psychometric properties for subsequent structural analysis.

These results indicate (table 1) that the measurement model demonstrated adequate psychometric properties for subsequent structural analysis.

Table 1. HTMT Discriminant Validity

	COORDINATION	PROGRAMME _IMPLEMENTATION	PROJECT _PERFORMANCE
COORDINATION			

PROGRAMME _IMPLEMENTATION	0,880		
PROJECT _PERFORMANCE	0,880	0,858	
RISK GOVERNANCE	0,814	0,781	0,853

HTMT < 0.90 → discriminant validity memadai.

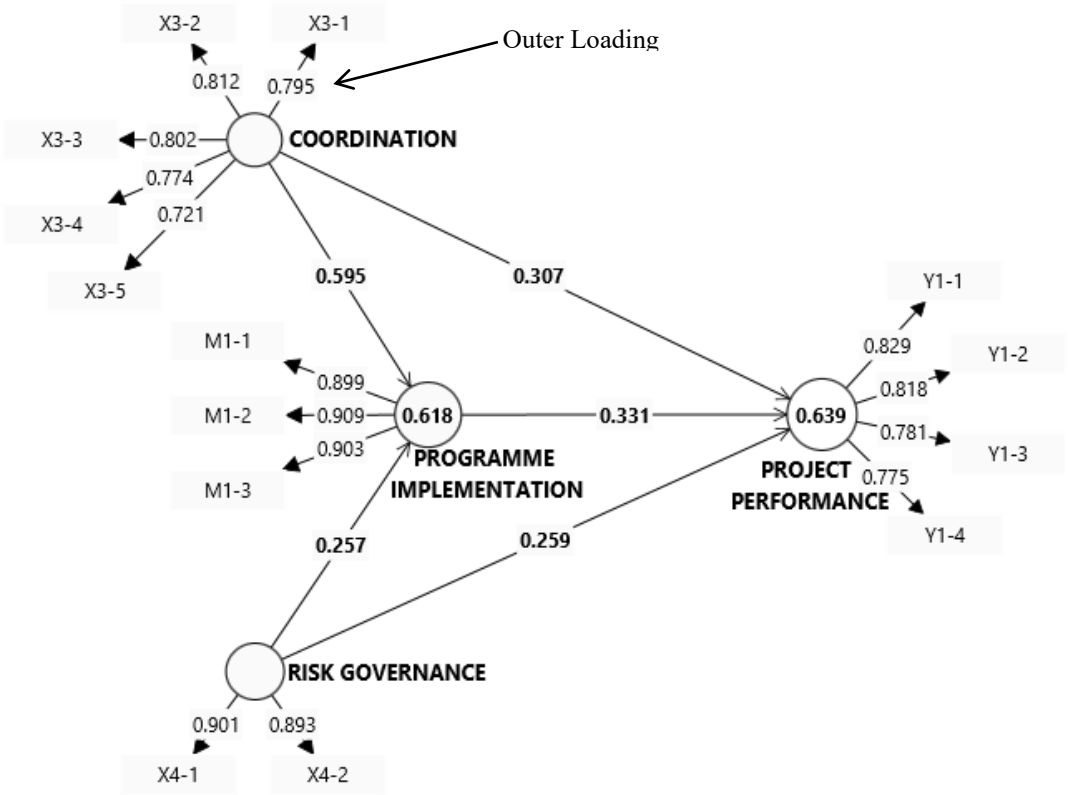

Figure 2. Measurement Model Outer Loading from PLS-SEM (Smart PLS-4)

Figure 2 presents the measurement model showing indicator loadings for all constructs. All retained indicators exceed the recommended threshold of 0.70, confirming adequate indicator reliability and supporting the validity of the reflective measurement specification.

2. Structural Model Assessment

The structural model exhibited strong explanatory power. Programme implementation showed substantial explained variance, while project performance achieved moderate-to-strong R^2 values, indicating that governance mechanisms account for meaningful variation in delivery outcomes.

Table 1 shows that the model demonstrates substantial explanatory power, with coordination and risk governance jointly explaining 61.8% of the variance in programme implementation, and with implementation and governance variables explaining 63.9% of the variance in project performance.

Table 2. R2 PLS-SEM (SmartPLS-4)

	R-square	R-square adjusted
PROGRAMME _IMPLEMENTATION	0,618	0,614
PROJECT _PERFORMANCE	0,639	0,633

Effect size analysis (Table 2) shows that coordination has a large effect on programme implementation (f^2 = 0.537), whereas risk governance has a smaller yet meaningful effect (f^2 = 0.100). For project performance, both coordination and risk governance show small direct effects, reinforcing the role of programme implementation as the primary explanatory mechanism.

Table 3. F2 PLS-SEM (SmartPLS-4)

	f-square
COORDINATION -> PROGRAMME _IMPLEMENTATION	0,537
COORDINATION -> PROJECT _PERFORMANCE	0,099
PROGRAMME _IMPLEMENTATION -> PROJECT _PERFORMANCE	0,116
RISK GOVERNANCE -> PROGRAMME _IMPLEMENTATION	0,100
RISK GOVERNANCE -> PROJECT _PERFORMANCE	0,098

As shown in Table 3, all indicators demonstrate positive Q^2 values, indicating strong predictive relevance of the model. This supports the stability and robustness of the predictive relationships identified within the governance–implementation–performance framework.

Table 4. Q2 PLS Predict (SmartPLS-4)

	Q^2predict
M1-1	0,464
M1-2	0,526
M1-3	0,496
Y1-1	0,398
Y1-2	0,404
Y1-3	0,327
Y1-4	0,354

All structural paths were found to be positive and statistically significant:

- Coordination → Programme Implementation was positive, confirming that stronger inter-organisational alignment, information flow and synchronisation improve implementation quality.
- Risk Governance → Programme Implementation was also positive, suggesting that uncertainty management, risk communication and timely mitigation improve operational coherence.
- Coordination → Project Performance showed significance, although with comparatively lower effect sizes than its influence on implementation.
- Risk Governance → Project Performance produced a stronger direct effect, consistent with the high sensitivity of vertical projects to design changes, compliance and quality-control requirements.
- Programme Implementation → Project Performance was significant, confirming its role as an operational driver of delivery outcomes.

These results provide empirical support for the proposed governance–implementation–performance linkages.

3. Mediation Analysis

Programme implementation exhibited significant mediating effects on both governance variables:

- The indirect effect of Coordination → Project Performance via implementation was statistically significant, indicating complementary mediation.

- The indirect effect of Risk Governance → Project Performance was also significant and, in vertical packages, relatively stronger.

The mediation results reinforce the theoretical view that implementation functions as the bridging process through which governance mechanisms translate into delivery outcomes.

This provides empirical validation for programme implementation as a key operational conduit in megaproject governance systems.

The mediation results (table 5) reinforce the theoretical view that implementation functions as the bridging process through which governance mechanisms translate into delivery outcomes.

Table 5. Mediation Analysis (SmartPLS-4)

	COORDINATION	PROGRAMME _IMPLEMENTATION	PROJECT _PERFORMANCE	RISK GOVERNANCE
COORDINATION			0,197	
PROGRAMME IMPLEMENTATION				
PROJECT _PERFORMANCE				
RISK GOVERNANCE			0,085	

4. Multi-Group Analysis: Horizontal vs Vertical Projects

The Multi-Group Analysis (MGA) revealed meaningful differences between horizontal and vertical project categories.

Horizontal Projects

For horizontal infrastructure (roads, utilities, land development):

- The Coordination → Implementation path was significantly stronger.

- Stakeholders in horizontal works reported higher reliance on cross-entity interfaces, scheduling alignment and shared site access.

- Coordination served as the primary driver of operational coherence and progress.

Vertical Projects

For vertical building works (government offices, facilities):

- The Risk Governance → Implementation path was significantly stronger.

- Respondents highlighted vulnerability to design iteration, quality-control processes, and regulatory approvals.

- Risk governance served as a more influential governance lever compared to coordination.

Group Differences

The MGA confirmed statistically significant differences for:

- H8: Coordination → Implementation (stronger in horizontal)
- H9: Risk Governance → Implementation (stronger in vertical)

These findings demonstrate that governance drivers are not uniform across infrastructure types but vary according to technical complexity, interface intensity and regulatory demands.

5. Integration of Quantitative and Qualitative Findings

Qualitative evidence from progress reports and field documentation supported the quantitative patterns:

- Horizontal packages faced sequencing challenges, shared access constraints and cross-agency coordination demands.
- Vertical packages experienced recurrent design changes, compliance inspections, material delivery issues and risk escalation.
- Both categories showed that successful delivery depended on implementation teams' ability to navigate interdependent tasks and institutional requirements.

The integrated analysis reinforces the multidimensional nature of governance in megaprojects and underscores the contextual sensitivity of governance mechanisms.

DISCUSSION

The findings provide empirical evidence that governance mechanisms exert differentiated influences on programme implementation and project performance within the IKN megaproject. Consistent with prior literature, coordination and risk governance demonstrated significant effects on implementation capability, validating the proposition that governance operates through operational processes that shape delivery outcomes (Serra & Kunc, 2015; Müller et al., 2019). The results reinforce the theoretical perspective that megaprojects function as socio-technical systems requiring alignment across actors, procedures and institutional arrangements (Flyvbjerg, 2014; Denicol et al., 2021).

1. Coordination as a dominant driver in horizontal projects

In horizontal infrastructure packages—such as roads, grading, land development and utilities—coordination emerged as the strongest predictor of implementation. This aligns with existing research showing that horizontal works require intensive inter-organisational synchronisation due to shared work zones, overlapping scopes and geographically distributed tasks (Davies et al., 2016; Ochieng & Price, 2010).

Qualitative evidence further substantiated these findings: delays in land acquisition, access constraints and sequencing issues frequently required rapid negotiation and harmonisation among PU–PKP units, MKI teams, supervising consultants and contractors. These field observations illustrate how coordination serves as the binding mechanism in multi-entity environments, supporting arguments that interdependence intensity amplifies reliance on coordination as a governance tool (Aaltonen & Kujala, 2016; Martinsuo & Hoverfält, 2018).

2. Risk governance as a dominant driver in vertical projects

Vertical building packages demonstrated stronger influence from risk governance. This pattern is consistent with the technical nature of vertical construction, where uncertainty arises from design integration, structural

detailing, inspection processes, quality-control requirements and regulatory compliance (Hu, 2015; Irimia-Diéguez et al., 2014).

Project documentation highlighted repeated design iterations, material delivery risks and multi-stage inspection requirements as critical sources of delay. These factors magnify the importance of risk governance mechanisms—such as early risk identification, timely mitigation and cross-actor risk communication—to stabilise implementation trajectories (Locatelli et al., 2017; Hillson, 2022).

Thus, vertical environments exhibit higher sensitivity to risk governance, supporting theoretical arguments on the differentiated uncertainty profiles of complex built-form projects (Flyvbjerg et al., 2016).

3. Programme implementation as a bridging mechanism

The significant mediating effects confirm the central role of programme implementation in translating governance intentions into operational performance. This aligns with perspectives that implementation is a dynamic process integrating planning, monitoring, sequencing and resource deployment across programme layers (Martinsuo & Hoverfält, 2018; Zwikael & Huemann, 2023).

Findings show that coordination and risk governance influence outcomes not only directly but also indirectly through implementation, highlighting implementation as the operational conduit linking governance structures to delivery results. This supports programme theory claims that governance effectiveness depends on execution capability rather than structural arrangements alone (Serra & Kunc, 2015; Müller et al., 2019).

4. Contextual sensitivity in developing-country megaprojects

The results emphasise that governance-performance relationships are shaped by contextual conditions typical of developing-country megaprojects—such as organisational fragmentation, fluctuating resources, regulatory ambiguity and uneven technical capacity (Scott, 2014; Wang et al., 2022).

Qualitative data from IKN progress reports illustrated how financial flow disruptions, design approval delays and cross-unit coordination gaps materially affected delivery sequencing. These contextual constraints reinforce the argument that governance frameworks must be adaptive, responsive and sensitive to field conditions, rather than uniformly applied across all project types (Locatelli et al., 2017; Flyvbjerg et al., 2016).

5. Contribution to megaproject governance theory

Overall, this study contributes three principal insights:

1. Governance mechanisms operate differently across project typologies.

   Coordination plays a stronger role in horizontal packages, while risk governance is more salient in vertical packages—addressing a gap identified in comparative governance research (Davies et al., 2016; Hu, 2015).

2. Programme implementation functions as a mediating layer.

   The findings provide empirical support for implementation as a bridging process linking governance structures to performance, an area previously under-examined (Serra & Kunc, 2015; Müller et al., 2019).

3. Mixed-methods evidence strengthens explanatory depth.

By integrating structural modelling with field-based documentation, the study provides richer insights into governance dynamics in developing-country megaprojects—responding to methodological gaps noted in prior literature (Molina-Azorín & Fetters, 2019).

CONCLUSION AND IMPLICATIONS

This study examined how coordination and risk governance influence project performance in Indonesia's National Capital City (IKN) megaproject and assessed the mediating role of programme implementation across different project types. The results demonstrate that governance mechanisms do not operate uniformly; instead, their effects depend on project typology and contextual delivery conditions. Coordination emerged as the dominant governance driver in horizontal infrastructure works, where shared site access, cross-agency sequencing and interdependent tasks necessitate intensive alignment. Conversely, risk governance exerted stronger influence in vertical building projects, which are characterised by design iterations, quality-control requirements and regulatory complexity. Programme implementation was found to be a significant mediating process through which governance mechanisms translate into operational outcomes, confirming its central role within programme theory.

By integrating PLS-SEM results with qualitative evidence from field documentation, the study highlights the contextual sensitivity of governance-performance relationships in developing-country megaprojects. The findings show that institutional fragmentation, technical capacity disparities and fluctuating resource conditions shape how governance mechanisms operate in practice. These insights contribute to megaproject governance literature by providing comparative evidence across horizontal and vertical environments, demonstrating the mediating role of implementation, and illustrating the value of mixed-methods approaches in complex programme settings.

From a practical standpoint, the results underscore the need for governance strategies that are differentiated by project typology. Strengthening cross-entity coordination mechanisms is essential for horizontal works, while enhancing risk governance and design-assurance systems is critical for vertical projects. More broadly, programme authorities in developing-country megaprojects may benefit from adaptive governance approaches that respond to evolving uncertainties and institutional dynamics.

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