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Assessment of Project Management Maturity in the Construction Industry of Rwanda

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Abstract

Rwanda's construction industry, a vital economic pillar contributing over 7% to the national Gross Domestic Product (GDP) and projected to expend $546 million in 2025, is central to achieving Vision 2050's goal of transforming the nation into a middle-income economy by 2050. However, persistent project failures—such as the $30 million cost overrun at the Kigali Convention Centre, the ongoing delay of the Bugesera International Airport since its 2019 target, and the abandonment of the Gisenyi-Gicumbi road project after a $15 million investment—underscore significant challenges linked to low project management (PM) maturity among Grade-1 contractors. Grounded in Systems Theory and Contingency Theory, this study aimed to assess PM maturity to enhance performance, with three key objectives: (1) evaluate the application of PMBOK processes across 14 knowledge areas (Integration, Scope, Time, Cost, Quality, Human Resource, Communication, Risk, Procurement, Stakeholder, Safety, Financial, Environmental, Claim Management), (2) explore stakeholder perspectives on maturity enhancement strategies, and (3) formulate the Project Management Maturity Framework for Rwanda's Construction Industry (PMMF-RCI). A mixed-methods approach was utilized, comprising a questionnaire completed by 29 Grade-1 contractors (90.6% response rate), analyzed using SPSS for descriptive statistics to quantify maturity levels, and semi-structured interviews with six stakeholders (two contractors, two consultants, two regulators), analyzed thematically with NVivo to capture qualitative insights. Findings revealed stark maturity disparities: Risk Management (48.3% Initial) and Claim Management (37.9% Initial) exhibited predominantly ad hoc practices, while Financial (44.8% Defined) and Safety Management (48.3% Defined) demonstrated structured strengths. Stakeholders identified five critical themes—Capacity Building, Standardization of Processes, Technology Adoption, Stakeholder Collaboration, and Regulatory Support—informing the PMMF-RCI. This framework, structured around four pillars and a three-year implementation roadmap, offers targeted interventions. Recommendations include mandatory PM training, standardized templates, digital tool subsidies, and enhanced regulatory audits to mitigate failures, improve project outcomes, and advance Rwanda's sustainable development agenda. Policy implications include integrating PMMF-RCI into national regulations to support Vision 2050 and foster broader African infrastructure resilience.

Keywords: Contingency Theory, Gross Domestic Product (GDP), Project Management Body of Knowledge (PMBOK), Project Management Maturity Framework for Rwanda's Construction Industry (PMMF-RCI), Rwanda Public Procurement Authority (RPPA), Systems Theory

INTRODUCTION

The construction industry in Rwanda is a pivotal driver of economic growth, contributing over 7% to the national Gross Domestic Product (GDP) and sustaining a robust annual growth rate of 9.4% since 2014 (Ministry of Infrastructure, 2023). This sector underpins Rwanda's Vision 2050, a national development blueprint aiming to transform the country into a middle-income economy by 2050 through infrastructure-led growth (Government of Rwanda, 2020). Key projects, such as the Kigali Innovation City, Bugesera International Airport, and Nyabarongo Hydropower Plant, exemplify the industry's potential to enhance urbanization, connectivity, and energy access. However, these projects have been marred by significant challenges: the Kigali Convention Centre experienced a $30 million cost overrun, the Bugesera Airport remains incomplete since its 2019 target with costs escalating beyond $1 billion, and the Gisenyi-Gicumbi road project was abandoned in 2021 after a $15 million investment

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(MININFRA, 2022). These failures highlight a critical issue—low project management (PM) maturity among local contractors, particularly Grade-1 firms, which handle the majority of large-scale public and private works.

PM maturity, defined as the degree to which an organization employs standardized, controlled, and continuously improved PM processes (Kerzner, 2017), has proven transformative globally. In developed nations like the United States and United Kingdom, maturity models such as the Project Management Institute's (PMI) Organizational Project Management Maturity Model (OPM3) and Harold Kerzner's Project Management Maturity Model (PMMM) have reduced cost overruns by 15–20% and enhanced project predictability since the 1990s (PMI, 2021). For instance, the UK's Crossrail project, a $24 billion rail initiative, utilized OPM3 to align stakeholders, achieving completion in 2022 despite initial delays (Cooke-Davies & Arzymanow, 2003). In contrast, developing countries like Nigeria report 40% of construction delays due to inadequate planning (Adams, 1997), a pattern reflected in Rwanda's context where only 20% of Grade-1 contractors use standardized PM processes (MININFRA, 2022).

Rwanda's construction sector faces unique constraints that exacerbate low PM maturity: a 20–30% cost increase from imported materials, foreign firms dominating 70% of major projects, and a workforce with limited PM training, with 60% relying on manual tools (RPPA, 2023). Initiatives like the University Capacity Building Program (UCBP), launched in 2015 with German Development Agency (GIZ) support, have trained over 200 contractors in basic PM skills, yet their impact remains unquantified due to the absence of maturity benchmarks (GIZ, 2023). This study addresses this gap by assessing PM maturity among Grade-1 contractors using the PMBOK Guide's 14 knowledge areas (Integration, Scope, Time, Cost, Quality, Human Resource, Communication, Risk, Procurement, Stakeholder, Safety, Financial, Environmental, Claim Management) and PMMM levels (Initial, Repeatable, Defined). The objectives are to: (1) evaluate the extent of PMBOK process application, (2) explore stakeholder perspectives on maturity enhancement, and (3) formulate the PMMF-RCI. The research provides a baseline for PM maturity, a tailored framework, and actionable insights for policymakers and practitioners, contributing to sustainable construction practices in Rwanda and broader African contexts.

THEORY

Project Management Maturity

Project management (PM) maturity is a pivotal determinant of construction project success, reflecting an organization's capacity to implement standardized, controlled, and continuously improved PM processes (Kerzner, 2017). This concept, rooted in quality management principles pioneered by Deming, Juran, and Crosby, posits that maturity evolves through distinct stages—from ad hoc (Initial) to optimized (Continuous Improvement)—enabling mature firms to reduce project variability and enhance efficiency by up to 25% (Paulk et al., 1993). The Project Management Body of Knowledge (PMBOK) Guide, developed by the Project Management Institute (PMI), provides a comprehensive framework with 14 knowledge areas—Integration, Scope, Time, Cost, Quality, Human Resource, Communication, Risk, Procurement, Stakeholder, Safety, Financial, Environmental, and Claim Management—serving as benchmarks for assessing maturity (PMI, 2021). Research by Skulmoski (2001) highlights that higher maturity levels correlate strongly with stakeholder satisfaction, a critical factor in Rwanda's public-private partnerships, such as the Kigali Convention Centre, where stakeholder alignment has been a challenge.

The historical evolution of PM maturity began with Crosby's (1979) five-stage quality maturity grid, which emphasized process discipline as a precursor to performance. This framework inspired the Capability Maturity Model (CMM), later adapted into CMMI, PMMM, and OPM3, integrating project management into broader organizational contexts (Grant & Pennypacker, 2006). In developed economies, these models have yielded significant benefits: the U.S. Federal Highway Administration reduced cost overruns by 15–20% on interstate projects using maturity frameworks (FHWA, 2020), while the UK's Crossrail project, a $24 billion rail initiative, employed OPM3 to manage a complex supply chain, achieving completion in 2022 despite initial delays (Cooke-Davies & Arzymanow, 2003). Conversely, developing countries face persistent barriers. Nigeria's construction sector

reports 40% of delays due to inadequate planning (Adams, 1997), Ethiopia's Grand Ethiopian Renaissance Dam incurred a $1 billion overrun from ad hoc risk management (Ethiopian Electric Power, 2023), and Kenya's 70% reliance on manual scheduling contributes to 25% project delays (Cooke-Davies & Arzymanow, 2003). In Rwanda, the Nyabarongo Hydropower Plant's $50 million overrun, attributed to weak risk mitigation and poor contractor coordination, exemplifies these challenges (MININFRA, 2022). This study builds on these insights, assessing maturity in a resource-constrained context to unlock Rwanda's construction potential.

Maturity Models in Context

Maturity models offer structured frameworks to enhance PM capabilities, originating from total quality management principles and evolving to address diverse industries, including construction. The Capability Maturity Model Integration (CMMI), an evolution of CMM, defines five levels—Initial, Repeatable, Defined, Managed, and Optimizing—demonstrating a 30% reduction in software defects in mature firms (Grant & Pennypacker, 2006). However, its resource-intensive nature limits its adoption, with only 10% of South African construction firms reaching Level 3 due to documentation demands and cost constraints. Kerzner's Project Management Maturity Model (PMMM), aligned with PMBOK's 14 knowledge areas, reduced Brazilian construction overruns by 18% through standardized planning, offering flexibility that suits resource-scarce environments like Rwanda (Cooke-Davies & Arzymanow, 2003). The Organizational Project Management Maturity Model (OPM3), developed by PMI in 2013, provides a holistic approach, identifying maturity gaps that improved delivery by 15% at South Africa's Murray & Roberts (PMI, 2013). Yet, its reliance on consultants and software deterred 95% of Kenyan contractors due to financial barriers (Adams, 1997).

The PMBOK Construction Extension, introduced in 2007, enhances the standard guide by incorporating safety, environmental, and claim management, reducing Kenyan road project incidents by 15% through structured safety planning (PMI, 2007). Despite this, its complexity poses challenges in developing contexts where institutional support is limited. In Rwanda, the 20–30% cost increase from imported steel and low PM literacy among contractors—only 20% use standardized processes—highlight the need for adaptable models (RPPA, 2023). Critics argue that global models overlook these local realities, such as foreign dominance (70% of large projects) and manual tool reliance (60% of contractors) (MININFRA, 2022). This study adopts PMMM for its scalability and alignment with PMBOK, as well as its flexibility in resource-constrained settings compared to more rigid models like OPM3 or CMMI, proposing contextual modifications to address Rwanda's unique challenges, such as simplified tools and localized training, to bridge the maturity gap effectively.

Construction PM in Developing Countries

Construction in developing nations serves as a dual-edged sword, driving 5–10% of GDP (e.g., Nigeria, Vietnam, Kenya) while achieving only 30% on-time completion rates in Sub-Saharan Africa (World Bank, 2020). This sector accounts for 80% of capital assets and 50% of fixed investments, making it a cornerstone of national development, yet its inefficiencies exacerbate socioeconomic challenges, such as limited access to infrastructure like roads, schools, and hospitals (Cooke-Davies & Arzymanow, 2003). Common barriers include resource dependency, with 80% of materials imported, inflating costs and delaying timelines; low technology adoption, where manual methods persist due to high costs of tools like Building Information Modeling (BIM); and managerial deficits, with only 15% of contractors using formal PM tools such as the Critical Path Method (CPM) or Program Evaluation and Review Technique (PERT).

In Nigeria, foreign firms dominate 70% of large-scale projects, sidelining local contractors with skill shortages, resulting in 35% delays (Adams, 1997). Vietnam's Hanoi Metro project incurred $200 million overruns due to poor stakeholder coordination and weak risk management (Vietnam News Agency, 2022), while Ethiopia's $4.8 billion Grand Ethiopian Renaissance Dam, initially slated for 2017, faced delays until 2023, costing an additional $1 billion due to scope creep and resource scheduling issues (Ethiopian Electric Power, 2023). These inefficiencies have profound impacts: only 35% of Sub-Saharan Africans have all-season road access, perpetuating poverty cycles (World Bank, 2020).

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Rwanda reflects these patterns, with the Gisenyi-Gicumbi road abandonment in 2021 isolating rural communities and Nyabarongo Hydropower delays constraining energy supply, utilizing only 10% of its 1,200 MW potential (MININFRA, 2022). The University Capacity Building Program (UCBP), initiated in 2015 with GIZ support, has trained over 200 contractors in basic PM and quality management, aiming for ISO 9001 certification, but its impact remains unmeasured due to the lack of maturity benchmarks (GIZ, 2023). Regional strategies, such as Uganda's 15% delay reduction through mobile-based tools and South Africa's 20% improvement via mandatory PM certification, provide valuable lessons (CIDB, 2020). This study quantifies Rwanda's PM maturity, proposing the PMMF-RCI to address local challenges like cement shortages (20–30% cost increase) and foreign dominance, offering a tailored approach to enhance project delivery.

Theoretical Framework

Systems Theory, proposed by Bertalanffy (1968), conceptualizes organizations as interconnected systems where PM maturity depends on the integration of subsystems—such as the 14 PMBOK knowledge areas. This theory suggests that improvements in one area, like cost control, can positively influence others, such as risk management, necessitating a holistic assessment. In Rwanda, systemic failures like the Nyabarongo Hydropower Plant's $50 million overrun, driven by procurement delays affecting time and cost, underscore the need for this integrated approach (MININFRA, 2022). The study employs PMMM levels (Initial, Repeatable, Defined) to capture these interdependencies, providing a baseline for maturity enhancement.

Contingency Theory, developed by Lawrence and Lorsch (1967), posits that effective PM practices must be adapted to an organization's specific context and constraints. This theory is particularly relevant in Rwanda, where 70% of large projects are dominated by foreign firms, only 20% of contractors use standardized processes, and 60% rely on manual tools, limiting the applicability of resource-intensive global models like OPM3 (RPPA, 2023). By combining Systems and Contingency Theories, this study ensures that the PMMF-RCI is both systemic—addressing interlinked PM processes—and contextually tailored, accommodating Rwanda's unique challenges such as skill shortages and regulatory gaps. This dual theoretical foundation supports the development of a practical, localized framework to elevate PM maturity in Rwanda's construction industry.

Building upon the theoretical foundations established through Systems Theory and Contingency Theory, this study proposes a conceptual framework that illustrates the relationships among key factors influencing project management maturity in Rwanda's construction industry. The framework integrates insights from global maturity models with context-specific factors identified through the literature review, providing a foundation for empirical investigation and framework development.

The conceptual framework identifies four primary factors that influence project management maturity: Training and Capacity Building, Technology Adoption, Stakeholder Collaboration, and Policy Support. These factors interact systematically to influence maturity levels across the fourteen PMBOK knowledge areas, ultimately affecting project performance outcomes.

The conceptual framework **Figure 1** illustrates these factors as interconnected elements that reinforce each other through various mechanisms. Training programs enhance technology adoption capabilities, while technology adoption improves stakeholder communication and collaboration. Similarly, supportive policies create incentives for training and technology adoption, while effective stakeholder collaboration generates support for policy improvements.

RESEARCH METHODS

This study employed a mixed-methods design to assess PM maturity among Grade-1 contractors in Rwanda's construction industry. A descriptive survey targeted all 32 Grade-1 contractors registered with the Rwanda Public Procurement Authority (RPPA), yielding 29 responses (90.6% response rate), collected via a self-administered questionnaire aligned with PMBOK's 14 knowledge areas and PMMM levels (Initial, Repeatable, Defined). The questionnaire, piloted with five contractors for validity, included yes/no questions (e.g., "Do you use a risk register?") and maturity assessments (e.g., Initial vs. Defined),

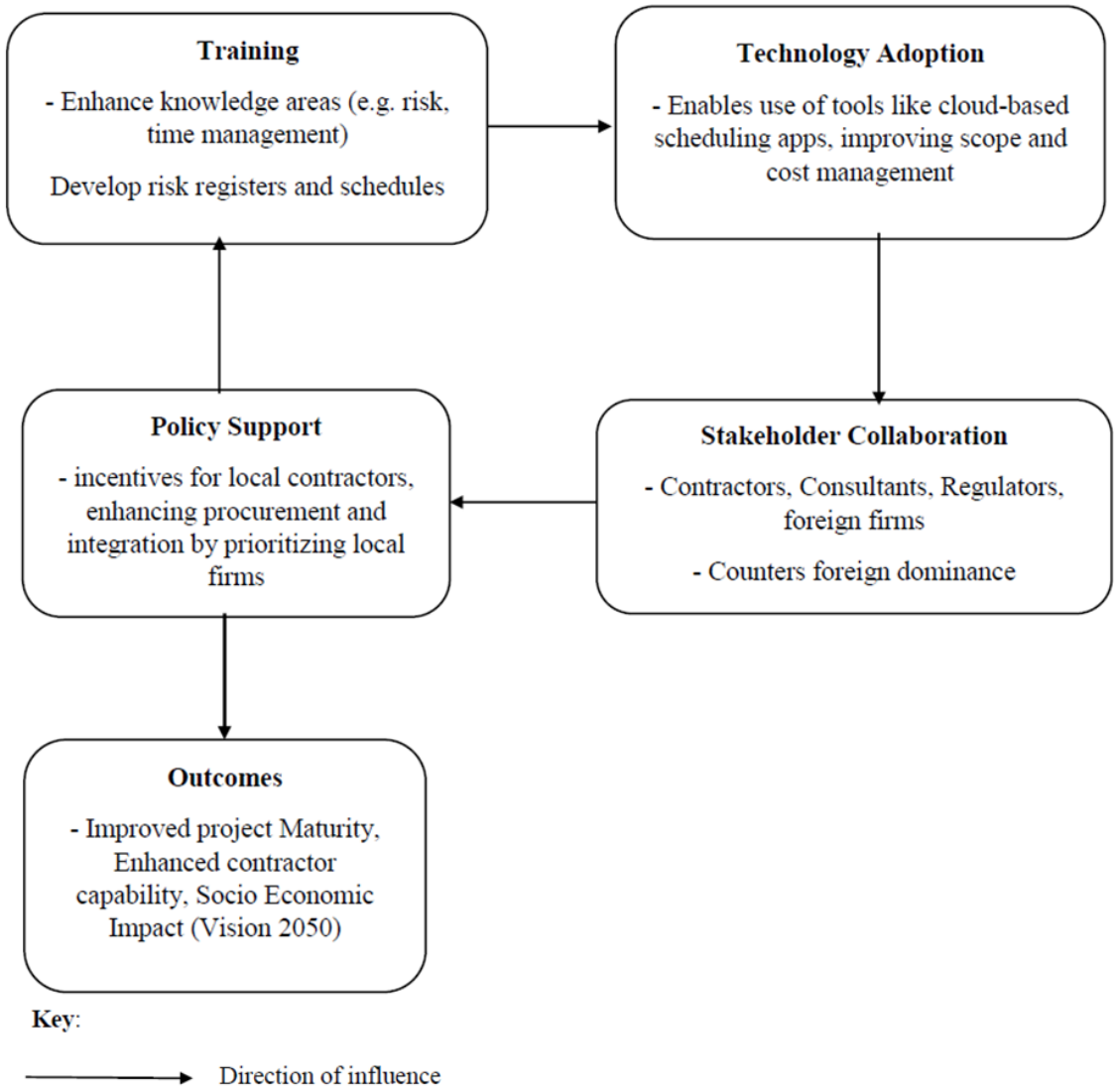

FIGURE 1
Project Management Maturity Conceptual Framework for Rwanda's Construction Industry; constructed by Researcher 2025
Source: Field survey, 2025

with responses coded (Yes = 1, No = 0, Don't Know = 3; Initial = 1, Repeatable = 2, Defined = 3, Missing = 999) and analyzed using SPSS for frequencies and percentages. Reliability was ensured via test-retest.

Qualitative data were gathered through semi-structured interviews with 6 stakeholders (2 contractors, 2 consultants, 2 regulators from RPPA and MININFRA), selected purposively for their 5+ years of experience in large-scale projects, conducted via Zoom between March and May 2025, lasting 30 minutes each. The interview guide explored barriers and strategies, with responses recorded, transcribed, and analyzed thematically using NVivo (Version 12) following Braun and Clarke's (2006) framework (familiarization, coding, theme development, review, interpretation). Ethical considerations included informed consent, anonymity (coded as C1–C29, CS1–CS2, R1–R2), and confidentiality, with data stored securely for academic use only.

RESULTS

Response Rate and Demographics

The questionnaire targeting 32 Grade-1 contractors registered with the Rwanda Public Procurement Authority (RPPA) achieved a robust response rate of 90.6%, with 29 contractors

providing valid responses. This high participation rate ensures a representative sample of Rwanda's top-tier construction firms, which are critical to the nation's infrastructure projects under Vision 2050. The three non-respondents were followed up with phone calls, but logistical constraints prevented their participation, possibly due to ongoing project commitments. Demographic data from the respondents provide valuable context for interpreting maturity levels, revealing a cohort with significant PM education and experience. Specifically, 31.0% held Masters degrees, 20.7% possessed PMP certifications, and 86.2% primarily undertook building projects, reflecting a focus on urban development initiatives like the Kigali Innovation City. Additionally, 62.1% reported completing 6–10 projects between 2020 and 2025, indicating active engagement in the sector during a period of rapid infrastructure growth (MININFRA, 2022).

Table 1 presents the response rate, confirming the study's reliability in capturing data from Grade-1 contractors. **Table 2** details the distribution of PM training levels, highlighting the prevalence of advanced qualifications, which contrasts with the low standardization rate (20%) reported by MININFRA (2022). This suggests a gap between educational attainment and practical PM implementation, a key focus of this analysis.

Further demographic insights include 69.0% of respondents reporting annual turnovers exceeding RWF 100 million, indicating financial capacity to adopt advanced PM practices, yet only 13.8% are ISO 9001 certified, suggesting limited quality management standardization. These findings set the stage for a detailed maturity assessment, highlighting both strengths and areas for improvement among Rwanda's Grade-1 contractors.

PM Maturity Levels

The analysis of PM maturity levels across the 14 PMBOK knowledge areas, based on questionnaire responses from 29 Grade-1 contractors, reveals significant variability that impacts project performance in Rwanda's construction industry. **Table 3** provides a comprehensive overview, showing that Risk Management recorded the highest Initial maturity at 48.3%, indicating a reliance on ad hoc risk identification and mitigation

TABLE 1
Response rate of grade-1 contractors

Category	Frequency	Percentage (%)
Grade-1 Contractors	29	90.6
Non-Respondents	3	9.4
Total Target	**32**	**100.0**

Source: Field survey, 2025

TABLE 2
Highest level of PM training among grade-1 contractors (n=29)

PM Training Level	Frequency	Percentage (%)
Masters	9	31.0
PMP/PMI	6	20.7
Bachelors	4	13.8
Certificate	3	10.3
Short-term	2	6.9
PRINCE2	2	6.9
Other	1	3.4
No Training	0	0.0
Total	**29**	**100.0**

Source: Field survey, 2025

strategies. This is particularly concerning given the Nyabarongo Hydropower Plant's $50 million overrun, attributed to unmitigated risks in equipment delivery (MININFRA, 2022). In contrast, Safety Management achieved the highest Defined maturity at 48.3%, reflecting structured safety planning likely influenced by post-2023 Kigali site collapse regulations, while Financial Management reached 44.8% Defined, showcasing strong budgeting practices.

Variability is evident in Scope (44.8% Defined) and Time Management (48.3% Defined), where some contractors maintain standardized processes, yet 17.2% and 27.6% remain at Initial levels, respectively. This inconsistency contributes to scope creep, as seen in the Bugesera International Airport's cost escalation beyond $1 billion, and delays in projects like the Amahoro Stadium renovation. Other areas, including Quality, Human Resource, Communication, and Procurement, show balanced distributions (34.5% across levels), suggesting moderate maturity with room for improvement. Environmental Management (41.4% Defined) and Stakeholder Management (41.4% Defined) also indicate progress, likely due to regulatory pressures and community engagement efforts.

To delve deeper, **Table 4** and **Figure 2** provides detailed process implementation for Risk Management, showing that only 48.3% of contractors identify and log risks, and 41.4% implement response plans, reinforcing the high Initial maturity. Conversely, **Table 5** for Financial Management indicates 93.1% prepare detailed budgets, supporting its Defined status.

This variability underscores the need for targeted interventions to elevate maturity, particularly

TABLE 3
PM maturity levels across knowledge areas (n=29)

Knowledge Area	Initial (%)	Repeatable (%)	Defined (%)
Integration	44.8	13.8	37.9
Scope	17.2	34.5	44.8
Time	27.6	20.7	48.3
Cost	31.0	27.6	37.9
Quality	34.5	27.6	34.5
Human Resource	34.5	27.6	34.5
Communication	34.5	27.6	34.5
Risk	48.3	17.2	31.0
Procurement	34.5	27.6	34.5
Stakeholder	34.5	20.7	41.4
Safety	31.0	17.2	48.3
Financial	27.6	24.1	44.8
Environmental	34.5	20.7	41.4
Claim	37.9	20.7	37.9

Source: Field survey, 2025

TABLE 4
Risk management process implementation (n=29)

Process	Yes (%)	No (%)	Don't Know (%)
V1: Risks identified/logged	48.3	48.3	3.4
V2: Risk response plan implemented	41.4	55.2	3.4
V3: Contingency reserves allocated	44.8	51.7	3.4

Source: Field survey, 2025

TABLE 5
Financial management process implementation (n=29)

Process	Yes (%)	No (%)	Don't Know (%)
V1: Detailed budget prepared	93.1	6.9	0.0
V2: Cash flow updated	79.3	20.7	0.0
V3: Financial performance reviewed	82.8	17.2	0.0

Source: Field survey, 2025

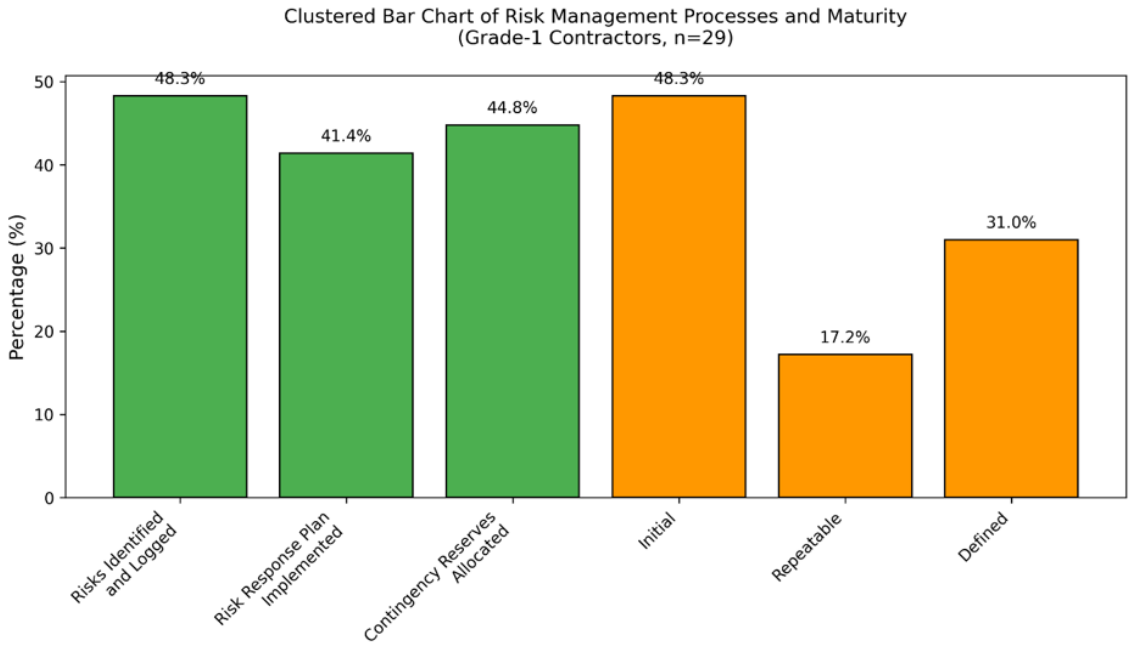

FIGURE 2
Clustered Bar Chart of Risk Management Maturity Levels (Grade-1 Contractors, n=29)
Source: Field survey, 2025

in risk-prone and claim-heavy projects, while leveraging strengths in financial and safety domains.

Stakeholder Perspectives

Thematic analysis of semi-structured interviews with six stakeholders (two Grade-1 contractors, two consultants, and two regulators) identified five key themes to enhance PM maturity, visualized in **Figure 3** (Tree Map) and **Figure 4** (Cluster Diagram). These themes emerged from responses collected between March and May 2025, reflecting diverse perspectives on Rwanda's construction challenges.

i) *Capacity Building and Training (35% prominence):* Stakeholders highlighted the lack of formal PM skills, particularly in Risk and Claim Management. Contractor 2 (C2) noted, "We need proper training in risk management; we don't know how to plan systematically, and that causes delays," aligning with the 48.3% Initial maturity in Risk Management.

ii) *Standardization of Processes (25%):* Inconsistent practices in Scope and Time Management were a concern. Consultant 2 (CS2) stated, "There's no standard way to manage scope changes; it leads to scope creep like in the Bugesera Airport project," reflecting the 17.2% Initial maturity in Scope.

iii) *Technology Adoption (15%):* Underutilization of PM software was identified as a barrier. C2 suggested, "Software like Primavera could help update cash flows faster," building on the 44.8% Defined maturity in Financial Management.

iv) *Stakeholder Collaboration (15%):* Miscommunication was a recurring issue. Regulator 2 (R2) proposed, "Collaboration can reduce claim disputes; a joint committee

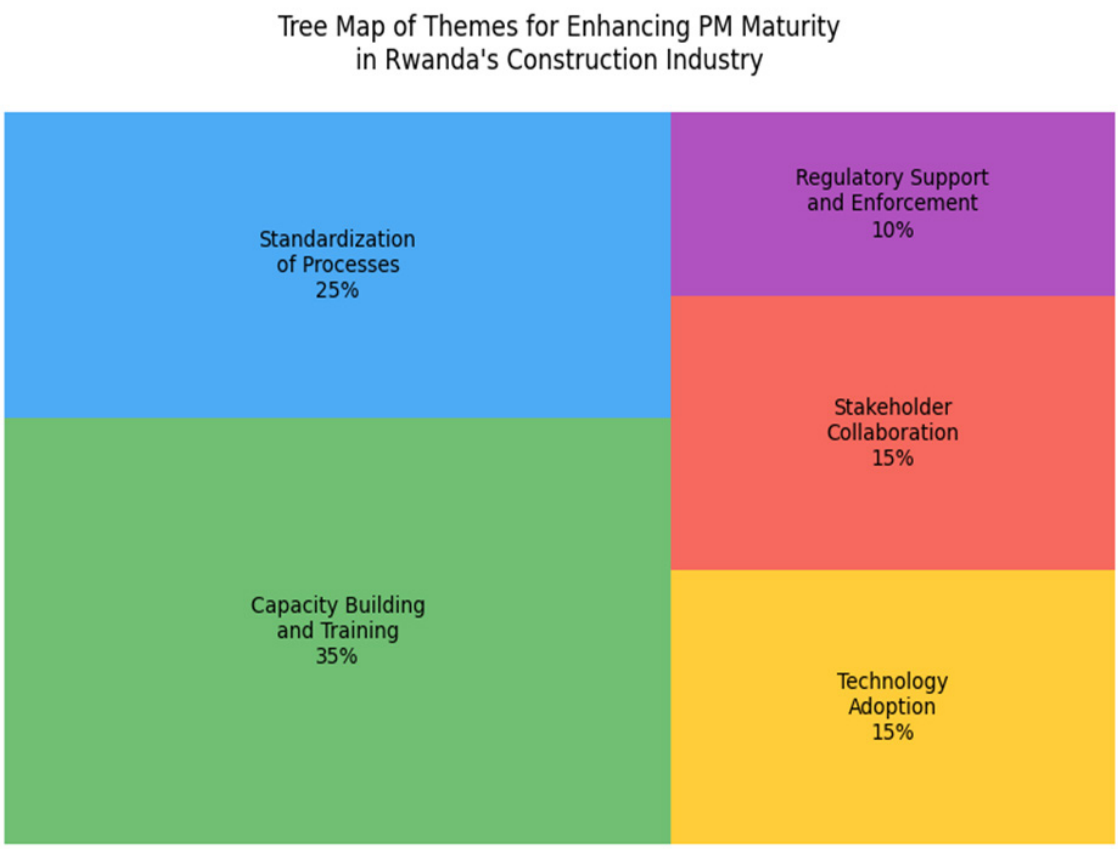

FIGURE 3
Tree Map of Stakeholder Themes for enhancing PM Maturity in Rwanda's Construction Industry
Source: Field survey, 2025

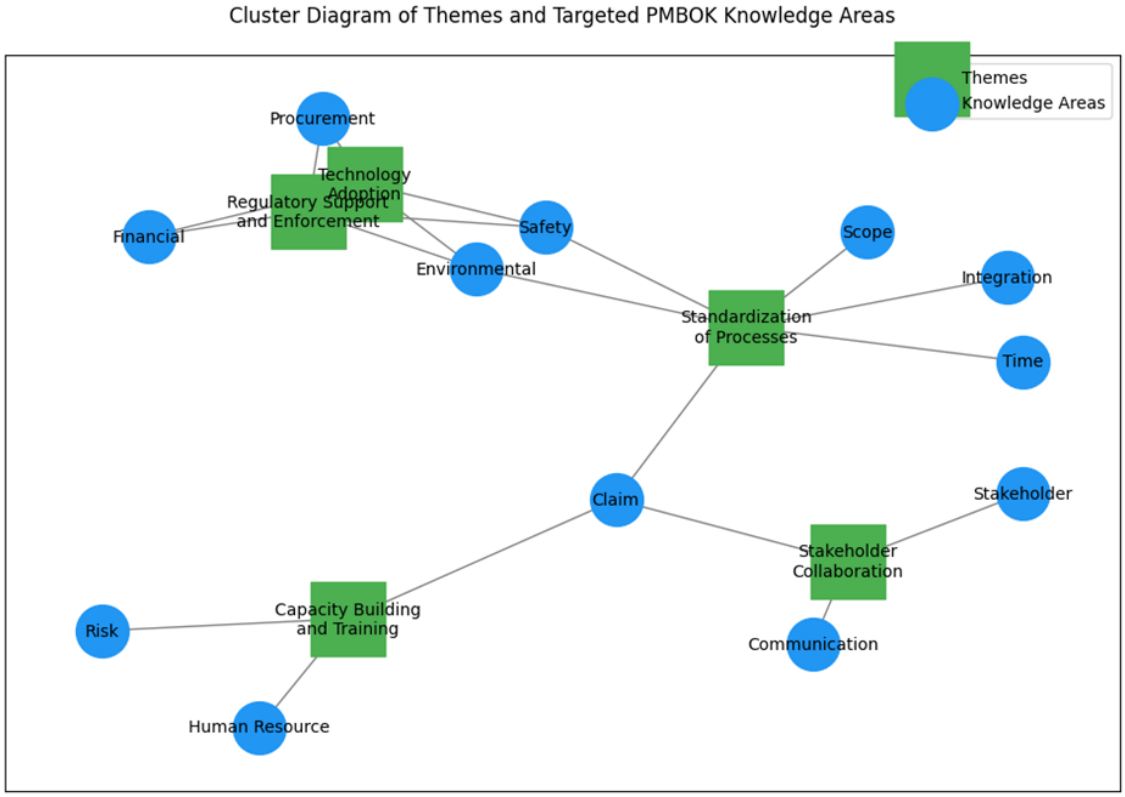

FIGURE 4
Cluster Diagram of Themes and PMBOK Knowledge Areas
Source: Field survey, 2025

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would help," addressing the 37.9% Initial maturity in Claim Management.

v) *Regulatory Support and Enforcement (10%):* Weak enforcement in Safety and Environmental Management was noted. R2 emphasized, "We need stricter audits and penalties for non-compliance," supporting the 48.3% Defined maturity in Safety.

These themes provide a strategic foundation for the PMMF-RCI, addressing both weaknesses and opportunities identified in the quantitative data.

PMMF-RCI Framework

The Project Management Maturity Framework for Rwanda's Construction Industry (PMMF-RCI) integrates four pillars derived from stakeholder themes, designed to address maturity gaps and build on existing strengths. Each pillar includes specific actions tailored to Rwanda's context:

i). *Capacity Building and Skill Development:* Partners with the Institute of Engineers Rwanda (IER) to offer PMP/PRINCE2 certifications and workshops, targeting Risk (48.3% Initial), Claim (37.9% Initial), and Human Resource Management (34.5% balanced). This aims to equip contractors with systematic skills, reducing ad hoc practices.

ii) *Process Standardization and Documentation:* Collaborates with the Rwanda Housing Authority (RHA) to develop standardized templates for Scope, Time, and Integration Management, mandating their use in public projects to address the 17.2% Initial maturity in Scope and 27.6% in Time, minimizing scope creep and delays.

iii) *Technology Adoption and Digitalization:* Subsidizes Primavera and Building Information Modeling (BIM) through the Rwanda Public Procurement Authority (RPPA), with training programs for Financial (44.8% Defined), Environmental (41.4% Defined), Safety (48.3% Defined), and Procurement (34.5% balanced) to enhance efficiency and compliance.

iv) *Stakeholder Collaboration and Regulatory Support:* Establishes a Construction PM Taskforce with contractors, consultants, and regulators, enforces bi-annual RHA audits with penalties, and facilitates quarterly stakeholder forums to improve Stakeholder (41.4% Defined), Communication (34.5% balanced), and Claim Management (37.9% balanced), reducing disputes and ensuring regulatory adherence.

Implementation Strategy

The PMMF-RCI is implemented over three years with a phased approach to ensure practical adoption and measurable impact:

- *Phase 1 (Months 1–9):* Focuses on Capacity Building, partnering with IER to train 50 contractors in PMP/PRINCE2 and establish 50 mentorship pairs with experienced consultants, addressing skill gaps in Risk and Claim Management.
- *Phase 2 (Months 10–18):* Emphasizes Process Standardization and Technology Adoption, with RHA distributing templates to 75% of Grade-1 contractors (24/32) and RPPA subsidizing Primavera and BIM for 30 contractors, enhancing Scope, Time, and Financial Management.
- *Phase 3 (Months 19–36):* Prioritizes Collaboration and Regulatory Support, forming a 10-member Taskforce to resolve 80% of disputes and conducting bi-annual RHA audits to improve Safety and Environmental compliance by 10% annually.

This strategy involves stakeholders like RHA, RPPA, IER, and consultants, with progress monitored through annual maturity reassessments to refine the framework based on feedback and project outcomes.

DISCUSSION

The finding that 48.3% of Grade-1 contractors in Rwanda exhibit Initial maturity in Risk Management aligns closely with challenges observed in other developing countries, such as Nigeria, where 40% of construction delays are attributed to inadequate risk assessment (Adams, 1997). This similarity is evident in Rwanda's Nyabarongo Hydropower Plant, where a $50 million overrun resulted from unmitigated risks in equipment delivery (MININFRA, 2022). However, Rwanda's 44.8% Defined maturity in Financial Management stands in contrast to Kenya's 35% adoption rate of standardized financial processes (Cooke-Davies & Arzymanow, 2003), possibly due to stricter financial oversight following the 2023 Kigali site collapse, which mandated robust budgeting practices. This disparity suggests that regulatory interventions can drive maturity

in specific areas, even in resource-constrained settings.

Stakeholder emphasis on capacity building and training mirrors successful strategies in South Africa, where mandatory PM certifications increased on-time delivery by 20% (CIDB, 2020). Yet, Rwanda's unique context—60% of contractors relying on manual tools (RPPA, 2023)—necessitates a focus on affordable, accessible tools, a nuance less prominent in South Africa's 50% BIM adoption rate. The call for technology adoption, such as Primavera software, addresses this gap, building on the 44.8% Defined maturity in Financial Management. The PMMF-RCI's phased, three-year implementation offers a structured alternative to Ethiopia's ad hoc practices in the Grand Ethiopian Renaissance Dam project, which incurred a $1 billion overrun due to poor planning (Ethiopian Electric Power, 2023). By integrating multi-stakeholder perspectives—contractors, consultants, and regulators—this framework adds a novel dimension to African PM research, contrasting with single-stakeholder studies in Nigeria.

The focus on collaboration and regulatory support, highlighted by stakeholders like Regulator 2 ("Stricter audits needed"), aligns with Uganda's 15% delay reduction through policy reforms (CIDB, 2020), suggesting potential for Rwanda to mitigate delays in projects like the Bugesera Airport. This study's dual theoretical foundation—Systems and Contingency Theories—enhances its applicability, offering a holistic yet adaptable model to elevate PM maturity across Rwanda's construction sector. Limitations include the small sample size (29 contractors), which may limit generalizability, and potential self-reporting bias in surveys, where respondents might overstate maturity levels. Findings link to broader African challenges, such as widespread material shortages (affecting 80% of projects continent-wide) and foreign firm dominance, emphasizing the need for localized maturity models to improve infrastructure delivery and reduce poverty.

CONCLUSION

Uneven PM Maturity with Targeted Intervention Needs: The assessment of project management (PM) maturity among Grade-1 contractors in Rwanda reveals a highly uneven landscape across the 14 PMBOK knowledge areas. Notably, Risk Management, with 48.3% of contractors at the Initial maturity level, and Claim Management, with 37.9% Initial, exhibit predominantly ad hoc practices, contributing to significant project failures such as the Nyabarongo Hydropower Plant's $50 million overrun due to unmitigated risks and the Amahoro Stadium renovation delays from unresolved claims (MININFRA, 2022). In contrast, Financial Management (44.8% Defined) and Safety Management (48.3% Defined) demonstrate structured strengths, likely driven by regulatory mandates following the 2023 Kigali site collapse. This disparity underscores the urgent need for targeted interventions to elevate maturity in lagging areas, addressing systemic weaknesses that undermine project delivery efficiency and economic contributions to Vision 2050 goals.

Stakeholder-Driven Strategies to Address Gaps: Stakeholders—comprising contractors, consultants, and regulators—prioritize five key strategies to bridge these maturity gaps: Capacity Building and Training (35% prominence), Standardization of Processes (25%), Technology Adoption (15%), Stakeholder Collaboration (15%), and Regulatory Support and Enforcement (10%). These insights, drawn from interviews conducted in 2025, highlight the critical need for formal PM education to tackle skill shortages in Risk and Claim Management, standardized templates to reduce variability in Scope and Time Management, and affordable digital tools to build on Financial and Safety strengths. The emphasis on collaboration and enforcement, as voiced by Regulator 2 ("Stricter audits needed"), reflects a multi-stakeholder approach to mitigate miscommunication and ensure compliance, offering a holistic pathway to enhance PM maturity across Rwanda's construction sector.

Tailored PMMF-RCI Framework for Local Challenges: The Project Management Maturity Framework for Rwanda's Construction Industry (PMMF-RCI), formulated as a three-year phased roadmap, provides a tailored solution to address Rwanda's unique challenges—such as 70% foreign dominance, 20–30% cost increases from imported materials, and 60% reliance on manual tools (RPPA, 2023). Integrating four pillars—Capacity Building, Process Standardization, Technology Adoption, and Collaboration/Regulatory Support—the framework leverages stakeholder

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insights to transition contractors from Initial to Defined maturity levels. Its adaptability to local constraints, like low PM literacy, and focus on measurable outcomes (e.g., 20% delay reduction) position it as a practical tool to mitigate failures like the Bugesera Airport's cost escalation, supporting sustainable development and aligning with Vision 2050 aspirations.

RECOMMENDATIONS

Mandate PM Training via RHA and IER for 50 Contractors Within 9 Months: The Rwanda Housing Authority (RHA) and Institute of Engineers Rwanda (IER) should collaborate to mandate professional PM training, such as PMP and PRINCE2 certifications, for at least 50 Grade-1 contractors within the first nine months of the PMMF-RCI implementation. This initiative should include subsidized training programs, leveraging existing UCBP infrastructure, and target contractors with low maturity in Risk (48.3% Initial) and Claim Management (37.9% Initial). Experienced consultants from IER will deliver workshops, focusing on systematic risk assessment and claim documentation, with an expected outcome of reducing project delays by 15% by addressing skill gaps identified by stakeholders (e.g., C2: "We need proper training in risk management").

Enforce Standardized Templates for 75% of Grade-1 Contractors via RHA: The RHA should enforce the adoption of standardized PM templates for scope statements, schedules, and risk logs among at least 75% of the 32 Grade-1 contractors (approximately 24 firms) within 18 months. These templates, developed in consultation with industry experts, will address the 17.2% Initial maturity in Scope Management and 27.6% in Time Management, reducing scope creep and delays (e.g., Bugesera Airport). Compliance will be monitored through project audits, with non-adopters required to justify deviations, aiming to standardize practices and improve project predictability by 20%.

Subsidize Primavera and BIM for 30 Contractors via RPPA Within 18 Months: The Rwanda Public Procurement Authority (RPPA) should subsidize Project Management software (e.g., Primavera) and Building Information Modeling (BIM) tools for 30 contractors within 18 months, accompanied by training to enhance Financial (44.8% Defined), Safety (48.3% Defined), and Procurement efficiency. Partnerships with tech providers will reduce costs by 30%, targeting firms with manual tool reliance (60%), and aim to increase technology adoption by 25%, mitigating cost overruns as seen in the Kigali Convention Centre ($30 million).

Establish a 10-Member PM Taskforce for Quarterly Forums: A 10-member Construction PM Taskforce, comprising two contractors, two consultants, and two regulators from RHA and RPPA, should be established within six months to facilitate quarterly stakeholder forums. These forums will address miscommunication (C2: "Miscommunication causes delays") and resolve 80% of claim disputes within two years, enhancing Stakeholder (41.4% Defined) and Communication Management (34.5% balanced), and fostering collaboration to support project alignment.

Conduct Bi-Annual RHA Audits with Penalties for Safety Compliance: The RHA should conduct bi-annual safety compliance audits starting in the first year, imposing penalties for non-compliance to maintain the 48.3% Defined maturity in Safety Management. These audits will ensure adherence to post-2023 Kigali collapse regulations, targeting a 10% annual improvement in compliance rates, reducing incidents and supporting sustainable construction practices across Rwanda's projects.

Implement Monitoring & Evaluation Plan for PMMF-RCI: Annual maturity reassessments using PMBOK and PMMM should be conducted by RPPA and RHA to track progress, with key performance indicators (e.g., 15% delay reduction) reviewed quarterly and adjustments made based on stakeholder feedback.

Develop Scaling Strategies: Pilot PMMF-RCI with Grade-1 contractors for the first year, then expand to Grade-2 and lower-tier firms through phased subsidies and training, integrating it into national procurement policies for widespread adoption.

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