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Technology-Management Capabilities and Digital Transformation of Township SMMEs in South Africa

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***Abstract*—Digital technologies can improve the productivity, market reach, resilience, and innovation of small, medium, and micro-enterprises (SMMEs), yet township firms in South Africa frequently struggle to translate adoption into sustained business value. This integrative literature review examines technology-management capability as the missing link between access to digital tools and successful digital transformation. A structured narrative search combined peer-reviewed research and institutional reports on technology adoption, digital transformation, township enterprise, dynamic capabilities, and technology management. The synthesis identifies six interdependent capabilities: technology sensing, strategic selection, acquisition and financing, assimilation and integration, governance and risk management, and evaluation and renewal. Existing evidence indicates that adoption is constrained not only by connectivity and affordability but also by weak managerial routines, limited digital and financial skills, fragmented support, cybersecurity concerns, and poor alignment between technologies and business tasks. The review develops a context-sensitive framework in which external conditions and firm resources shape technology-management capability, which in turn enables changes in processes, offerings, and business models and produces agility, resilience, productivity, and growth. Feedback from these outcomes informs subsequent technology decisions. The article argues that policy and enterprise-support programmes should move beyond generic digital-literacy training toward staged, task-based technology management linked to finance, mentoring, cybersecurity, and market access. Future research should employ longitudinal and comparative designs and assess productive use, integration quality, realised value, and unintended consequences rather than measuring adoption alone.**

***Index Terms*— Digital Transformation, Dynamic Capabilities, SMMEs, South Africa, Technology Management, Township Economy.**

I. Introduction

DIGITAL transformation is becoming a strategic requirement for small firms rather than an optional technical upgrade. Cloud services, mobile applications, digital payments, social media, business information systems, and data analytics can help SMMEs lower transaction costs, reach customers, coordinate suppliers, and respond to disruption [1]–[3]. In South Africa, these opportunities are particularly important because SMMEs are expected to contribute to employment and spatial inclusion while operating in an economy marked by weak growth, high unemployment, and persistent inequality. The national Digital Transformation Roadmap and Digital and Future Skills Strategy further position digital infrastructure and capability as foundations of economic participation [4]–[5].

Township SMMEs, however, face a distinctive management problem. They may possess smartphones, use messaging applications, and maintain social-media pages while remaining unable to integrate technology into inventory, cash-flow management, customer retention, procurement, or strategic decision making. Research on township firms demonstrates that awareness, willingness, confidence, affordability, compatibility, infrastructure, and external support all affect adoption [6]–[8]. These findings are important, but adoption is only the beginning. Purchasing or opening an account for a digital tool does not establish whether it fits a business need, becomes embedded in routines, is governed safely, or produces measurable value.

Technology management provides a more demanding analytical lens. It concerns the managerial processes through which organisations identify, select, acquire, exploit, protect, and renew technologies to achieve strategic objectives [9]–[10]. For resource-constrained SMMEs, these activities are rarely performed by specialised departments. They are concentrated in the owner-manager, supported unevenly by employees, vendors, incubators, community organisations, and government agencies. Technology decisions therefore reflect managerial cognition, relationships, financial constraints, and local operating conditions as much as technical features.

This review addresses three questions: Which technology-management capabilities enable township SMMEs to convert digital adoption into transformation? How do internal resources and external conditions shape these capabilities? What policy and research agenda can improve the strategic value of digitalisation? The contribution is a context-sensitive framework that shifts attention from technology availability and behavioural intention toward the complete management cycle and its realised outcomes.

II. Methods

An integrative review design was used to combine conceptual, empirical, and policy evidence. Searches conducted in August 2026 used combinations of "technology management," "digital transformation," "SMME," "SME,"

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"township," "South Africa," "technology adoption," "digital capability," "dynamic capability," and "business resilience." Sources were identified through scholarly web searches and the publication portals of South African journals, government departments, the World Bank, and international development institutions. Peer-reviewed research was prioritised, and authoritative policy documents were included where they described current infrastructure, skills, or enterprise-support arrangements.

Studies were eligible when they examined one or more of the following: technology adoption or digital transformation in SMEs; South African township or informal-enterprise conditions; technology-management or dynamic capabilities; and performance, resilience, or innovation outcomes. Foundational works were retained to define the technology-organisation-environment (TOE) framework, technology acceptance, dynamic capabilities, and technology management. The final synthesis comprised 28 sources. Evidence was coded by antecedents, management activities, transformation mechanisms, outcomes, and research limitations. This is a structured integrative review, not a systematic review or meta-analysis; it does not claim exhaustive database coverage or formal risk-of-bias assessment.

TABLE I.
ANALYTICAL FOUNDATIONS OF THE REVIEW

Perspective	Central question	Value for township SMMEs
Technology acceptance	Will decision makers perceive a technology as useful and usable?	Explains initial willingness, trial, and adoption behaviour [11].
TOE framework	How do technological, organisational, and environmental conditions affect adoption?	Organises multilevel constraints such as compatibility, leadership, finance, and infrastructure [12].
Dynamic capabilities	How does a firm sense opportunity, seize them, and reconfigure resources?	Explains adaptation and renewal beyond one-time acquisition [13]–[14].
Technology management	How is technology identified, selected, acquired, exploited, protected, and evaluated?	Connects technology decisions with strategy, operations, governance, and value [9]–[10].
Township context	How do spatial inequality, informality, networks, and infrastructure shape practice?	Prevents models developed for well-resourced firms from being applied without contextual adaptation [6]–[8].

III. RESULTS

A. From Digital Adoption to Technology-Management Capability

The literature distinguishes digitisation, digitalisation, and digital transformation. Digitisation converts analogue information into digital form; digitalisation uses technologies to improve activities; digital transformation produces more extensive changes in processes, offerings, organisational arrangements, or business models [1], [15]. Township SMMEs often remain at the first two levels. Mobile communication and social media are relatively accessible, whereas integrated accounting, inventory, e-commerce, analytics, and customer-management systems require complementary knowledge, data discipline, finance, and process redesign [6]–[8].

Technology-management capability explains this progression. First, sensing involves scanning customer behaviour, competitor practices, supplier requirements, and technology developments. Second, selection translates identified opportunities into priorities based on task fit, cost, compatibility, security, and expected value. Third, acquisition covers procurement, vendor assessment, financing, contracting, and access to devices or infrastructure. Fourth, assimilation integrates a technology into routines, responsibilities, data flows, and employee practice. Fifth, governance addresses access control, privacy, cybersecurity, continuity, vendor dependence, and legal compliance. Finally, evaluation compares costs and outcomes and supports renewal, scaling, modification, or discontinuation. These capabilities form a cycle rather than a linear implementation checklist.

B. Contextual Constraints and Enabling Conditions

South African evidence shows that township technology decisions are embedded in material and institutional constraints. Connectivity costs, unreliable electricity, device limitations, unsafe premises, weak logistics, and restricted finance raise the cost and risk of adoption [7]–[8], [16]. Organisational barriers include limited digital and financial literacy, owner-manager time scarcity, resistance to change, inadequate records, and uncertainty about benefits. Environmental pressure from customers and competitors can stimulate adoption, but poorly matched external support can lead firms to acquire tools that are unused or abandoned.

Digital literacy is necessary but narrower than management capability. Literacy enables a person to operate and evaluate digital tools; management capability connects those skills to priorities, investment choices, organisational routines, risk controls, and performance measurement. Township research finds meaningful differences among awareness, willingness, confidence, and actual application [7]. Similarly, studies of business-information-system adoption show that perceived usefulness, ease of use, trialability, affordability, and task-technology fit influence decisions [17]. A programme that teaches platform functions without helping a firm redesign ordering, payment, recordkeeping, or customer service therefore addresses only part of the problem.

TABLE II.
TECHNOLOGY-MANAGEMENT CAPABILITIES AND PRACTICAL INDICATORS

Capability	Managerial practices	Observable indicators
Sense	Monitor customers, competitors, suppliers, technologies, and operational problems.	Documented needs; opportunity pipeline; information sources; frequency of review.
Select	Assess task fit, usability, compatibility, total cost, risk, and strategic relevance.	Selection criteria; alternatives compared; user involvement; business case.

Capability	Managerial practices	Observable indicators
Acquire	Choose vendors and financing; negotiate support; obtain devices, connectivity, and services.	Acquisition cost; contract clarity; financing burden; support availability.
Assimilate	Redesign workflows; assign responsibilities; train users; migrate and maintain data.	Active use; process integration; data completeness; staff proficiency.
Govern	Manage access, cybersecurity, privacy, continuity, compliance, and platform dependence.	Backups; access controls; incident response; vendor-exit plan.
Evaluate and renew	Measure benefits and costs; learn; scale, modify, replace, or discontinue.	Productivity, sales, resilience, user outcomes, review decisions, lessons captured.

C. Transformation Mechanisms and Strategic Outcomes

When management capability is present, technology creates value through several mechanisms. Process digitalisation improves speed, visibility, coordination, and record accuracy. Customer-facing technologies extend communication and market reach. Digital payments and transaction histories may improve financial control and potentially strengthen evidence for financing. Data generated through operations can support demand forecasting, stock management, and customer segmentation. More advanced transformation can alter offerings or business models, including online services, platform-mediated sales, subscriptions, and shared logistics.

These mechanisms support agility and resilience by allowing firms to detect change, switch channels, coordinate remotely, and preserve information during disruption [2], [18]. They may also improve productivity, innovation, revenue diversity, and growth. Yet benefits are not automatic. Digital systems can create subscription costs, cyber-fraud exposure, surveillance, platform dependence, data loss, and exclusion of customers with limited digital access. Evidence reviews therefore caution against measuring success through adoption counts alone [3], [19]. Realised value depends on depth of use, integration quality, complementary capability, and the distribution of costs and benefits.

D. Implementation Patterns and Digital Maturity

The reviewed evidence implies that township SMMEs do not follow a single transformation path. One pattern begins with customer communication through messaging and social media, followed by digital payments, basic records, and eventually integrated sales and inventory. A second begins with an operational bottleneck, such as unreliable stock information or manual booking, and introduces a focused business system before expanding outward to customer channels. A third is ecosystem-led: a platform, large buyer, supplier, or public programme requires a technology and thereby accelerates adoption. Each path creates different risks. Customer-led adoption may remain fragmented; problem-led adoption may be technically effective but isolated; and ecosystem-led adoption may create dependence on a dominant platform or buyer [20],[21]. Technology-management capability allows owners to recognise these trade-offs and determine when integration, diversification, or exit is required.

Digital maturity should consequently be assessed through management practices rather than a list of technologies owned. At an access stage, the firm has devices and connectivity but relies mainly on personal communication. At an applied-use stage, tools support identifiable tasks such as payments, marketing, booking, or records. At an integrated stage, information moves across functions and responsibilities are defined. At a managed stage, the firm uses performance indicators, cybersecurity controls, vendor oversight, backups, and documented review. At a renewal stage, evidence is used to reconfigure processes and test new offerings or business models. This progression is consistent with multilevel approaches to SME transformation [23], but it should not be interpreted as a requirement to acquire increasingly complex technology. A firm may become more mature by simplifying its technology portfolio and improving discipline, interoperability, and governance.

Vendor and platform relationships require particular attention because very small firms often outsource technical expertise. Vendors can reduce capability gaps by configuring systems, providing training, and maintaining infrastructure, yet they may also obscure total costs, retain control over data, or make switching difficult. Platform participation can rapidly extend market access while exposing firms to commissions, algorithmic visibility, unilateral rule changes, and weak ownership of customer relationships. Responsible technology management therefore includes contract comprehension, data portability, service-level expectations, alternative channels, and contingency planning. These practices are not peripheral legal tasks; they protect continuity, bargaining power, and the enterprise's capacity to learn from its own information.

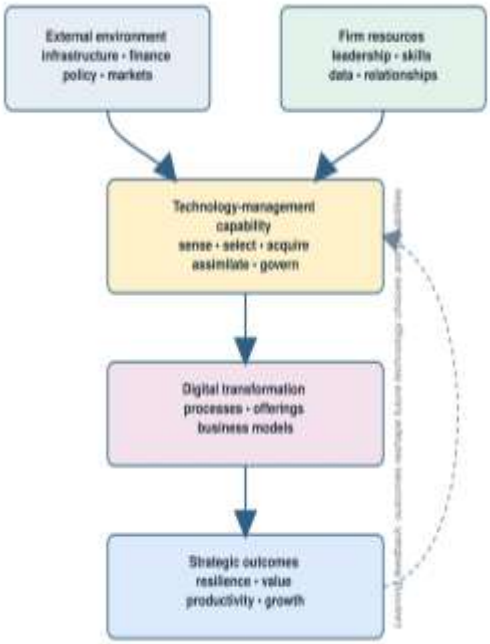


Fig. 1. Context-Sensitive Technology-Management Framework

IV. Discussion

The synthesis suggests that technology-management capability is the conversion mechanism between access and strategic outcomes. As Figure 1 shows, external conditions and firm resources shape a firm's capacity to sense, select, acquire, assimilate, and govern technology. This capability enables transformation of processes, offerings, and business models, which may generate agility, resilience, productivity, and growth. Performance feedback then reshapes future choices. The framework combines TOE's contextual breadth with the temporal logic of dynamic capabilities and the operational specificity of technology management.

This framework challenges three assumptions. The first is that technology adoption is a discrete success event. Adoption is better understood as the beginning of an assimilation and renewal process. The second is that training deficits are the dominant constraint. Skills matter, but their returns depend on task fit, finance, infrastructure, workflow redesign, data quality, mentoring, and market access. The third is that sophisticated technology is inherently superior. For a microenterprise, a well-governed mobile payment and recordkeeping routine may produce more value than an advanced system that exceeds its resources and capabilities.

Policy should consequently support staged technology management. Initial diagnostic assistance should identify business problems and existing routines before recommending tools. Selection support should compare alternatives and calculate total costs, including data, hardware, maintenance, training, cybersecurity, and switching. Acquisition finance should be linked to implementation milestones rather than equipment purchase alone. Post-adoption mentoring should continue through workflow integration, data cleaning, performance measurement, and renewal decisions. Incubators and community-based intermediaries can reduce information asymmetry and connect firms to reputable vendors, finance, training, and markets [24],[25].

South Africa already has relevant policy foundations. The National Digital and Future Skills Strategy promotes a coordinated digital-skills ecosystem [5], while enterprise-support programmes provide finance, assets, infrastructure, and non-financial assistance [26]. The policy opportunity is to connect these components around firm-level transformation journeys. Programme monitoring should distinguish participation, adoption, active use, integration, realised value, and sustained outcomes. Procurement and reporting requirements should remain proportionate so that formalisation support does not impose costs exceeding the benefits available to microenterprises.

A capability-centred approach also changes the division of responsibility among ecosystem actors. Owner-managers remain accountable for strategic priorities and operating routines, but they cannot reasonably internalise every technical skill. Public agencies should improve infrastructure, standards, consumer protection, and access to suitable finance. Incubators and community intermediaries should provide diagnostic and implementation support. Technology providers should offer transparent pricing, interoperable data, accessible security features, and proportionate service agreements. Financial institutions can recognise verified transaction histories while avoiding automated decisions that reproduce exclusion [27]. Shared accountability is essential because digital transformation is simultaneously a firm-level change process and an ecosystem-level coordination problem [28].

TABLE III.
Policy and Research Agenda

Priority	Recommended action	Evaluation focus
Diagnostic support	Assess business tasks, digital maturity, constraints, risks, and market opportunities before tool selection.	Quality of diagnosis; fit between problem and chosen technology.
Staged capability building	Combine practical training with selection, workflow redesign, data practices, and mentoring.	Productive use; proficiency; integration; retention after 6–24 months.
Finance and infrastructure	Bundle affordable finance with connectivity, power continuity, devices, cybersecurity, and support.	Total cost; financial stress; downtime; incidents; return on investment.
Market and ecosystem links	Connect township firms to procurement, platforms, suppliers, logistics, and trusted technology partners.	New customers; revenue diversity; bargaining position; platform dependence.
Longitudinal research	Compare firms, sectors, locations, and capability levels using mixed methods and repeated measurement.	Causal mechanisms; survival; productivity; resilience; distributional effects.
Responsible transformation	Track privacy, cyber-risk, exclusion, unpaid work, debt, displacement, and environmental costs.	Unintended harms and the distribution of benefits across owners, workers, and customers.

The evidence base remains limited in four respects. First, many South African studies are cross-sectional or qualitative and cannot establish whether adoption causes improved performance. Second, measures often collapse simple communication use and integrated transformation into a single adoption category. Third, survivalist and growth-oriented firms are insufficiently differentiated. Fourth, township contexts are heterogeneous; infrastructure, market proximity, sector, gender, education, migration status, and household responsibilities can alter capability formation and outcomes. Future research should use baseline and follow-up data, transaction records, matched comparisons, and qualitative process evidence. Measurement should include technology-management routines, depth of use, integration, net benefits, resilience, job quality, and unintended harm.

V. Conclusion

Digital transformation among South African township SMMEs is fundamentally a management challenge. Access, literacy, and favourable attitudes are important, but they do not ensure that a technology is strategically appropriate, financially

sustainable, integrated into operations, governed safely, or renewed through learning. The literature supports six connected capabilities: sensing, selection, acquisition, assimilation, governance, and evaluation and renewal. Together, these capabilities convert external opportunities and internal resources into changes in processes, offerings, and business models.

The practical implication is a shift from tool-centred interventions toward capability-centred transformation. Government agencies, incubators, technology providers, financiers, and community intermediaries should organise support around the enterprise's full technology-management cycle and evaluate realised business value rather than registrations, purchases, or course completions. Research should similarly move beyond intention and adoption toward longitudinal analysis of productive use, integration, resilience, performance, and risk. Strengthening technology-management capability will not remove structural inequality or substitute for wider employment policy, but it can help township firms exercise greater strategic control over digitalisation and convert technology into more durable and inclusive economic value.

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