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A Knowledge-Based Competency Metric for ICT Project Managers in South Africa's Digital Transformation Era

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Abstract

Technology-intensive ICT projects in emerging economies, particularly South Africa, continue to underperform despite the widespread use of global competency frameworks such as PMBOK, IPMA and PRINCE2, indicating a misalignment with local contextual realities. This study aims to examine this gap and identify the competencies most critical for project success in digitally intensive environments. A systematic literature review (SLR) with thematic synthesis was employed to analyse recent theoretical and empirical studies on project manager competencies and digital transformation, including artificial intelligence, data analytics and remote collaboration. The findings indicate that, in addition to foundational technical competencies, adaptive, digital and strategic capabilities such as AI literacy, data-driven decision-making, stakeholder sensemaking and contextual intelligence are key determinants of success yet are insufficiently represented in existing frameworks. To address this gap, the study proposes a knowledge-Based Competency Metric (KBCM) comprising four domains: knowledge, performance, personal and agile/adaptive competencies. The proposed metric provides a context-sensitive tool for competency assessment, targeted capability development and governance, thereby supporting improved project performance and more effective leadership in South Africa's evolving digital transformation landscape.

Keywords: Digital transformation, Emerging economies, ICT projects, Project manager competencies, South Africa

1. Introduction

Persistent project underperformance in technology-intensive environments suggests that widely used competency frameworks do not adequately reflect the dynamic and interdisciplinary nature of modern ICT contexts. In South Africa, this misalignment is intensified by rapid digitalisation, organisational complexity, resource constraints and critical skills gaps, while emerging technologies such as artificial intelligence, data analytics and cybersecurity are reshaping project management expectations. This study aims to examine the alignment of global competency frameworks with the realities of South Africa's ICT sector and to identify competencies critical for project success in digitally intensive environments. The objectives are to (i) evaluate the contextual fit of global competency frameworks, (ii) synthesise competencies associated with project success under digital transformation conditions, and (iii) develop a knowledge-based competency metric (KBCM) tailored to the South African ICT context. The research adopts a systematic literature review to synthesise theoretical and empirical evidence, enabling structured identification of key competency domains and gaps. The study is significant in addressing the lack of a context-specific competency model by providing a practical, evidence-based tool to support competency assessment, development, governance and improved project performance in complex digital environments.

2. Literature Review

2.1. Foundational perspectives on competence

Competency theory defines competencies as integrated combinations of knowledge, skills and behaviours that enable effective performance in role-specific contexts, a view that underpins contemporary project management competence models (Boyatzis,1982; PMI, 2017). In ICT settings, scholarship consistently elevates behavioural and relational capabilities (leadership, communication, emotional intelligence) alongside technical mastery as key predictors of success (Alvarenga et al., 2020; Pacheco et al., 2023). These insights are typically operationalised through structured frameworks that allow assessment across multiple dimensions (knowledge/performance/personal) (PMI, 2017).

2.2. Global project management competence frameworks

Widely adopted frameworks such as PMBOK/PMCD, IPMA ICB and PRINCE2 codify competence domains and provide guidance on role expectations, assessment and development (PMI, 2017; Alvarenga et al., 2020). While these models offer strong structure and portability, evidence increasingly shows that rigid, one-size-fits-all prescriptions underperform in volatile, digitally intensive contexts where agile and hybrid delivery dominate (Dias et al., 2023; Ndou et al., 2024).

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Studies also point to gaps in how traditional frameworks represent data/AI fluency, cybersecurity, and human-centred change skills that are now pivotal in ICT projects (Mishra et al., 2023; Li et al., 2025).

2.3. Digital transformation and dynamic capabilities

Digital transformation reframes competence as a dynamic capability: project leaders must sense technological and stakeholder shifts, seize opportunities through adaptive governance, and transform delivery systems through learning and reconfiguration (Teece, 2007; Anning-Dorson et al., 2025). At the project level, this translates into data-driven decision-making, iterative product/value road-mapping, and psychologically safe experimentation, particularly in AI-centred initiatives (Vial et al., 2023; Mishra et al., 2023). These demands elevate competencies such as stakeholder sensemaking, contextual intelligence, and ethical judgement alongside technical prowess (Alvarenga et al., 2020; Pacheco et al., 2023).

2.4. Technological readiness and adoption barriers

Technology adoption depends on organisational and individual readiness. Readiness constructs (optimism, innovativeness, discomfort, insecurity) explain variance in adoption and usage behaviours that PMs must actively manage (Parasuraman, 2000; Kumar et al., 2022). In digital programmes, algorithm aversion, reluctance to trust AI recommendations, can derail benefits unless competencies in transparent communication, participatory design and change leadership are present (Filiz et al., 2023). In parallel, readiness for AI/cloud/cyber initiatives hinges on governance and maturity practices that PMOs can institutionalise (Lavoie & Daim,2017; Bertránd, 2016).

2.5. Competence and performance relationships

Empirical studies link PM competencies to multi-dimensional project success (goal attainment, stakeholder satisfaction, time, cost, quality). Soft-skill clusters, leadership, communication, and emotional intelligence consistently moderate and amplify the effects of technical expertise on outcomes (Alvarenga et al., 2020; Sposito et al., 2024). Systematic reviews identify competencies across cognitive, personal, social, and sustainability dimensions, with decision-making, ethics, and EI frequently associated with higher success rates (Pacheco et al., 2023; Sampaio et al., 2022). Quantitative studies also show positive associations between PMBOK-aligned capabilities (e.g., risk, cost, HR, procurement) and KPI achievement during implementation phases (Dias et al., 2023).

2.6. South African ICT context and competency implications

South Africa's digitalisation is framed by national strategies and governance guidelines that specify expectations for skills, ethics and accountability in ICT programmes. The National Digital and Future Skills Strategy prioritises foundational and advanced digital capabilities, including data, AI and cybersecurity literacy, with implications for PM role definitions and development pathways (Department of Communications and Digital Technologies,2020). Public-sector CGICT Project Management Guidelines formalise roles (Sponsor, Steering Committee, PM) and lifecycle governance, reinforcing competencies in strategic alignment, business case stewardship and risk management (DPSA,2022). Sector reports highlight infrastructural unevenness (e.g., power reliability; rural connectivity), 5G rollout dynamics, and digital inclusion gaps, demanding resilience planning, regulatory navigation, and equity-oriented stakeholder engagement (ICASA, 2025; SITA, 2024). Empirical local studies further emphasise leadership, communication, and knowledge-sharing competencies, including the role of informal knowledge systems in SMEs (Mbebe & Jowah,2024; Shongwe,2017). Collectively, these drivers require a hybrid competence model that blends global standards with SA-specific constraints and opportunities (Aigbavboa et al., 2023; Lesebo et al., 2023).

2.7. Synthesis and gap

Across the above strands, ICT project managers need balanced portfolios spanning **knowledge** (ICT/AI/cyber/agile), **performance** (planning, risk/quality, stakeholder alignment), **personal** (leadership, EI, ethics) and **agile/adaptive** capabilities (iterative delivery, learning, VUCA navigation) (PMI,2017; Ndou et al.,2024). However, mainstream frameworks under-specify digital-era competencies and offer limited guidance on contextualisation for resource-constrained, institutionally complex settings.

This gap motivates a knowledge-based competency metric tailored for South Africa's ICT sector to support assessment, development and governance that are simultaneously standardised and context-sensitive (Mishra et al.,2023; Mbebe & Jowah,2024).

3. Research Methodology

3.1. Design

This study employed a Systematic Literature Review (SLR) with narrative/thematic synthesis to identify, appraise, and integrate evidence on project manager competencies associated with success in digitally intensive ICT projects, particularly within the South African context. The SLR followed a structured multi-phase process of planning, conducting, and documenting, ensuring methodological rigour, transparency, and replicability in the identification and

synthesis of evidence. An SLR was selected over other review types because the study aims to develop a defensible, context-sensitive competency metric (KBCM), which requires a comprehensive, systematically validated evidence base rather than a descriptive or conceptually driven overview. Unlike narrative, scoping, or integrative reviews, the SLR approach enables explicit inclusion and exclusion criteria, traceable screening decisions, and formal quality appraisal, thereby reducing selection bias and enhancing the credibility of derived competency constructs. This is particularly important in the context of digital transformation, where competencies are fragmented across diverse bodies of literature and must be systematically consolidated into a coherent, operationalisable model suited to the South African ICT environment.

3.2. Protocol, eligibility, search and selection

Table 1 presents an adapted PRISMA-style summary of the systematic literature review process. A written protocol defined information sources, search strings, inclusion/exclusion criteria, quality appraisal, and extraction variables to ensure methodological rigour and traceability (Hassan et al., 2022; Rahman & Rahman, 2023). Keywords: digital transformation, emerging economies, ICT projects, project manager competencies, and South Africa were structured into four concept blocks and combined using Boolean logic across Scopus, Web of Science, IEEE Xplore, and targeted domain journals and South African policy sources (Mangaroo-Pillay & Coetzee,2022; Rahman & Rahman,2023). Database searches and citation chasing identified 85 candidate studies (n=85); following screening and quality appraisal, 33 were retained (n=33). Included sources addressed ICT project-manager competencies, links to project success, and emerging-economy or South African contexts, while exclusions removed duplicates, non-English papers, methodologically weak studies, and those lacking extractable competency constructs.

3.3. Data extraction and analysis

A structured extraction template captured study characteristics, competency constructs, measurement indicators, project success dimensions, and contextual factors. The extracted data were synthesised by mapping constructs and indicators onto the four meta-domains of the Knowledge-Based Competency Metric (KBCM): Knowledge, Performance, Personal, and Agile/Adaptive, consistent with coding approaches used in related systematic literature reviews (Mangaroo-Pillay & Coetzee,2022).

3.4. Limitations and trustworthiness

Trustworthiness was enhanced by using multiple databases, targeted sectoral and policy sources, and predefined inclusion and exclusion criteria. These measures supported transparency and methodological rigour consistent with systematic review standards (Rahman & Rahman, 2023).

4. Findings and Discussion

The review identifies a balanced portfolio of competencies across four domains, digital/technical, leadership/behavioural, execution/performance, and agile/adaptive, as the most consistent predictor set of ICT project success in South Africa (PMI,2017; Alvarenga et al.,2020; Pacheco et al.,2023). Specifically, the analysis shows growing salience of AI/data literacy, cybersecurity, and systems integration, complemented by communication, emotional intelligence, ethical judgement, robust risk/quality management, and iterative learning practices (Vial et al.,2023; Mishra et al., 2023; Ayyaz et al.,2021; Ndou; Ingrosso & Di Girolamo,2024).

The findings further show that digital and data-centric practices are reshaping ICT project delivery through data-driven decision-making, human–AI teaming and product-oriented road-mapping. These findings align with scholarship advocating a blend of traditional governance and agile experimentation, while emphasising transparent communication, stakeholder education and trust-building to mitigate algorithm aversion and strengthen technology readiness (Vial et al.,2023; Mishra et al.,2023; Parasuraman,2000).

Table 1: Adapted PRISMA Review Summary for the Included Literature

Review Stage	Count	Description
Records identified	**85**	Records captured in the literature review analysis workbook (treated as the master identification set).
Records excluded during screening and appraisal	**52**	Duplicate records were removed during screening. Methodologically weak studies were excluded during appraisal. Studies lacking extractable competency constructs were excluded.
Studies included in the final synthesis	**33**	Inclusion focused on ICT PM competencies, project success links, and emerging economy/South African relevance.
Synthesis output	**4 domains**	The included studies were synthesised into four KBCM domains: Knowledge, Performance, Personal, and Agile/Adaptive.

South African contextual realities. Resilience planning for power and connectivity disruptions, alignment with e-government priorities, and inclusive delivery reflect

South Africa's digital strategy and public-sector ICT governance frameworks (Department of Communications and Digital Technologies, 2020; DPSA, 2022). These priorities are reinforced by infrastructural and access inequalities, while local scholarship highlights leadership, communication, and knowledge-sharing, particularly in SMEs, as competencies that support the inclusion of lightweight knowledge-based practices in the proposed metric (ICASA, 2025; SITA, 2024; Mbebe & Jowah, 2024; Shongwe, 2017).

4.1. Discussion of findings in relation to the literature

(A) Digital/technical competencies are necessary but not sufficient.AI literacy, data governance, cybersecurity, and agile/hybrid delivery are now threshold competencies (PMI, 2017; Li et al., 2025; Mishra et al., 2023). The literature shows that outcomes improve materially when these capabilities are integrated with behavioural strengths that enable sensemaking, explanation, and ethical decision-making in tech-mediated contexts (Vial et al., 2023; Filiz et al., 2023). The finding that PMs must educate stakeholders and cultivate psychological safety for experimentation, therefore, aligns with evidence that human factors determine whether algorithmic insights translate into value (Kumar et al., 2022; Vial et al., 2023).

(B) Leadership/behavioural competencies moderate project outcomes. Evidence indicates that leadership, communication, and emotional intelligence strengthen the contribution of technical expertise to multidimensional project success, including time, cost, quality, and stakeholder satisfaction (Alvarenga et al., 2020; Pacheco et al., 2023; Sampaio et al., 2022). These competencies reduce rework, accelerate delivery cycles and improve stakeholder satisfaction, thereby translating project plans into realised benefits (Sposito et al.,2024; Pacheco et al.,2023). In the South African context, behavioural competence also encompasses ethical stewardship and cultural intelligence, particularly in diverse and public-interest project settings (Mbebe & Jowah,2024).

(C) Execution/performance discipline continues to predict success. Despite the shift towards hybrid delivery models, execution discipline, including planning and re-baselining, risk quantification, quality control, KPI tracking and stakeholder alignment, remains strongly associated with on-time, on-budget and quality outcomes (PMI, 2017; Ayyaz et al., 2021). The use of artefact reviews, dashboarding and sponsor 360° feedback further anchors competence in observable performance and delivery results (Souza et al., 2022; PMI, 2017).

(D) Agile/adaptive capacity is a differentiator in VUCA settings. Where requirements shift and infrastructure is uneven, adaptive governance and team-level agility (Scrum/Kanban, rapid experiments, high-quality retrospectives) correlate with resilience and throughput (Ndou et al., 2024; Moe et al., 2010). These practices instantiate dynamic capabilities, the ability to sense, seize, and transform, which reframes competence as continuous reconfiguration under uncertainty (Teece, 2007).

(E) Contextualisation to South Africa is essential for validity and use. Policy frameworks (CGICT), national skills priorities, and sector conditions (5G rollout patterns, digital inclusion gaps) shape both competency requirements and their assessment (DPSA, 2022; DCDT, 2020; ICASA, 2025). In SME-dominated ecosystems, embedding knowledge-management practices increases maturity without heavy process overheads (Shongwe, 2017).

4.2. Implications for the Knowledge-Based Competency Metric (KBCM)

The proposed four-domain KBCM Knowledge, Performance, Personal, and Agile/Adaptive faithfully operationalises the integrative profile surfaced by the review and provides observable indicators with fit-for-purpose assessment methods (scenario tasks, artifact reviews, KPI dashboards, EI inventories, live simulations) (PMI,2017; Sonstein et al.,2022; Ndou et al.,2024). Two implications follow: Measurement for development. Domain-level heatmaps support targeted upskilling (e.g., AI/data governance clinics; risk/quality masterclasses; agile facilitation coaching), a strategy widely advocated in fast-moving digital contexts (Mishra et al., 2023; PMI, 2017).

Context-specific governance. Annual metric refreshes anchored in SA policy/sector updates maintain relevance and ensure the tool reflects evolving constraints and opportunities (DPSA, 2022; ICASA, 2025; SITA, 2024).

4.3. Knowledge-based competency metric (KBCM)

Table 2 synthesises the literature into four interrelated domains: Knowledge, Performance, Personal, and

Table 2: Knowledge-Based Competency Metric (KBCM)

Domain	Example Indicators	Primary Assessment Methods	Typical Development Actions
Knowledge (ICT/AI/cyber/agile)	Explains model lifecycle and risks; maps systems integrations; applies data governance	Scenario-based items; short practicals; portfolio evidence	AI/cyber labs; integration playbooks; policy clinics
Performance (delivery discipline)	Schedules/re-baselines; quantifies risk; tracks KPIs; aligns stakeholders	Artifact review; KPI dashboards; 360° sponsor feedback	Risk/quality masterclasses; OKR/KPI coaching
Personal (leadership/EI/ethics)	Frames vision; negotiates; demonstrates EI; ethical trade-offs	Behavioural interview; EI inventory; ethics vignettes	Coaching; EI workshops; ethics roundtables
Agile/Adaptive (learning, VUCA)	Runs Scrum/Kanban; enables rapid experiments; learns from retrospectives	Live simulations; retrospective quality; WIP metrics	Agile facilitation training; experimentation funds

Agile/Adaptive, each with indicators, assessment methods, and development actions to address competency gaps. In Knowledge, actions emphasise hands-on upskilling and governance literacy through AI/ML and cybersecurity labs, data-governance practicums, and systems-integration clinics (PMI, 2017; Vial et al.,2023; Mishra et al.,2023). Performance focuses on delivery discipline, including risk and quality masterclasses, schedule re-baselining, KPI/OKR coaching, and stakeholder alignment practices (PMI, 2017; Ayyaz et al., 2021; DPSA, 2022). Personal actions develop leadership, emotional intelligence, and ethical capability through coaching, EI workshops, and ethics-based case discussions (Alvarenga et al., 2020; Sampaio et al., 2022; Mbebe & Jowah, 2024). Agile/Adaptive emphasises learning and experimentation via Scrum/Kanban facilitation, retrospectives, and simulations supporting dynamic capabilities in VUCA contexts (Ndou et al.,2024; Teece,2007; DPSA,2022). Each indicator is scored on a 5-point rubric, producing heat maps to support development planning, role alignment, and PMO governance, with annual updates to ensure continued relevance.

5. Conclusion and Further Research

This study developed a Knowledge-Based Competency Metric (KBCM) to identify and operationalise the competencies most critical to ICT project success in South Africa's digital environment. The findings demonstrate that project performance depends on an integrated portfolio of digital, technical, behavioural and agile/adaptive capabilities, with behavioural and adaptive competencies enhancing the value of technical expertise. By combining established competency frameworks with dynamic capability and technology readiness perspectives, the KBCM provides a practical, context-sensitive tool for assessing and developing project management capability in AI-enabled environments. Aligned with national policy and governance requirements, the metric supports organisations in translating digital transformation priorities into measurable competencies, thereby improving project delivery and strengthening adaptive leadership in complex and evolving ICT contexts.

Recommendations

To enhance project outcomes, organisations should implement the KBCM as a development-driven governance tool by conducting baseline and periodic competency assessments and linking identified gaps to targeted interventions such as AI/data-governance training, risk and quality management workshops, and agile facilitation development (PMI,2017; Mishra et al.,2023; Ndou et al.,2024). PMOs should integrate competency indicators into project assurance and decision-making processes, thereby strengthening alignment with business objectives and performance monitoring (DPSA, 2022; Ayyaz et al., 2021). Given South Africa's infrastructural and digital inclusion challenges, organizations should prioritise resilience planning, stakeholder education, and transparent communication to support the adoption of advanced technologies (Filiz et al., 2023; Vial et al., 2023; DCDT, 2020). Regular updates to competency frameworks, aligned with policy and sector changes, are essential to sustain their relevance and effectiveness (ICASA, 2025; SITA, 2024).

Further Research

Building on these contributions, further research should validate the KBCM using mixed methods across organisations to confirm reliability and links to project KPIs (PMI, 2017; Ayyaz et al., 2021). Studies should also assess the influence of policy, governance, and infrastructure constraints on the effectiveness of competency (DCDT, 2020; DPSA, 2022; ICASA, 2025). Longitudinal research is required to evaluate the impact of KBCM-aligned upskilling on project performance in AI-enabled environments (Mishra et al., 2023; Ndou et al., 2024).

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