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Digital risk intelligence and supplier failure in African public infrastructure delivery: Evidence from Nigeria

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Abstract – Digital risk intelligence (DRI) has emerged as a strategic mechanism for mitigating supplier failures in public infrastructure delivery, particularly in African contexts where project delays, cost overruns, and non-compliance remain pervasive. This review critically examines empirical studies from the last nine years to explore how the dimensions of DRI— predictive analytics, real-time monitoring systems, and e-procurement with automated reporting—interact with supplier performance outcomes in Africa, with a particular focus on Nigeria. Findings indicate that predictive analytics enhances foresight in supplier risk assessment, enabling proactive interventions that reduce delays and cost escalations. Real-time monitoring systems facilitate continuous oversight, early detection of deviations, and improved contractual compliance, while e-procurement and automated reporting strengthen transparency, accountability, and governance mechanisms. Comparative analysis across Nigerian case studies, other African countries, and developed economies reveals both opportunities and constraints, highlighting institutional and infrastructural factors that mediate DRI effectiveness. The review further demonstrates theoretical implications for Agency Theory and Dynamic Capabilities Theory by illustrating how DRI reduces information asymmetry and operationalizes sensing, seizing, and transforming capabilities in procurement organizations. Despite growing evidence of DRI's potential, gaps remain in longitudinal, comparative, and context-specific empirical research. The study concludes by recommending policy reforms, practical adoption strategies, and targeted empirical investigations to optimize DRI deployment and improve supplier performance in African public infrastructure delivery.

Keywords: Digital Risk Intelligence, Supplier Failure, Predictive Analytics, Real-Time Monitoring Systems, E-Procurement, African Public Infrastructure

1. Introduction

Across the globe, organizations responsible for delivering critical public infrastructure are increasingly confronted with complex, interconnected risks arising from globalization, digitalization, and growing uncertainty in supply markets. In response, there is a growing yearning for the adoption of digital risk intelligence as a strategic capability for anticipating, monitoring, and mitigating risks that threaten project delivery and organizational performance. Studies from developed economies demonstrate that data-driven risk intelligence enhances transparency, accountability, and decision-making in infrastructure and supply chain systems (Handfield et al., 2019; Mandl, 2023; Rodriguez, 2024). As urban systems become more technologically dependent and financially constrained, the ability to proactively manage procurement and supplier risks has emerged as a critical determinant of urban lifeline sustainability and resilience.

Digital risk intelligence manifests through several interrelated digital capabilities that transform how procurement risks are identified and managed. Predictive analytics usage enables

organizations to analyze historical and real-time data to anticipate supplier performance failures and emerging risks before they materialize (Costa, 2022; Oyeyemi, 2023; Rice, 2024). Real-time monitoring systems support continuous tracking of supplier activities, project milestones, and delivery deviations, allowing early detection of delays and performance anomalies (Alfian et al., 2017; Helo & Shamsuzzoha, 2020). Similarly, e-procurement and automated reporting tools improve visibility, compliance tracking, and auditability of procurement processes by digitizing transactions and supplier interactions (Pralat, 2019; Afolabi et al., 2022; Ahmad et al., 2023). Collectively, these dimensions position digital risk intelligence as a governance mechanism capable of reshaping procurement oversight and supplier management in public infrastructure delivery.

The relevance of digital risk intelligence becomes particularly evident when examined against the persistent challenge of supplier failure in public infrastructure projects. Supplier failure often manifests through project delays, cost overruns, and non-compliance with contractual or regulatory requirements, all of which undermine infrastructure performance and urban resilience. Project delays have been widely linked to poor supplier coordination, information asymmetry, and weak monitoring systems (Frimpong et al., 2003; Durdyev & Hosseini, 2020). Cost overruns frequently result from supplier inefficiencies, opportunistic behaviour, and delayed risk detection during procurement and execution stages (Asiedu and Adaku, 2020; Abdelalim et al., 2025). Non-compliance, including deviations from technical specifications and contractual terms, further exacerbates infrastructure failure and governance risks in public procurement (Klingler and Telles, 2023). These dimensions collectively define supplier failure as a systemic threat rather than an isolated operational issue.

Evidence from developed economies suggests that digital risk intelligence has significantly reduced supplier-related disruptions by enabling early warning systems, predictive supplier scoring, and automated compliance monitoring (Handfield et al., 2019; Mandl, 2023). In African public infrastructure delivery, emerging studies indicate that data-driven procurement and digital monitoring tools are beginning to address long-standing challenges of delay, cost escalation, and weak accountability, although adoption remains uneven (Afolabi et al., 2022; Molepo & Jahed, 2022). In Nigeria, despite the introduction of e-procurement platforms and digital reforms, public procurement organizations continue to experience recurrent supplier failures in major infrastructure projects, suggesting a gap between digital adoption and effective risk intelligence utilization (Adebayo, 2016; Mansfield et al., 1994; Omoregie & Radford, 2006). This gap underscores the need to move beyond transactional digitization toward integrated digital risk intelligence frameworks.

The motivation and research problem of this study therefore lie in the limited scholarly and empirical attention given to digital risk intelligence as a procurement risk management tool within African public infrastructure delivery, particularly in Nigeria. While digital analytics, real-time monitoring, and e-procurement systems have been widely studied in private-sector and developed-country contexts, their role in mitigating supplier failure in public procurement organizations remains underexplored. Existing Nigerian studies have largely focused on delays and cost overruns without explicitly linking these outcomes to digital risk intelligence capabilities embedded in procurement systems. This study addresses this gap by examining how digital risk intelligence influences supplier failure in public infrastructure delivery, using Nigeria as empirical evidence within the broader African context.

Guided by this problem, the study seeks to address the following conceptual research questions: (1) How does digital risk intelligence influence supplier failure in African public infrastructure delivery? (2) To what extent do predictive analytics, real-time monitoring systems, and e-procurement tools mitigate project delays, cost overruns, and non-compliance? (3) What lessons can be drawn from Nigeria to inform urban lifeline resilience in other developing economies?

This study contributes to theory by extending procurement risk management literature through the integration of digital risk intelligence into explanations of supplier failure in public infrastructure systems. It contributes to policy by providing evidence-based insights to support

digital procurement reforms and risk governance frameworks in African public sectors. From a practice perspective, the study offers procurement professionals and infrastructure managers actionable insights on how digital tools can be leveraged to improve supplier oversight, reduce delivery failures, and enhance urban lifeline sustainability.

1 The remainder of this paper is structured as follows. The next section presents a comprehensive literature review on digital risk intelligence and supplier failure in public infrastructure delivery. This is followed by the methodology section, outlining the study design and analytical approach (for empirical studies) or synthesis strategy (for review papers). The final sections provide the discussion, conclusion, and policy recommendations, highlighting implications for future research and practice in African public procurement systems.

3. Results and Discussion

3.1 Results

The nexus between digital risk intelligence and supplier failure in African public infrastructure delivery can be theoretically anchored in Agency Theory and Dynamic Capabilities Theory, which together illuminate both the governance and capability dimensions of procurement risk management. Agency Theory, advanced by Jensen and Meckling in 1976 following earlier insights by Ross in 1973, conceptualizes organizational relationships as contractual arrangements in which principals delegate tasks to agents whose interests may not align with those of the principals. In the context of public infrastructure procurement, public sector organizations act as principals, while contractors and suppliers serve as agents responsible for project execution. The theory emphasizes that information asymmetry, moral hazard, and opportunistic behavior often undermine performance, particularly in complex and capital-intensive projects.

These agency problems are especially pronounced in African public infrastructure systems, where institutional capacity constraints and weak monitoring mechanisms exacerbate supplier-induced project delays, cost overruns, and non-compliance with contractual specifications. While subsequent scholars such as Eisenhardt expanded the theory to incorporate behavioral and governance considerations, critiques persist regarding its narrow assumption of self-interested rationality and limited attention to trust, collaboration, and contextual institutional dynamics. Nonetheless, Agency Theory remains highly relevant to this study because supplier failures in public infrastructure delivery represent classic agency outcomes arising from insufficient oversight, delayed information flows, and enforcement challenges. Digital risk intelligence directly addresses these agency inefficiencies by reducing information asymmetry and strengthening monitoring and control mechanisms. Predictive analytics enable procurement authorities to anticipate supplier performance risks before they escalate, real-time monitoring systems enhance visibility over project execution, and e-procurement platforms with automated reporting improve transparency and compliance enforcement, thereby aligning agent behavior more closely with principal objectives.

Complementing this governance perspective, Dynamic Capabilities Theory, introduced by Teece et al.(1997) and further refined by Teece in 2007, offers a capability-based explanation for how public procurement organizations adapt to uncertainty and complexity. The theory departs from static resource-based views by emphasizing an organization's ability to sense emerging risks, seize strategic responses, and reconfigure operational processes in dynamic environments. In recent scholarship, digital technologies have been increasingly recognized as enablers of dynamic capabilities, particularly through data analytics, real-time information systems, and platform-based coordination mechanisms. Although the theory has been critiqued for conceptual ambiguity and challenges in empirical operationalization, its relevance to public sector risk management is increasingly acknowledged, especially in contexts characterized by volatility and institutional constraints. Within African public infrastructure delivery, digital risk intelligence constitutes a dynamic capability that enhances organizational responsiveness by enabling early detection of supplier risks, timely intervention in performance deviations, and continuous reconfiguration of procurement governance processes. Through predictive analytics, procurement organizations improve their sensing capability; through real-time monitoring systems, they strengthen their ability to seize corrective actions; and through e-procurement and

automated reporting tools, they transform traditional procurement practices into data-driven governance systems capable of mitigating supplier failure.

Taken together, these theoretical perspectives provide a robust foundation for examining how digital risk intelligence influences supplier failure in African public infrastructure delivery. Agency Theory offers the primary explanatory lens by framing supplier failure as a consequence of governance and information asymmetry problems, while Dynamic Capabilities Theory enriches the analysis by explaining how digital risk intelligence enables public procurement organizations to adaptively manage these risks. By integrating these theories, the study advances a theoretically grounded argument that digital risk intelligence is not merely a technological enhancement but a strategic governance and capability mechanism through which public sector organizations can anticipate, control, and reduce supplier-induced project delays, cost overruns, and non-compliance. This integrated theoretical framing underpins the study's examination of Nigeria as empirical evidence and contributes to the broader urban lifeline and public procurement literature by positioning digital risk intelligence as a critical enabler of resilient public infrastructure delivery.

Digital risk intelligence (DRI) has emerged as a critical construct in contemporary risk management, particularly in the governance of public infrastructure projects where supplier performance and delivery outcomes are often uncertain and complex. The concept reflects the strategic integration of digital technologies and analytical tools to anticipate, detect, and respond to risks associated with procurement and project execution. Scholars have approached its conceptualization from varying perspectives. For instance, Kulworatit et al. (2021) describe digital risk intelligence as a framework for assessing and mitigating risks in digital environments, emphasizing the systematic use of data and technology to identify vulnerabilities and forecast potential disruptions, whereby predictive analytics form the core mechanism for risk anticipation. Similarly, Aydin and Seferoglu (2025) define digital risk intelligence as the capacity to measure, monitor, and control risk exposure through digital platforms and tools, highlighting the operationalization of real-time monitoring systems for proactive risk management. In a complementary perspective, Balogun et al. (2021) conceptualize digital risk intelligence as an organizational capability that leverages data analytics and automated reporting to enhance transparency, accountability, and responsiveness in complex operational environments, which underscores the integration of e-procurement and reporting tools as central to risk governance.

A synthesis of these definitions reveals several converging points: digital risk intelligence inherently involves the strategic use of technology to anticipate and manage risks, it requires continuous monitoring of risk indicators, and it is embedded in organizational processes that enhance accountability and decision-making. Accordingly, in the context of African public infrastructure, and more specifically within Nigeria, digital risk intelligence can be defined as the organizational capability to employ predictive analytics, real-time monitoring systems, and e-procurement with automated reporting tools to proactively identify, assess, and mitigate supplier-related risks in public infrastructure delivery. This operationalization aligns most closely with the perspective of Balogun et al. (2021), who emphasize the combination of technological integration and organizational responsiveness as central to effective risk intelligence.

In African public infrastructure, digital risk intelligence is carried out through multiple interrelated mechanisms. Predictive analytics are utilized to anticipate supplier performance challenges based on historical data, project schedules, and risk indicators, allowing procurement managers to identify high-risk suppliers before project disruptions occur (Oyeyemi, 2023; Rice, 2024). Real-time monitoring systems enable continuous tracking of procurement processes, contract execution, and project milestones, providing early warnings of delays, deviations, or non-compliance (Helo and Shamsuzzoha, 2020; Alfian et al., 2017). E-procurement platforms with automated reporting tools standardize procurement workflows, enhance transparency, and generate auditable records that support accountability and compliance enforcement (Prašat, 2019; Afolabi et al., 2022). Empirical evidence from Nigeria indicates that while these digital mechanisms have been introduced in major public infrastructure projects – particularly in urban

transport, energy, and water systems – their implementation remains partial, fragmented, and often constrained by limited digital literacy, infrastructural deficiencies, and institutional inertia (Adebayo, 2016; Molepo and Jahed, 2022).

The challenges associated with implementing digital risk intelligence in African public infrastructure include weak IT infrastructure, inadequate technical capacity among procurement personnel, low adoption of integrated digital platforms, and resistance to change in entrenched bureaucratic systems (Ahmad et al., 2023; Kumar et al., 2023). Additional obstacles relate to data quality, interoperability of monitoring systems, and the cost of sustaining digital platforms over long project lifecycles. Despite these constraints, the benefits of digital risk intelligence are substantial. Studies demonstrate that the adoption of predictive analytics, real-time monitoring, and e-procurement platforms can reduce project delays, minimize cost overruns, enhance contract compliance, and improve overall supplier performance (Handfield et al., 2019; Mandl, 2023; Rodriguez, 2024). In the Nigerian public sector, successful implementation of these digital tools has been linked to greater procurement transparency, faster detection of supplier underperformance, and strengthened accountability in large-scale infrastructure projects (Afolabi et al., 2022; Molepo and Jahed, 2022).

Overall, the conceptual framework positions digital risk intelligence as a multidimensional construct – encompassing predictive analytics usage, real-time monitoring, and e-procurement with automated reporting tools – that serves as a proactive mechanism to mitigate supplier failure, which is operationalized through project delays, cost overruns, and non-compliance. In the African public infrastructure context, the framework highlights how integrating digital capabilities into procurement systems can enhance foresight, control, and responsiveness, ultimately improving the efficiency and reliability of urban lifeline infrastructure delivery. This conceptualization as illustrated in Figure 1, provides the foundation for examining the interplay between digital risk intelligence and supplier failure in Nigeria and sets the stage for empirically investigating its effectiveness as a strategic governance tool in public procurement.

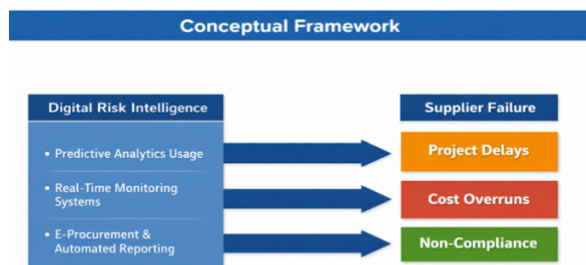


Figure 1. Conceptual diagram of digital risk intelligence vs supplier failure

3.1.1 Supplier Failure in African Public Infrastructure

Supplier failure in African public infrastructure represents a critical challenge that undermines project delivery, escalates costs, and compromises the social and economic benefits of public investments. It encompasses instances where suppliers or contractors fail to meet contractual obligations, resulting in negative consequences for project schedules, budgets, and regulatory compliance. Various models and perspectives have been advanced to conceptualize supplier failure in African and developing-country contexts. For example, Enshassi et al. (2010) classify supplier failure in construction projects through performance dimensions such as timeliness, cost efficiency, and quality compliance, emphasizing the project-based consequences of inadequate supplier performance. Similarly, Panova and Hilletoft (2018) frame supplier failure as disruptions in supply chain continuity, highlighting material shortages, delivery delays, and non-adherence to specifications as core elements. Other perspectives, such as those proposed by Durdyev and Hosseini (2020) and Omoregie and Radford (2006), integrate risk and capability-

based classifications, identifying operational, financial, and compliance-related failures as distinct categories.

For the purposes of this study, the performance-based perspective advanced by Enshassi et al. (2010) provides the most appropriate conceptual grounding. This perspective aligns directly with the measures adopted here—project delays, cost overruns, and non-compliance—and emphasizes tangible, measurable outcomes that are critical to assessing the effectiveness of supplier performance in public infrastructure delivery. These dimensions are widely observable in African projects and allow for empirical assessment of digital risk intelligence as a mitigating factor.

Project delays, the first measure, refer to the failure of suppliers to complete assigned tasks within the stipulated contractual timelines. According to Frimpong et al. (2003), project delays occur when planned schedules are not adhered to due to supplier inefficiencies, material shortages, or coordination lapses, whereby delays translate into disruptions in project sequencing and resource allocation. Complementarily, Alinaitwe et al. (2013) define project delays as the temporal deviation from agreed milestones, which in practice compounds costs and impacts the operationalization of subsequent project phases. Across these definitions, the common thread is the adverse effect of supplier inefficiency on time-bound objectives. For this study, project delays are conceptualized as the extent to which supplier inefficiency extends project timelines beyond contractual schedules, aligning closely with the definition of Frimpong et al. (2003), while incorporating the practical emphasis on systemic disruption.

Cost overruns constitute the second measure and capture instances where actual project expenditures exceed approved budgets due to supplier performance issues. Mansfield et al. (1994) identify cost overruns as a consequence of inadequate planning, resource mismanagement, and supplier-induced inefficiencies, whereby financial deviations escalate project risks and reduce value-for-money. Similarly, Asiedu and Ameyaw (2021) describe cost overruns as the cumulative effect of misaligned supplier delivery and unexpected expenditure variations, which in turn undermine project sustainability and fiscal accountability. The shared emphasis in these definitions is the tangible financial impact arising from supplier failure. Within the Nigerian public infrastructure context, cost overruns are frequent in road, water, and energy projects, largely due to weak supplier oversight and delayed interventions (Omoriegbe and Radford, 2006; Panova and Hilletoft, 2018). In this study, cost overruns are conceptualized as the additional expenditures incurred as a direct result of supplier non-performance, echoing the practical orientation of Mansfield et al. (1994) and emphasizing the link to governance and monitoring mechanisms.

Non-compliance, the third measure, captures the inability or unwillingness of suppliers to adhere to contractual, regulatory, or technical standards. Klingler and Telles (2023) define non-compliance as the failure to observe stipulated legal and contractual obligations, whereby deviations may include substandard materials, unsafe practices, or unauthorized procedural shortcuts. In a complementary perspective, Alfian et al. (2017) frame non-compliance as the discrepancy between expected and actual adherence to operational and quality standards, which directly affects project safety, integrity, and stakeholder confidence. Both definitions converge on the critical role of adherence to norms and obligations in mitigating risks associated with supplier failure. Accordingly, non-compliance in this study is conceptualized as the extent to which suppliers fail to fulfill regulatory, technical, and contractual requirements during project execution, in alignment with Klingler and Telles (2023), while incorporating practical dimensions of operational integrity.

Overall, the dimensions of supplier failure—project delays, cost overruns, and non-compliance—represent interrelated outcomes of inadequate supplier performance in African public infrastructure. Across these dimensions, the commonality lies in the tangible impact on project delivery, financial sustainability, and compliance governance. In the African context, and particularly in Nigeria, measuring supplier failure is challenged by incomplete records, inconsistent reporting practices, and limited digital monitoring infrastructure (Afolabi et al., 2022; Molepo and Jahed, 2022). Despite these constraints, enhancing supplier failure measurement

provides significant benefits, including improved project predictability, reduced fiscal waste, enhanced accountability, and better allocation of resources (Handfield et al., 2019; Mandl, 2023). Empirical observations from Nigeria reveal that projects employing structured monitoring and reporting mechanisms—such as digital dashboards, automated alerts, and periodic performance audits—exhibit reduced delays, controlled costs, and higher compliance adherence (Esan et al., 2023; Oyeyemi, 2023). These findings underscore the practical importance of quantifying supplier failure and highlight the critical role of digital risk intelligence in anticipating, managing, and mitigating supplier-induced disruptions, thereby enhancing the overall resilience and sustainability of public infrastructure delivery.

3.1.1.2 Empirical review

Empirical evidence over the past eight years underscores the critical role of digital risk intelligence in mitigating supplier failures within African public infrastructure delivery, with predictive analytics, real-time monitoring systems, and e-procurement platforms emerging as complementary mechanisms for risk anticipation, control, and compliance management. Predictive analytics has been consistently demonstrated as a forward-looking tool capable of forecasting supplier performance risks and cost deviations; for instance, Handfield et al. (2019) utilized a mixed-method approach across infrastructure-intensive public and private sectors to show that cognitive analytics improved early identification of supplier disruptions, while Costa (2022) confirmed in developing economy contexts that predictive models enhance cost estimation accuracy and supplier evaluation. Esan et al. (2023) further evidenced within Nigerian public procurement organizations that predictive analytics enables proactive vendor risk identification, while Rice (2024) and Ayebo and Olajide (2024) highlighted its role in bridging information asymmetry and fostering anticipatory risk governance, supporting the assertion that predictive capabilities constitute a dynamic organizational asset in mitigating supplier failures.

Complementing predictive analytics, real-time monitoring systems offer continuous oversight that addresses operational latency in supplier performance. Helo and Shamsuzzoha (2020) demonstrated through conceptual-empirical simulations that real-time supply chain visibility enhances delivery coordination and compliance verification, whereas Alfian et al. (2019) showed empirically that sensor-based monitoring reduces delays and operational uncertainties in infrastructure projects. European benchmarks, such as Prałat (2019), and African experiences in South Africa (Molepo and Jahed, 2022) confirm that continuous digital monitoring improves compliance enforcement and reduces opportunistic supplier behavior, with Nigerian cases (Esan et al., 2023) illustrating feasibility despite institutional and infrastructural constraints. E-procurement and automated reporting tools similarly reinforce accountability and transparency within procurement processes. Studies in Nigeria by Afolabi et al. (2022) revealed that digitized procurement platforms enhance supplier traceability and minimize irregularities, while Molepo and Jahed (2022) demonstrated that automated dashboards strengthen audit trails and contractual compliance.

Further empirical support from Ahmad et al. (2023) and Mutangili (2019) emphasizes that automated reporting reduces discretionary manipulation and enhances supplier adherence to contractual obligations, and European evidence from Prałat (2019) shows the broader applicability of these mechanisms for institutionalizing risk intelligence. Taken together, these studies empirically illustrate that integrating predictive analytics, real-time monitoring, and e-procurement systems enables African public infrastructure organizations to anticipate, detect, and manage supplier failures in terms of project delays, cost overruns, and non-compliance. My scholarly interpretation is that such multidimensional digital risk intelligence provides both predictive foresight and operational control, transforming procurement governance from reactive crisis management into proactive, data-driven supply chain resilience, thereby offering a practical pathway for addressing endemic supplier failures in Nigerian public infrastructure delivery.

This synthesis demonstrates that each DRI dimension addresses supplier failure through complementary mechanisms: predictive analytics primarily targets forward-looking risk (reducing delays and cost overruns), real-time monitoring ensures operational oversight (reducing delays and non-compliance), and e-procurement with automated reporting

strengthens institutional transparency and enforcement (reducing cost overruns and non-compliance) as illustrated in table 1. Together, these digital risk intelligence tools create an integrated framework capable of significantly improving the reliability and resilience of public infrastructure delivery in African contexts, particularly in Nigeria.

Table 1: A comparative empirical synthesis table linking each DRI dimension to supplier failure measures

DRI Dimension	Empirical Evidence	Supplier Failure Measure(s) Addressed	Study Context and Design	Key Findings / Scholarly Interpretation
Predictive Analytics Usage	Handfield et al. (2019); Costa (2022); Esan et al. (2023); Rice (2024); Ayebo and Olajide (2024)	Project Delays, Cost Overruns	Mixed-method, quantitative cross-sectional, conceptual-empirical case studies; Sample sizes 180-varies; Data collected via surveys, interviews, secondary data; Analyzed using regression and multivariate statistics	Predictive analytics enables early identification of high-risk suppliers and potential cost escalations, reducing uncertainty in project schedules and cost planning. It provides forward-looking risk intelligence that mitigates supplier failures in African public infrastructure contexts.
Real-Time Monitoring Systems	Helo and Shamsuzzoha (2020); Alfian et al. (2019); Pralat (2019); Molepo and Jahed (2022); Esan et al. (2023)	Project Delays, Non-Compliance	Conceptual-empirical simulations, quantitative implementation studies, qualitative case studies; Sample sizes varied; Data from sensor systems, interviews, document review; Analysis via simulation, descriptive and inferential statistics	Real-time monitoring allows continuous oversight of supplier activities, enhancing delivery coordination, compliance verification, and early disruption detection. This mechanism is crucial for preventing delays and ensuring contractual adherence in African public infrastructure delivery.
E-Procurement and Automated Reporting Tools	Afolabi et al. (2022); Molepo and Jahed (2022); Ahmad et al. (2023); Mutangili (2019); Pralat (2019)	Cost Overruns, Non-Compliance	Quantitative surveys, qualitative case studies, comparative institutional analysis; Sample sizes 200-250+; Data via structured questionnaires, interviews, document review; Analysis using regression, inferential statistics	E-procurement platforms and automated reporting increase transparency, traceability, and auditability of procurement processes, limiting supplier opportunism, reducing irregularities, and enforcing compliance, which mitigates cost overruns and contractual breaches.

3.2 Discussion

The empirical review demonstrates that digital risk intelligence (DRI) is increasingly recognized as a critical mechanism for mitigating supplier failures in African public infrastructure delivery. Across the studies examined, predictive analytics, real-time monitoring systems, and e-procurement/automated reporting consistently contribute to anticipating, detecting, and controlling supplier-related risks. Predictive analytics enables procurement entities to forecast

potential supplier disruptions, project delays, and cost overruns before they materialize, while real-time monitoring provides operational oversight to detect non-compliance and early delivery deviations. E-procurement and automated reporting platforms enhance institutional transparency and enforce contractual adherence, reducing opportunities for supplier opportunism. Collectively, these mechanisms create a complementary digital risk intelligence ecosystem capable of improving procurement governance and infrastructure project outcomes, particularly in contexts characterized by high uncertainty and fragmented data systems. From my scholarly perspective, the integration of these dimensions highlights a shift from reactive to anticipatory supply chain risk management in African public infrastructure.

Patterns emerging from the literature indicate that DRI adoption correlates with reductions in supplier-induced delays, cost overruns, and non-compliance, yet the empirical evidence is heavily uneven across regions and contexts. While studies from developed economies, such as the EU and the United States (Pralat, 2019; Handfield et al., 2019), demonstrate mature application of real-time monitoring and predictive analytics, African studies, particularly from Nigeria and South Africa, reveal institutional and infrastructural constraints that hinder full-scale implementation. Contradictions are also evident: while some Nigerian case studies report substantial reductions in supplier failure through predictive analytics (Esan et al., 2023), other evidence points to persistent delays and cost overruns due to limited ICT infrastructure and inconsistent adherence to e-procurement protocols (Afolabi et al., 2022; Molepo and Jahed, 2022). This divergence highlights a gap between the potential of DRI tools and the practical realities of implementation in resource-constrained environments, suggesting that contextual factors strongly mediate DRI effectiveness in African public infrastructure delivery.

When comparing lessons from Nigeria with other African countries and developed economies, a clear distinction emerges between institutional capacity and technology adoption. Developed economies demonstrate standardized digital procurement platforms, integrated monitoring systems, and predictive analytics embedded within robust governance frameworks, yielding measurable reductions in project delays, cost overruns, and contractual breaches. In contrast, African countries, including Nigeria, often rely on piecemeal digital interventions, where adoption is fragmented, data quality is poor, and enforcement of procurement regulations is inconsistent. Nonetheless, the empirical evidence from Nigeria underscores that even limited DRI adoption can generate meaningful improvements in supplier oversight, provided that interventions are strategically targeted, such as implementing predictive risk models for high-value contracts and real-time dashboards for critical infrastructure projects. From a scholarly perspective, these findings reinforce the notion that DRI is not merely a technological tool but a strategic governance instrument that requires alignment with institutional capacity and project management culture.

The interaction between DRI dimensions and supplier failure measures underscores a direct and multidimensional relationship. Predictive analytics primarily addresses cost overruns and project delays by enabling foresight and scenario planning, real-time monitoring mitigates delays and non-compliance through continuous oversight, and e-procurement platforms enforce transparency and contractual adherence, reducing cost escalation and non-compliance. These interactions suggest that DRI functions both as a preventive mechanism, by anticipating risks, and as a corrective mechanism, by enabling timely interventions to address deviations. The implications for policy and governance are profound: African public infrastructure agencies can leverage DRI not only to optimize supplier performance but also to embed accountability mechanisms, reduce fraud and opportunism, and enhance infrastructure delivery efficiency. Furthermore, embedding DRI within procurement regulations can institutionalize a culture of data-driven decision-making, bridging gaps between planning, execution, and monitoring.

Despite these advances, the literature reveals critical research gaps. Empirical studies on DRI in African public infrastructure remain limited, particularly in Nigeria, with most research being exploratory or conceptual. Few studies provide longitudinal evidence of the impact of DRI adoption on supplier failure metrics, and comparative analyses across African contexts are scarce. Additionally, there is limited understanding of how institutional, socio-political, and

technological factors mediate the effectiveness of DRI tools, creating uncertainty about scalability and sustainability. From my scholarly perspective, these gaps justify the need for rigorous, context-specific empirical research that examines the causal linkages between DRI adoption and supplier failure outcomes, integrates cross-country comparisons, and investigates organizational and technological enablers of successful digital risk intelligence implementation.

The findings from this review extend both Agency Theory and Dynamic Capabilities Theory within the context of digital risk intelligence (DRI) in public infrastructure delivery. From an agency perspective, the persistent challenge of supplier opportunism, contract non-compliance, and performance deviations in African public infrastructure reflects classic principal-agent dilemmas. The evidence reviewed demonstrates that DRI – through predictive analytics, real-time monitoring, and e-procurement – acts as a mechanism to align agent behavior with principal objectives, by reducing information asymmetry and enabling proactive oversight. Furthermore, the review contributes to Dynamic Capabilities Theory by illustrating how public procurement organizations in resource-constrained environments can develop sensing, seizing, and transforming capabilities through digital technologies to mitigate supplier failures. In particular, predictive analytics allows organizations to sense potential supplier risks, real-time monitoring enables immediate corrective action (seizing), and automated reporting institutionalizes these processes (transforming). These findings refine theoretical understanding by highlighting that digital risk intelligence operationalizes dynamic capabilities in the governance of public infrastructure, bridging the gap between strategic foresight and operational execution in African contexts.

The evidence reviewed underscores the urgent need for public procurement regulations and institutional frameworks to formally integrate DRI systems in African public infrastructure delivery. Policymakers should mandate the adoption of predictive analytics for high-value contracts, implement real-time monitoring systems across procurement cycles, and institutionalize e-procurement with automated reporting to enhance transparency and accountability. Furthermore, procurement guidelines should include standard operating procedures for data collection, validation, and analysis to ensure that digital tools are effectively leveraged to mitigate supplier failure. The review also suggests the necessity for capacity building at the institutional level, including training procurement officers in data-driven decision-making, risk modeling, and compliance monitoring. By embedding DRI requirements into procurement policy, governments can reduce delays, cost overruns, and non-compliance, while creating a data-enabled governance culture that promotes accountability and resilience in infrastructure delivery.

For procurement officers, project managers, and technology implementers in African public infrastructure, the findings offer actionable insights. Predictive analytics should be used to forecast supplier performance risks and anticipate potential delays or cost overruns, allowing timely mitigation strategies. Real-time monitoring systems can provide continuous oversight of supplier activities, detect early deviations from contractual obligations, and facilitate immediate corrective actions. E-procurement and automated reporting tools enhance transparency, improve supplier traceability, and streamline compliance verification, reducing opportunities for corruption and opportunistic behavior. Collectively, these tools equip practitioners to shift from reactive problem-solving to anticipatory risk management, improving project delivery efficiency and reliability. The review also suggests that integrating these digital capabilities requires an organizational culture shift, investment in ICT infrastructure, and consistent training, which are essential to operationalizing digital risk intelligence in practical procurement and infrastructure management contexts.

4. Conclusion and Recommendations

4.1 Conclusion

This section concludes the review by synthesizing the key insights on digital risk intelligence (DRI) and its role in mitigating supplier failures in African public infrastructure delivery, while outlining directions for future research, policy, and practice.

Key Insights from the Review are as follows.

- Digital risk intelligence, encompassing predictive analytics, real-time monitoring systems, and e-procurement with automated reporting, is a critical tool for anticipating, detecting, and mitigating supplier failures such as project delays, cost overruns, and non-compliance.
- Predictive analytics enables proactive risk identification and performance forecasting, reducing uncertainty in project delivery schedules and cost management.
- Real-time monitoring systems facilitate continuous oversight of supplier activities, enhancing compliance monitoring and early detection of deviations from contractual obligations.
- E-procurement and automated reporting platforms promote transparency, accountability, and traceability, constraining opportunistic behavior and improving governance in public procurement.
- Evidence from Nigeria and other African contexts demonstrates that while DRI adoption is feasible, institutional capacity, ICT infrastructure, and governance structures significantly mediate its effectiveness.

Despite promising evidence, there is a paucity of longitudinal and comparative empirical studies examining the causal impact of DRI on supplier failure metrics in African public infrastructure. Future research should explore cross-country analyses, sector-specific applications, and institutional and technological enablers of DRI effectiveness

4.2 Recommendations

The following emerge based on the evidence reviewed;

- Policy: Integrate DRI requirements into public procurement regulations, mandate predictive analytics for high-risk contracts, and institutionalize real-time monitoring and e-procurement platforms.
- Theory: Extend Agency Theory and Dynamic Capabilities Theory by empirically testing how DRI mediates principal-agent relationships and enhances organizational capabilities in infrastructure delivery.
- Practice: Encourage procurement officers, project managers, and ICT implementers to adopt DRI tools for anticipatory risk management, improve project planning, and embed a culture of data-driven decision-making.

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