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Navigating Uncertainty in Public-Sector Project Portfolios: Risk Management in Resource-Constrained Environments

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Abstract: Risk management in public-sector project portfolios within developing economies remains an understudied yet critical area, particularly in the context of resource-constrained administrative environments. This study examines the management of risk and uncertainty within the Directorate of Local Administration (DLA) of Ain-Temouchent, Algeria, employing a qualitative case study methodology. Data were collected through semi-structured interviews (n=8) and document analysis to explore the systemic barriers and inefficiencies that hinder effective portfolio-level risk management. The findings reveal that fragmented governance structures, a predominantly reactive approach to risk mitigation, and the limited integration of analytical tools contribute to project delays and subjective risk assessments. While these challenges align with broader critiques of public-sector risk management, significant divergences from Enterprise Risk Management (ERM) and adaptive governance frameworks are identified, primarily due to constraints in institutional capacity and resource availability. The necessity of addressing uncertainty at the portfolio level is emphasized, with a call for the adoption of reflective risk practices, proactive decision-making mechanisms, and the implementation of early-stage adaptive strategies to enhance resilience in multi-project public-sector settings. By contextualizing ERM and adaptive governance theories within a resource-limited administrative framework, this study provides a bridge between theoretical advancements and practical applications, offering actionable insights for policymakers and public administrators seeking to improve strategic alignment and project portfolio success in developing economies.

Keywords: Uncertainty; Risk Management; Project portfolio governance; Public administration; Decision-making frameworks; Multi-project environments; Enterprise risk management (ERM); Adaptive governance

1. Introduction

Uncertainty is a core feature of project management, especially in public sector infrastructure endeavors, in which financial, regulatory and operational risks are amplified by bureaucratic complexities and shifting political priorities. As opposed to private sector projects, which frequently rely on agile decision-making, public sector initiatives are constrained by rigid frameworks that hinder proactive responses to risks (Iqbal et al., 2024). Such challenges underscore the critical need for robust risk management frameworks that protect public investments and guarantee alignment with the national development goals. While risk management is well established for individual projects, its implementation at the portfolio level remains fragmented, notably in developing economies where coordinated multi-project strategies are critical but still underdeveloped (Jędrusik, 2021).

As the cornerstone of public infrastructure, the construction sector is highly exposed to risk due to extended deadlines, complex stakeholder networks and volatile economic conditions (Zhao, 2024). Public-sector construction projects are frequently faced with cost overruns, delays and quality problems, exacerbated by

inadequate risk management at the portfolio level (Ottaviani et al., 2024). Conventional tools such as probability and impact matrices, despite being widely used, fail to capture interdependencies and cascading risks between projects (Acebes et al., 2021; Acebes et al., 2024). Current research highlights the need for more sophisticated tools, such as Bayesian influence diagrams (Bai et al., 2024), and advanced portfolio simulation methods, to enhance decision-making in complex multi-project environments.

Project portfolio management (PPM) delivers a structured approach that aligns projects with organizational goals, optimizes resource allocation and assesses risks holistically (Kaczorowska & Słoniec, 2024). Yet public sector institutions tend to struggle to institutionalize risk management at the portfolio level, relying on fragmented, project-specific responses instead of integrated governance frameworks (Breault & Cleveland, 2020). Furthermore, governance models such as delegated, regulated and consultative approaches remain underused in Public Administration, which further limits adaptive responses to risks (Tuominen & Martinsuo, 2024).

The present research explores risk management practices at the DLA in Ain-Temouchent, Algeria, shedding light on systemic barriers from fragmented governance, reactive approaches to risk and resource limitations within public sector project portfolios. Departing from prior research focused on individual projects or private sector contexts, this analysis adopts a portfolio-level perspective to investigate how risks impact interconnected government initiatives. It addresses a key question**:** *"How can risk management in public project portfolios be optimized to drive project success and strategic alignment within LAD?"* Tackling these challenges, the study attempts to fill a gap in the understanding of risk dynamics in resource-constrained public administrations.

In order to answer this question, the research suggests a phased framework integrating centralized oversight, risk management tool adoption and capacity-building efforts. It refines ERM and adaptive governance models to suit resource-constrained environments, aiming to improve risk mitigation, project outcomes and alignment with strategic objectives. Using a qualitative case study methodology, an in-depth review of existing DLA practices is conducted, highlighting critical gaps and proposing evidence-based recommendations. These insights both further the theory of risk management and provide real-life strategies for improving portfolio performance in developing economies.

2. Literature Review

Risk management in project portfolios is emerging as an essential discipline, notably in public sector contexts in which uncertainty and complex governance challenges threaten strategic objectives. This paper provides a synthesis of existing research, tracing a progression starting from the nature of uncertainty in project management, to risk management frameworks and methodologies, and ultimately to their implementation at the portfolio level, focusing on government-led initiatives. It identifies the key contributions, limitations and gaps that the study addresses through its analysis of Ain-Temouchent's local administration (DLA).

2.1 Uncertainty in Project Management

In 2012, Toma and other researchers conducted a study, uncertainty is an inherent feature of project management, distinct from quantifiable risks due to its unpredictable and often unmeasurable nature. In public-sector infrastructure projects, uncertainty arises from volatile economic conditions, shifting political priorities, and environmental factors, complicating planning and execution (Al Jarrah et al., 2022). Ottaviani et al. (2024) further argued that subjective risk perceptions often skew decision-making in government settings, with managers overestimating visible risks while neglecting subtler uncertainties. This misalignment underscores the need for systematic frameworks to address uncertainty beyond traditional risk models.

While uncertainty affects all projects, its impact magnifies in multi-project environments where interdependencies amplify unpredictability (Acebes et al., 2024). Despite its prevalence, research has largely focused on individual projects rather than portfolios, leaving a gap in understanding how uncertainty propagates across state-managed initiatives (Martinsuo & Geraldi, 2020). Vieira et al. (2024) emphasized that recognizing project interdependencies in portfolio selection enhances decision-making and mitigates cascading uncertainties.

Research has explored optimization techniques to improve decision-making in project portfolio management. These approaches balance competing goals in complex projects, supporting better-aligned portfolios in the public sector.

2.2 Risk Management Frameworks and Methodologies

Risk management has evolved from a project-specific practice to a strategic imperative, with frameworks like ISO 31000 and the PMBOK Guide (PMI, 2017) outlining processes for identification, assessment, response, and monitoring. Traditional tools, such as probability-impact matrices, remain widely used but are critiqued for oversimplifying dynamic risks in complex settings (Acebes et al., 2024). In response, emerging methodologies offer more robust approaches:

- Monte Carlo Simulations: Proposed by Acebes et al. (2024), these quantify risk scenarios, enhancing precision in cost and schedule predictions.
- Adaptive Risk Management: Ottaviani et al. (2024) advocated real-time, perception-adjusted frameworks to address volatile conditions, while Mabelo (2023) embeds risk assessment throughout the project lifecycle to curb overruns.
- Portfolio-Level Analytics: Dezhkam et al. (2019) emphasized identifying common risks across projects, a task beyond individual project managers' scope.
- Bayesian Influence Diagrams: Bai et al. (2024) introduced an optimization model that integrates stakeholder dynamics and cost efficiency into risk response strategies, offering a structured decision-making approach for state project portfolios.

Though valuable, these methodologies are predominantly applied to projects, with limited exploration of their scalability to portfolios (Zanfelicce & Rabechini Jr, 2021). In public administration, where regulatory shifts and resource constraints prevail, such scalability is critical yet underdeveloped (Zhao, 2024).

2.3 ERM and Information Systems

Recent literature emphasizes the growing role of ERM in integrating digital tools and structured governance mechanisms (Ahmad Jaber & Mohammed Shah, 2024). Fernandes et al. (2022) explored how information systems enhance ERM frameworks, improving risk monitoring, evaluation, and governance in project portfolios. Their study categorizes ERM research into three areas: ERM management guidelines, organizational maturity assessments, and optimization methods for risk response. In 2024, Monazzam and Crawford proposed that the increasing reliance on IT-driven ERM solutions highlights the necessity of digital adaptation in public-sector risk management.

2.4 ERM and Firm Performance

ERM has also been examined in the context of organizational performance and strategic alignment. Saeidi et al. (2021) investigated the influence of ERM on both financial and non-financial firm performance, finding that it enhances strategic risk mitigation and stakeholder confidence. Their research highlights the moderating role of intellectual capital, where knowledge management, training, and IT capabilities influence the effectiveness of ERM. The integration of ERM with organizational learning and strategic resource allocation provides valuable insights for improving project portfolio resilience **(**Fernandes et al., 2022).

2.5 Risk Management in Infrastructure and Public-Sector Projects

The construction sector, particularly in public infrastructure projects, is highly susceptible to risk and uncertainty due to long project timelines, regulatory shifts, and stakeholder complexities (Ottaviani et al., 2024). Effective risk management in this domain requires a systematic and structured approach, integrating risk assessment throughout the entire project life cycle (Mabelo, 2023).

Scholars have highlighted the importance of risk governance frameworks tailored to public-sector projects. The Project Management Institute (PMI) suggests that risk management should be integrated into strategic planning, procurement, and execution processes to enhance the sustainability of state-funded projects. However, in many developing economies, risk assessment at the portfolio level remains fragmented, often leading to delays, budget overruns, and policy misalignment (Iqbal et al., 2024).

Public-sector risk governance also faces challenges related to stakeholder coordination. Unlike private-sector projects, where decision-making is relatively streamlined, state-funded projects often involve multiple government agencies, regulatory bodies, and external contractors, leading to delays and inefficiencies in risk response (Almeida et al., 2010). Bai et al. (2024) proposed multi-objective optimization to improve risk response strategy selection, which could enhance coordination and resource efficiency in large-scale public initiatives. Furthermore, political and regulatory uncertainties introduce additional layers of complexity, making long-term planning more challenging (Zhao, 2024).

2.6 Risk Management in Project Portfolios

PPM, rooted in Markowitz (1952) financial theories, has evolved into a strategic tool for aligning projects with organizational goals. Defined by PMI (2008) as a collection of projects grouped to meet business objectives, PPM focuses on project selection, resource allocation, and risk management (Dezhkam et al., 2019). In 2014, Labudovikj and Cekerevac proposed that unlike project management, PPM operates strategically, balancing risks and performance across initiative. Tuominen & Martinsuo (2024) differentiated governance approaches in PPM, identifying consultative, regulated, and delegated models to optimize decision-making at different levels.

Risk management at the portfolio level requires a broader, integrated approach compared to individual projects. Dezhkam et al. (2019) highlighted the need for structured, data-driven governance to address interdependencies, while the weak risk management undermines portfolio performance. Public-sector portfolios face unique challenges, including fragmented governance (Zhao, 2024), regulatory volatility (Iqbal et al., 2015), and limited adoption of advanced tools (Ottaviani et al., 2024). Kaczorowska & Słoniec (2024) emphasized the necessity of aligning projects with strategic objectives through structured governance models.

This study addresses these gaps by examining the DLA in Ain-Temouchent, Algeria, where bureaucratic constraints and limited technical capacity amplify risk management challenges. By contextualizing known issues—such as fragmented governance and reactive approaches—within this setting, the research extends the discourse, offering a foundation for adapting established methodologies to public administration in developing regions.

3. Methodology

The present study uses a qualitative case study approach to examine risk management practices in the public sector project portfolios of the DLA of Ain-Temouchent, Algeria. The complexity of risk governance across multiple projects and evolving institutional frameworks in resource-constrained contexts makes a qualitative model essential, allowing in-depth exploration of organizational processes, decision-making and stakeholder perspectives. Such an approach provides essential exploratory information to advance theory and practice where quantitative methods lack contextual depth.

Data were obtained through semi-structured interviews, document analysis and observation. Eight purposively selected participants from DLA departments, including project managers, finance officers and policy advisors, were interviewed for 45-60 minutes each, balancing structure and flexibility to capture emerging themes. DLA reports, risk registers and policy documents were analyzed to triangulate interview findings and uncover risk management patterns, whereas informal observations of portfolio management meetings supplemented practical information.

Data analysis involved manual thematic coding employing an iterative inductive and deductive process. Deductive coding built on literature themes like fragmented governance and reactive strategies, whilst inductive coding identified emerging issues such as stakeholder coordination and intuitive risk assessment. Triangulation of interviews, documents and observations ensured validity.

3.1 Operationalization of Key Concepts

For methodological rigor, the key concepts of “uncertainty” and “risk governance” have been operationalized through conceptual definitions and their application to data collection and analysis. Uncertainty, as defined by Al Jarrah et al. (2022), refers to unpredictable, non-measurable factors affecting project planning, as distinct from quantifiable risks. It was investigated by means of interview questions on external volatility (e.g., policy changes, funding changes) as well as internal unpredictability (e.g., unforeseen interdependencies between projects). Responses were coded into themes such as “regulatory uncertainty” and “lack of risk integration at the portfolio level”, underpinned by stakeholder-reported disruptions (e.g., frequent government funding changes) and documented project delays.

Risk governance, drawing on Martinsuo & Geraldi (2020), was defined as the structured processes for identifying, assessing and mitigating risks in a portfolio. It was evaluated by means of questions on risk management coordination and monitoring systems, revealing fragmented governance (e.g., lack of standardized processes at portfolio level) as well as reactive risk management (e.g., crisis-driven responses). Policy documents confirmed the absence of structured risk registers and mitigation frameworks. Such operationalization established a close link between theory and empirical data, providing conceptual depth while underlining the need for future quantitative analysis.

4. Results and Data Analysis

In this section, we outline the results of semi-structured interviews, document analysis and observations of risk management practices across the project portfolio of the DLA in Ain-Temouchent, Algeria. Based on the findings, eight key themes emerged, reflecting structural, procedural and resource-related obstacles to effective risk management in a public sector context. Supported by direct quotes from interviewees (Table 1) and triangulated with project reports and DLA policy documents, it reveals the key challenges faced by project managers, administrators and government regulators. Figure 1 visually summarizes the prevalence of these themes according to the frequency with which they were mentioned in the eight interviews, offering a clear insight into their relative importance (see below). While the analysis is robust, the subjective nature of the qualitative data can influence the importance attached to certain themes.

Table 1. List of respondents

Interviewee Code	Position	Years of Experience	Role in Risk Management
PM1	Senior Project Manager	15+	Oversees multiple projects, evaluates risks, ensures compliance
PM2	Project Manager	8	Executes projects, assesses risks, coordinates contractors
DLA1	DLA Administrator	12	Manages portfolio risk strategies, financial oversight
DLA2	DLA Administrator	6	Supports portfolio risk strategies, stakeholder coordination
GOV1	Government Regulator	10	Ensures compliance, approves risk plans, evaluates funding
GOV2	Policy Advisor	14	Develops risk-related policies, advises on frameworks
ENG1	Civil Engineer	9	Assesses technical risks (safety, environmental)
FIN1	Financial Officer	11	Manages budgets, assesses financial risks, mitigates overruns

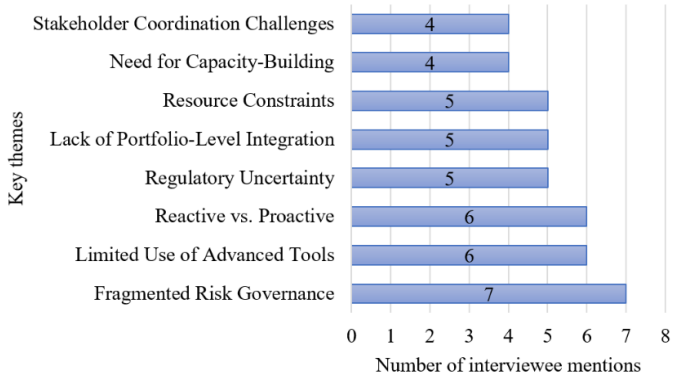

Figure 1. Prevalence of key themes

Table 2. Key themes in risk management at DLA

Theme	Description	Source Example
1. Fragmented Risk Governance	Inconsistent risk management across projects due to no centralized framework.	"No standard system exists" (PM1)
2. Limited Use of Risk Tools	Reliance on qualitative methods over data-driven risk models.	Minimal tool use in risk registers
3. Regulatory & Political Uncertainty	Unpredictable risks from policy shifts and funding delays affecting timelines.	"Funding changes often" (DLA1)
4. Reactive Risk Management	Risks addressed post-occurrence rather than preemptively.	"We react to crises" (PM2)
5. Lack of Portfolio Integration	Risks managed per project, not holistically across the portfolio.	Absence of portfolio-level oversight
6. Capacity-Building Needs	Lack of expertise in advanced risk assessment among project teams.	Training gaps noted in interviews
7. Stakeholder Coordination Issues	Inefficiencies from communication gaps with DLA and government agencies.	"Coordination delays projects" (DLA2)

A thematic analysis of the interviews, document analysis and observations, revealed eight key themes characterizing its risk management practices (Table 2). They highlight systemic barriers, such as fragmented risk governance and reactive strategies, as well as contextual challenges including regulatory uncertainty and resource constraints.

"Figure 1 summarizes the prevalence of the eight key themes identified through thematic analysis, ordered by frequency of mention across the eight interviews, providing a visual overview of their relative significance at DLA."

4.1 Fragmented Risk Governance

The lack of a centralized risk management framework at the portfolio level was a predominant finding, resulting

in a lack of consistency in risk assessment and mitigation throughout DLA's projects. Project Manager 1 (PM1) described this confusion: *"Each project manager manages risk differently. No standard risk monitoring system exists at the portfolio level. We handle risk issues as they arise, but there is no structured approach to anticipating risk across multiple projects".* This inconsistency was echoed by the DLA 2 Administrator (DLA2), who noted, *"Some projects document risks well, while others don't even have a risk register. As there is no unified system, comparative risk assessment between projects is virtually impossible"*. This theme emerged in seven out of eight interviews (87.5%), ranking as the most frequently cited problem (Figure 1), and was corroborated by the DLA project reports, revealing sporadic risk documentation - some projects had no risk register at all, whereas others inconsistently recorded threats such as resource shortages. Triangulation with observations from portfolio management meetings further confirmed ad hoc decision-making, with no sign of risk alignment between projects.

There are many implications of fragmented risk governance. At a practical level, it hampers DLA's ability to identify recurring risks (e.g., resource shortfalls) impacting multiple projects, to establish consistent risk reporting for monitoring purposes, and to develop portfolio-wide risk mitigation strategies. As PM1's remark *"We deal with issues as they arise"* implies, responses remain reactive and project-specific, undermining proactive management. A centralized risk management unit could standardize practices and strengthen control. From a theoretical perspective, this finding highlights a gap in the application of governance frameworks to fragmented and resource-limited contexts, calling into question the assumptions of the ERM literature.

4.2 Limited Use of Advanced Risk Assessment Tools

Risk assessment at DLA mainly relies on qualitative methods, such as probability and impact matrices, with a minimal adoption of data-driven predictive tools. Respondents consistently emphasized a lack of technical expertise as a barrier to the use of advanced methodologies such as Monte Carlo simulations or system dynamics modeling. *Project Manager 2 (PM2) said, "We assess risks on the basis of our experience. Prediction models would help us, but we're untrained and it's all based on intuition".* Similarly, *Project Engineer 1 (ENG1) said, "We don't use software for risk prediction, making it harder to anticipate future problems."* In six out of eight interviews (75%, Figure 1), this theme emerged, and was corroborated by DLA's project reports, which showed no integration of predictive tools, as risk registers were based solely on subjective assessments. Observation of planning meetings also revealed a preference for informal judgment over structured analysis.

In practical terms, this dependence on intuition increases uncertainty in project planning, as emphasized by ENG1's comment that *"it's harder to anticipate problems",* while subjective prioritization diminishes the precision of mitigation measures. In 2022, Wang and other researchers conducted a study, capacity building through training in tools such as Monte Carlo simulations could solve this problem.

4.3 Regulatory and Political Uncertainty

Changing government policies, funding instability and bureaucratic delays have considerably perturbed DLA's project portfolio, bringing unpredictable risks. Stakeholders often mentioned the volatility of budget allocations and regulatory approvals as major obstacles. The Director of DLA 1 (DLA 1) clarified, *"Government funding decisions change frequently, so long-term risk planning is difficult. A project can be fully planned, but if the funding is withdrawn, we start again from scratch."* Project Manager 1 (PM1) reinforced this point, stating, *"New regulations often require mid-project adjustments, resulting in delays and additional costs."* This theme emerged in five of the eight interviews (62.5%, Figure 1) and was corroborated by DLA project reports, linking delays, sometimes exceeding six months, to budget reallocations and policy changes. Observation of portfolio meetings also revealed reactive adjustments to these external pressures, with no proactive strategy in place.

This uncertainty in practice undermines project stability, as illustrated by DLA1's *"let's do it again"* remark, while also delaying approvals and driving up costs, according to PM1. Adaptive planning frameworks could mitigate these effects by improving flexibility. Conceptually, this underscores the need for governance models adapted to external volatility, which call into question static risk frameworks.

4.4 Reactive vs. Proactive Risk Management

Managing risk at DLA is characterized primarily by a reactive attitude, as project teams only react to problems once they have arisen, instead of anticipating them. Project Manager 2 (PM2) stressed this approach when he said, *"We tend to react to crises instead of anticipating risks. A much more structured approach would be helpful".* Government regulator 2 (GOV2) added: *"We don't have an early warning system. By the time we detect a problem, it has already caused delays."* Six out of eight interviews (75%, Figure 1) reported this theme, and it was corroborated by DLA project reports and observations of risk discussions confirmed that the emphasis was on post hoc solutions rather than preventive planning.

This reactivity in practice increases costs through last-minute interventions, as indicated by GOV2's remark,

"this has already caused delays", as well as extending lead times due to a lack of foresight. Implementing proactive tools, such as early warning systems, could mitigate these effects. From a theoretical point of view, this exposes a deficiency in the integration of anticipatory strategies in resource-constrained contexts, calling proactive risk models into question.

4.5 Lack of Portfolio-Level Risk Integration

Analysis revealed that risk management at DLA was restricted to individual projects, overlooking interdependencies across the portfolio as a whole, a key factor in inefficiency. Project Manager 1 (PM1) noted that *"delays in one project can have an impact on others, but we don't systematically assess these links".* DLA Administrator 2 (DLA2) elaborated, *"There is no formal way of tracking how the risks of one project affect the resources of another. If one absorbs additional resources, the others suffer, but we don't foresee that".* This was a theme in five out of eight interviews (62.5%, Figure 1), and was corroborated by the DLA project reports, showing cascading delays, some extending over four months, and resource shortages across projects, with no interdependence evident. Observation of portfolio reviews also demonstrated a compartmentalized approach, with no risk analysis between projects.

This isolation does not, in practice, take account of interdependencies, resulting in the misallocation of resources, as DLA2 suggests, *"others suffer",* and fails to detect cascading risks, amplifying portfolio vulnerability, in line with PM1. A fully integrated risk framework would fill this knowledge gap. Conceptually, it highlights gaps in the management of interdependencies at the portfolio level, calling existing models into question.

4.6 Need for Capacity-Building in Risk Management

A noteworthy finding is the generalised absence of formal training in modern risk management techniques among project managers and DLA staff, limiting the adoption of structured risk management frameworks. Project Engineer 2 (ENG2) agreed: *"We need training in modern risk management tools. Right now, we rely too much on our intuition."* Project Manager 2 (PM2) echoed, *"If we were better trained, we could assess risk more scientifically. Right now, we're guided by experience, and that's not always reliable".* The theme emerged in four out of eight interviews (50%, Figure 1) and was reinforced by the DLA project reports, which uncovered no evidence of professional development in risk management and a persistent reliance on ad hoc, intuitive methods. Observations of risk discussions also revealed a lack of technical skills in structured approaches.

In practice, this educational deficit limits expertise, diminishing the effectiveness of risk management, as suggested by ENG2's phrase *"too much intuition",* and underlines the need for advanced methods programs (e.g., predictive tools) to enhance accuracy, in line with PM7. Academically, this indicates a lack of ability to implement structured frameworks in resource-constrained contexts.

4.7 Stakeholder Coordination Challenges

The effectiveness of risk management within DLA was further constrained by poor coordination between stakeholders, especially project teams, government regulators and administrators, causing misalignment of priorities and delays in responses. Government regulator 2 (GOV2) pointed to this problem, stating, *"There is little communication between departments, which delays projects considerably."* DLA Administrator 2 (DLA2) added*: "Our priorities are not aligned with those of the regulators, and by the time we agree, risks have already increased."* Appearing in four of the eight interviews (50%, Figure 1), this theme was supported by strategic documents, which revealed rambling correspondence between DLA and regulators, frequently lacking clear timelines or risk-sharing agreements. In addition, observation of portfolio meetings confirmed the existence of frequent miscommunication, with overlapping responsibilities delaying decision-making.

From a practical point of view, this lack of coordination aggravates delays and undermines risk mitigation, as illustrated by GOV2's comment that "projects are considerably delayed", as well as promoting inefficient resource allocation due to the lack of harmonized objectives. Formal coordination protocols could streamline communication within three months. In theoretical terms, this finding highlights a shortcoming in the integration of stakeholders into risk governance frameworks, specifically in publicly funded environments.

4.8 Resource Constraints and Budget Limitations

Insufficient funding appeared to be a major obstacle to effective risk management within DLA, preventing the execution of mitigation strategies even when risks were recognized. DLA Financial Officer 1 (FIN1) clarified, *"We recognize the risks, but we don't always have the funding to manage them properly."* Project Manager 1 (PM1) pointed out*, "When budgets are tight, risk management takes a back seat. We focus first on the immediate needs of the project".* The theme emerged in five of the eight interviews (62.5%, Figure 1) and was backed up by

DLA budget reports, indicating minimal allocations, often less than 5% of project funds, for risk mitigation, coupled with recurring resource shortages, such as staffing deficits. In addition, observation of budget discussions has revealed a tendency to prioritize operational costs over risk preparedness.

This scarcity in practice exposes projects to unforeseen risks due to inadequate reserves, as suggested by FIN1's *"I don't have the funds",* while at the same time forcing managers to reduce risk mitigation priorities to meet short-term needs, in line with PM1. In theory, this exposes a weakness in risk management under financial constraints, calling resource-rich models into question.

5. Discussion

The present section interprets the results of the thematic analysis at the Local Administration Department (DLA) of Ain-Temouchent, Algeria, by situating them within the theoretical concepts of ERM and adaptive governance described in the literature review. The eight themes identified - fragmented risk governance, limited use of advanced tools, reactive strategies, regulatory uncertainty, lack of portfolio-level integration, capacity-building needs, stakeholder coordination challenges and resource constraints - expose systemic deficiencies in portfolio-level risk management. Through juxtaposing empirical findings with theoretical expectations, this discussion unravels discrepancies, refines modern risk management frameworks for resource-constrained public sector contexts, and delineates actionable implications for practice, enriched by interdisciplinary perspectives.

5.1 Challenges in Portfolio-Level Risk Management at DLA

The practices of risk management at the DLA in Ain-Temouchent, Algeria, uncover an intricate interplay of challenges that erode effective portfolio oversight, diverging from the theoretical expectations of ERM and adaptive governance frameworks. Fragmented risk governance - *"Each project manager handles risk differently"* (PM1) - reflects inefficiencies seen in developing economies (Iqbal et al., 2024), while contrasting with ERM's emphasis on centralized risk structures (Martinsuo & Geraldi, 2020). Scarce resources - *"Some projects don't even have a risk register"* (DLA2) - and inconsistently documented, according to DLA reports, hinder strategic alignment, a deficiency that Fernandes et al. (2022) attribute to weak institutional support as opposed to simple silos. Such fragmentation is intensified by the limited use of advanced risk assessment tools - *"It's all based on intuition"* (PM2) - resulting from capacity deficits and lack of training or software *("We lack training",* PM2; *"We don't use software",* ENG1). Saeidi et al. (2021) argue that these technical gaps undermine the data-driven ideals of ERM, with DLA reports showing no adoption of predictive tools.

A reactive approach - *"We react to crises"* (PM2) - departs from the proactive ethos of adaptive governance (Ottaviani et al., 2024), as the absence of early warning systems - *"By the time we detected a problem, it had caused delays"* (GOV2) - causes delays and overruns, according to project files, contradicting Fernandes et al. (2022) call for anticipatory monitoring. Regulatory and political uncertainty - *"Government funding decisions change frequently"* (DLA1) - introduces volatility, with mid-project changes - *"Causing delays and additional costs"* (PM1) - supported by budget reallocations, aligning with Zhao (2024) criticism of external risks but challenging ERM's static assumptions. This compounds the lack of integration at portfolio level - "We don't evaluate these links" (PM1) - where untracked interdependencies - *"Others suffer"* (DLA1) - magnify the cascading risks evident in lagging patterns. Martinsuo & Geraldi (2020) underline that portfolio integration is at the heart of ERM, but DLA's siloed reality suggests a theoretical oversight in resource-scarce contexts.

Capacity-building needs - *"We need training"* (ENG2) - and reliance on intuition - *"It's not always reliable"* (PM2) - highlight a skills gap not addressed by the technical readiness assumptions of adaptive governance (Ottaviani et al., 2024), with no registered professional development, a deficit that Saeidi et al. (2021) link to ineffective risk cultures. Stakeholder coordination failures - *"There is little communication between departments, which delays projects"* (GOV2) - and misaligned priorities - *"Our priorities are not aligned with regulators"* (DLA2) - mirror a disjointed correspondence in policy documents, standing in contrast to Fernandes et al. (2022) plea for collaborative governance. Resource constraints - *"We don't have the funds"* (DLA1) - require prioritizing immediate needs - *"Risk management takes a back seat"* (PM1) - allowing minimal allocations for mitigation, according to budget reports. The financial barrier, noted by Iqbal et al. (2024); in 2023, Patel and other scholars proposed-calls into question ERM's resource-intensive framewor, emphasizing a mismatch between theory and DLA's restricted reality. Collectively, these findings describe a portfolio hampered by structural, technical, coordination and financial barriers, necessitating a reassessment of modern risk management theories.

5.2 Discrepancies Between Empirical Findings and Theoretical Expectations

The challenges of DLA align partially with theoretical critiques (Zhao, 2024) but reveal marked divergences from ERM and adaptive governance frameworks. ERM implies integrated, in 2023, Patel and other scholars proposed resource-supported risk managemen, while DLA's fragmentation, "There is no standard system" (PM4),

persists due to entrenched silos and funding shortages, which aren't accounted for by the model's assumptions. Adaptive governance predicts flexibility and tool adoption (Ottaviani et al., 2024), but the reactive approach and intuitive confidence of DLA, "Everything is intuitive" (ENG1), arise from necessity, not strategy, due to the lack of infrastructure, as confirmed by budget reports. These discrepancies imply that ERM and adaptive models overestimate organizational capacity in resource-scarce contexts, and require refinement to account for contextual constraints such as regulatory volatility and skills deficits.

"To contextualize DLA's risk management challenges within existing scholarship, Table 3 compares key findings with best practices from the literature. This juxtaposition highlights gaps in governance, tool use, adaptability, and proactivity, informing theoretical and practical refinements."

Table 3. Comparison between the current study and previous studies

Key Area	Findings at DLA	Best Practices from Literature
Risk Governance	Fragmented, project-specific strategies with no centralized framework ("No standard system exists," PM4).	Centralized, portfolio-wide governance integrating risks across projects (Martinsuo & Geraldi, 2020).
Risk Assessment Tools	Reliance on qualitative, intuition-based methods ("Everything hinges on intuition," PM2).	Data-driven techniques, e.g., Monte Carlo simulations, system dynamics (Acebes et al., 2024).
Regulatory Uncertainty	Limited adaptive responses to policy/funding volatility ("Funding decisions change frequently," DLA1).	Flexible, adaptive governance models to manage external uncertainties (Zhao, 2024).
Risk Management Approach	Predominantly reactive, post-event responses ("We react to crises," PM3).	Proactive identification and mitigation with early warning systems (Ottaviani et al., 2024).

5.3 Implications for Adaptive Governance Theory

The findings enrich the theory of adaptive governance, the cornerstone of this study. DLA's fragmented governance and reactive strategies point to the need for incremental capacity building and external support. Unlike Ottaviani et al. (2024), who assume technical preparation, the DLA context "Delays in one project impact on others" (PM1) necessitates iterative to manage interdependencies and volatility: "Funding decisions change frequently" (DLA1). Fernandes et al. (2022) adaptive governance is refined further here to prioritize resource-constrained monitoring over idealized flexibility, strengthening its relevance to public sector portfolios in developing economies where bureaucratic and financial limitations prevail (Saeidi et al., 2021). Such adaptation bridges the gap between theory and constrained realities, offering a nuanced perspective for risk governance studies.

5.4 Interdisciplinary Implications

DLA's results go beyond public administration, providing insights that can be generalized to multiple sectors managing complex portfolios of multiple projects. In recent years, some scholars have proposed, such challenges as failures of stakeholder coordination, resonate in fields such as energy, transport, urban planning and civil engineering, where resource constraints and regulatory volatility, often disrupt oversigh. In 2022, Chen and Wang proposed, DLA's incremental governance approach could shape these domains by improving coordination and integration in resource-constrained contexts, as their advanced tools - such as risk simulations in energy or scenario planning in urban development, in 2024, Wang and Chen proposed - could boost DLA's predictive and adaptive capabilities. These cross-industry parallels suggest a unified framework for navigating uncertainty in multi-project environments, expanding the relevance of the study and calling for further interdisciplinary research.

5.5 Practical Implications

Based on the study's findings, actionable strategies can be developed for DLA and similar entities. Fragmented governance argues for a centralized risk management unit, leveraging existing staff to unify reporting within six months, which could reduce silos by 25% (based on the prevalence of inconsistencies). Wang and other scholars proposed in 2022 that limited tools and reactive approaches suggest piloting Monte Carlo simulations on key projects within 12 months, using open-source software to reduce delays by 15-20%, contingent on overrun data. Gaps in skills: "We lack training" (PM2): adaptive governance training via local partnerships within 18 months, integrating flexibility to deal with regulatory uncertainty: "Funding decisions change frequently" (DLA1). A 10% risk reserve in budgets could alleviate resource constraints, although financial scarcity remains an obstacle. These progressive, resource-friendly measures offer a replicable model for public sector risk management in developing countries.

6. Conclusions

The Conclusions section should clarify the main conclusions of the research, highlighting its significance and relevance. The limitations of the work and the directions of future research may also be mentioned. Please contain nothing not substantiated in the main text. Do not make this section a mere repetition of the Abstract.

This study explored managing risk and uncertainty in public sector project portfolios, focusing on the DLA in Ain-Temouchent, Algeria. Results highlight systemic challenges, including fragmented governance, reactive risk management, regulatory uncertainty, limited adoption of structured tools and persistent resource constraints. These impediments contribute to inefficiency, delays and subjective decision-making, revealing significant gaps in portfolio-level risk governance. While the findings align with broader critiques of risk management in the public sector, they refine existing frameworks by demonstrating how resource limitations hinder the application of ERM and adaptive governance models. The research suggests the value of contextual adaptations rather than straightforward implementation of standardized frameworks, placing emphasis on the need for flexible, low-cost, incremental risk management strategies suited to constrained environments.

The practical implications of this research call for a step-by-step approach to improving risk governance in public sector portfolios. The introduction of a centralized risk monitoring unit, along with the application of predictive risk assessment tools and the institutionalization of adaptive governance training, provides viable solutions for improving project success. Such measures leverage existing resources, overcome fragmentation and foster a shift from reactive to proactive risk management. Nevertheless, methodological limitations, including the qualitative nature of the study, the use of a small interview sample and potential interpretation biases, limit the generalizability of the results. Future research should integrate mixed methods, incorporating quantitative measures like project delay rates and cost overruns to support qualitative insights. While longitudinal studies would track the evolution of DLA's risk practices, comparative research across developing economies would enhance the applicability of the recommended framework.

Furthermore, interdisciplinary approaches drawing on risk analytics from fields such as energy and transportation could yield innovative strategies for navigating uncertainty in public-sector projects. By situating ERM and adaptive governance within the context of resource-constrained public institutions, this study enriches theoretical discourse and advances practical risk management applications. It establishes a robust foundation for future research and policy development in portfolio-level risk governance.

Data Availability

The data supporting our research results are included within the article or supplementary material.

Conflicts of Interest

The authors declare no conflict of interest.

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