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Digital Maturity in SMEs: A Systematic Synthesis Review and Framework Selection Guidance

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Abstract

This study presents a Systematic Synthesis Review (SSR) of digital transformation maturity frameworks, with emphasis on their suitability for Small and Medium-sized Enterprises (SMEs). Using PRISMA-informed identification and screening procedures, 432 records were examined, and ten maturity frameworks were included for comparative analysis. The review classifies frameworks into five categories: foundational organizational alignment models, general diagnostic maturity assessments, SME-oriented capability-building models, Industry 4.0 operational readiness tools, and macro-level digital ecosystem indicators. The comparative findings show that digital maturity in SMEs develops through iterative, context-dependent capability cycles shaped by leadership alignment, internal resource configurations, and external infrastructural support. SME-specific frameworks that incorporate prioritization mechanisms, phased capability development, and dependency management provide more actionable guidance than universal benchmarking approaches. The study contributes a structured rationale for selecting maturity frameworks aligned with organizational conditions and ecosystem context.

Keywords: Digital Transformation, Digital Maturity, SMEs, Literature Review, Capability Development, Resource Dependence, Sustainability.

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1. Introduction

Digital transformation (DT) refers to the strategic integration of digital technologies into organizational processes, structures, and value creation mechanisms (Furr et al., 2022; Verhoef et al., 2021; Mohamad et al., 2022; Al-Ayed et al., 2023). It extends beyond technology adoption and entails shifts in managerial thinking, workflows, organizational culture, and inter-organizational relationships (Furr et al., 2022; Teece, 2018). In sectors characterized by technological acceleration and evolving customer expectations, DT has emerged as a central driver of competitiveness and long-term sustainability.

For Small and Medium-sized Enterprises (SMEs), the transition is considerably more complex (Kahveci, 2025; Omol et al., 2024). SMEs commonly operate with limited financial resources, reduced access to specialized digital talent, and heightened sensitivity to operational risk during transformation initiatives (Omol et al., 2024; Krulčić et al., 2025). They may also depend on external partners, supply-chain platforms, and ecosystem service providers, which can constrain their ability to independently coordinate and sequence transformation actions(Omol et al., 2024; Jaciow et al., 2025). Despite these constraints, SMEs play a central role in regional innovation systems, employment stability, and economic resilience, which underscores the need for transformation approaches that are realistic, scalable, and aligned with their structural conditions (Kahveci, 2025).

Digital Maturity Models (DMMs) serve as structured diagnostic instruments for assessing an organization's current stage of digital transformation, identifying capability gaps, and informing strategic prioritization (Teichert, 2019; Haryanti et al., 2024). However, the maturity model landscape remains diverse in terms of theoretical grounding, scope, and methodological depth(Silva et al., 2021; Krulčić et al., 2025). Foundational frameworks emphasize strategic alignment and cultural readiness, while SME-oriented approaches focus on resource pacing, incremental development, and dependency management (Kahveci, 2025; Omol et al., 2024). Domain-specific maturity models, particularly those linked to Industry 4.0, address operational and production system readiness in manufacturing-oriented contexts (Silva et al., 2021).

Furthermore, organizational digitalization is influenced by broader ecosystem conditions, including national digital infrastructure, regulatory frameworks, and innovation support mechanisms (Jaciow et al., 2025; Fortier et al., 2025). Accordingly, maturity assessment must be understood not only as an internal organizational exercise but as a process embedded within a wider policy and ecosystem environment, where external enablers and constraints shape transformation feasibility and pacing.

The aim of this study is to synthesize and compare digital maturity frameworks that are relevant to SME transformation. The contribution lies in clarifying the conceptual logic, structural dimensions, and practical applicability of different frameworks and in distinguishing firm-level capability models from ecosystem-level readiness instruments. This structured comparison supports informed framework selection for research, policy design, and managerial decision-making.

2. Research Methodology

This study adopts a Systematic Synthesis Review (SSR) design, integrating principles of methodological transparency and structured comparison following PRISMA guidelines (Moher et al., 2009; Higgins et al., 2024). The SSR approach allows the integration of diverse sources of evidence—including peer-reviewed academic models, validated consulting frameworks, and ecosystem-level readiness tools—while ensuring replicability and coherence in comparative maturity assessment.

2.1 Research Protocol

The review was conducted according to a predefined research protocol specifying the scope, data sources, search procedures, screening logic, and inclusion criteria. The protocol ensured that framework selection was systematic rather than retrospective or convenience-based, aligning with best practices in systematic research synthesis (Cooper, 2017).

Table 1: Structured Research Protocol for the Systematic Synthesis Review

Protocol Component	Specification
Objective	Identify and synthesise digital maturity frameworks relevant to SME digital transformation.
Timeframe	2011–2025
Data Sources	Scopus, Web of Science, IEEE Xplore, Google Scholar; Capgemini, Deloitte, BCG repositories; European Commission & EDIH/DIHNET platforms.
Search Strategy	Three-tier Boolean blocks (general maturity, SME-focused, Industry 4.0) & backward/forward snowballing.
Inclusion Criteria	Staged progression; Theoretical grounding; Reconstructability; SME applicability.
Exclusion Criteria	No maturity staging; Proprietary undocumented tools; Non-generalizable single-case prototypes.

2.2 Scope and Temporal Boundary

The review covers the period 2011–2025, which coincides with the institutionalization of digital transformation as a research domain and the proliferation of maturity model publications following the rise of Industry 4.0 (Teichert, 2019; Verhoef et al., 2021). This timeframe captures both foundational and contemporary frameworks, from early digital capability models to recent SME-oriented or policy-linked tools (Kahveci, 2025; Omol et al., 2024). Only English-language documents with sufficient methodological documentation were included, ensuring the ability to reconstruct the structural logic and dimensions of each framework.

2.3 Data Sources

To reflect the interdisciplinary nature of digital maturity research, this study drew upon a diverse set of data sources encompassing academic, consulting, and policy-oriented domains. Scopus and Web of Science served as the primary peer-reviewed academic repositories, while targeted searches in Google Scholar and IEEE Xplore were conducted to capture relevant gray literature and technology-focused maturity models. In parallel, publications from consulting and industry research institutes, including the Capgemini Research Institute, Deloitte Insights, and the Boston Consulting Group, were reviewed to incorporate practice-validated frameworks that have been widely applied in real organizational contexts (Teichert, 2019). Additionally, policy and ecosystem-level resources were examined through European Commission digital strategy documentation and the EDIH/DIHNET portals, supporting the identification of macro-level digital readiness tools designed to reflect regional or national transformation capacity (Heinrichs et al., 2022).

2.4 Search Strategy

The literature search was conducted using a three-tier Boolean search protocol designed to capture both general and context-specific digital maturity frameworks. The first query block targeted broad maturity constructs, combining terms such as "digital maturity model," "digital transformation maturity," and "digital readiness assessment" with descriptors including "framework," "capability," and "benchmark." A second search block focused on the SME context by pairing "SME" or "small and medium enterprise" with "digital transformation" and "maturity model." A third block was employed to identify Industry 4.0 operational readiness approaches by combining expressions such as "Industry 4.0 readiness" or "I4.0 maturity" with "assessment" or "evaluation." To ensure comprehensiveness and to trace conceptual lineage across frameworks, backward and forward snowball citation tracking was applied to foundational and frequently cited works (Teece, 2007), allowing the identification of derivative or adapted maturity models that may not have appeared directly in the initial search outputs.

2.5 Inclusion and Exclusion Criteria

A digital maturity framework was included in the review if it satisfied four core criteria. First, it needed to define structured maturity levels or a staged progression logic, indicating how organizations advance from lower to higher states of digital capability. Second, the framework was required to demonstrate theoretical grounding, drawing on established conceptual foundations such as Dynamic Capabilities Theory, Resource Dependence Theory, or process maturity logic informed by CMMI or SPICE standards. Third, the framework had to offer sufficient methodological and structural documentation to allow the reconstruction of its dimensions, constructs, and assessment mechanisms. Fourth, it needed to demonstrate relevance to small and medium-sized enterprises (SMEs), either through explicit SME-oriented design or through evidence of validated

implementation in SME contexts.
Conversely, frameworks were excluded if they lacked staged maturity logic (e.g., simple technology adoption checklists), if they were proprietary consulting tools without transparent methodological disclosure, or if they constituted single-case prototypes without demonstrable generalizability beyond their original empirical setting.

Table 2: Inclusion Criteria for Selecting Digital Maturity Frameworks

Criterion	Requirement
Structure	Defined staged maturity levels or capability progression.
Theoretical Grounding	Explicit anchoring in Dynamic Capabilities Theory (DCT), Resource Dependence Theory (RDT), Process Maturity Logic (e.g., CMMI/SPICE), or Organizational Alignment Theories.
Reconstructability	Sufficient documentation to reconstruct dimensions and assessment logic.
SME Relevance	Demonstrated applicability, scalability, or validated deployment in SME contexts.

2.6 Prisma Screening Flow

The review process followed the PRISMA guidelines to ensure transparency and replicability in the identification, screening, and selection of maturity frameworks (Moher et al., 2009; Page et al., 2021). The analytical orientation aligns with the principles of systematic synthesis reviews, which emphasize structured comparison and conceptual integration rather than statistical aggregation (Snyder, 2019; Cooper, 2017). The full screening pathway from initial retrieval to final inclusion is summarized in the PRISMA flow diagram presented below.

Table 3: PRISMA Screening Flow Summary

Stage	Description	Records (n)
Identification	Records identified across all data sources (Scopus, WoS, GS, IEEE, consulting & policy repositories)	432
Screening	Titles and abstracts screened for relevance	118 retained
Eligibility	Full-text articles assessed against inclusion criteria	72 eligible
Inclusion	Final distinct maturity frameworks included in comparative synthesis	10 frameworks

2.7 Coding and Comparative Analysis Procedures

A structured coding protocol was applied to the ten selected maturity frameworks to enable systematic cross-model comparison. Each framework was examined along four analytical lenses: (1) conceptual foundation, documenting whether the model is grounded in Dynamic Capabilities Theory, Resource Dependence Theory, organizational alignment logic, or process maturity principles; (2) structural dimensionality, capturing the number, hierarchy, and granularity of maturity domains and sub-dimensions; (3) methodological design, including scoring mechanisms, prioritization and sequencing logic, and standardization procedures; and (4) SME applicability conditions, such as capacity constraints, required resource configurations, and scalability assumptions.

Coding was conducted in two iterative rounds. The first round involved independent descriptive coding of each framework. The second round applied cross-model normalization to synthesize overlapping constructs, harmonize terminology, and refine dimension boundaries. Divergences in interpretation were resolved through iterative comparative synthesis rather than averaging, following established procedures in thematic framework synthesis (Thomas and Harden, 2008). The two-stage coding logic and normalization approach align with recognized standards for comparative qualitative data synthesis (Miles et al., 2014).

2.8 Model Categorization Logic

Following coding and normalization, the frameworks were grouped into five functional categories based on their primary analytical purpose, scope, and intended application context. The categorization approach follows maturity model design and structuring principles, which recommend grouping models according to conceptual intent and use-case orientation rather than surface-level dimensional similarity (De Bruin et al., 2005; Teichert, 2019). Moreover, the distinction between firm-level maturity models and macro-level digital ecosystem readiness tools aligns with classification logics in Industry 4.0 maturity research (Schumacher et al., 2016).

Table 4: Framework Grouping Based on Conceptual Orientation and Application Scope

Category	Models	Primary Purpose	Target Context	Core Orientation
Foundational Organizational Alignment	Capgemini-MIT; McKinsey 7S	Diagnose strategic, cultural, and leadership readiness	Large firms; adaptable to SMEs	Strategic Alignment & Leadership Coherence
General Digital Capability Benchmarking	Deloitte DMM; DX-SAMM	Multi-domain maturity assessment and staged progression	Cross-sector organizations	Standardized Dimensional Maturity
SME-Adaptive Capability Development	DASAT; DAMA-AHP; Tailored DMAM	Guide capability sequencing and investment prioritization under constraints	SMEs with limited internal resources	Iterative Capability pacing & Dependency management
Domain-Specific Operational Readiness	DREAMY	Evaluate Industry 4.0 Production system readiness	Manufacturing SMEs	Operational Digitalization & Process Maturity
Macro-Level Ecosystem Readiness Tools	DAI;			Macro-Level Ecosystem Readiness Tools

Note: Firm-level models (Categories 1–4) were subsequently compared to assess their theoretical orientation, structural cohesion, and scalability under different capability and resource conditions. In contrast, macro-level tools (Category 5) were interpreted as contextual enablers rather than internal maturity assessment instruments, as they capture external digital ecosystem conditions that shape SMEs' digital transformation trajectories.

3. Theoretical Framework

Digital maturity in SMEs can be interpreted through three complementary theoretical lenses: Dynamic Capabilities Theory (DCT), Resource Dependence Theory (RDT), and Process Maturity Logic. Together, these perspectives explain how firms develop, sustain, and operationalize digital transformation capabilities under different strategic, environmental, and operational conditions.

3.1 Dynamic Capabilities Theory (DCT)

Dynamic Capabilities Theory conceptualizes the firm's ability to sense shifts in the external environment, seize emerging opportunities, and transform internal resource configurations to maintain competitiveness (Teece et al., 1997; Teece, 2007; Teece, 2018). Within digital transformation, maturity is therefore understood not merely as the adoption of digital technologies, but as the capacity for continuous learning, recombination, and reconfiguration. Progression toward higher digital maturity reflects increasingly routinized and intentional adaptive processes, making digital maturity an iterative rather than linear process.

3.2 Data analysis Resource Dependence Theory (RDT)

Resource Dependence Theory emphasizes that organizations operate within interdependent ecosystems where access to external resources—such as funding, digital infrastructure, skilled labor, and institutional support—is unevenly distributed (Pfeffer and Salancik, 1978). This perspective is particularly relevant to SMEs, which often face structural constraints that limit internal capability development. Contemporary digital transformation research highlights that maturity depends on how effectively SMEs negotiate, secure, embed, and govern external technological and knowledge resources (Omol et al., 2024). Partnerships, innovation networks, and policy support often function not as accelerators, but as preconditions for advancing digital maturity.

3.3 Process Maturity Logic

Process maturity logic conceptualizes organizational advancement as movement through structured stages of process definition, standardization, monitoring, and improvement. The staged progression logic present in numerous digital maturity models can be traced to the Capability Maturity Model Integration (CMMI), originally developed by the Software Engineering Institute to describe levels of process definition, consistency, and continuous improvement (Chrissis et al., 2011). Complementarily, the SPICE / ISO/IEC 15504 framework formalizes process capability assessment as an internationally standardized evaluation method, widely adopted in software engineering and Industry 4.0 manufacturing settings (ISO/IEC, 2004). These foundations explain why digital maturity is often operationalized as structured movement from ad hoc digital adoption toward institutionalized, continuously improving digital practices.

3.4 Integrative Interpretation

Taken together, these perspectives show that digital maturity is shaped by the adaptive learning capability of the organization (Teece et al., 1997; Teece, 2007), its ability to secure and manage external resources and interdependencies (Pfeffer and Salancik, 1978; Omol et al., 2024), and the extent to which digital processes are standardized and subject to continuous improvement (Chrissis et al., 2011; ISO/IEC, 2004). This integrated theoretical lens supports the comparative evaluation of maturity frameworks by clarifying the underlying assumptions each framework prioritizes. Such distinctions are particularly critical for SMEs, where digital maturity trajectories reflect the combined influence of internal dynamic capability development and external enabling or constraining ecosystem conditions (Verhoef et al., 2021).

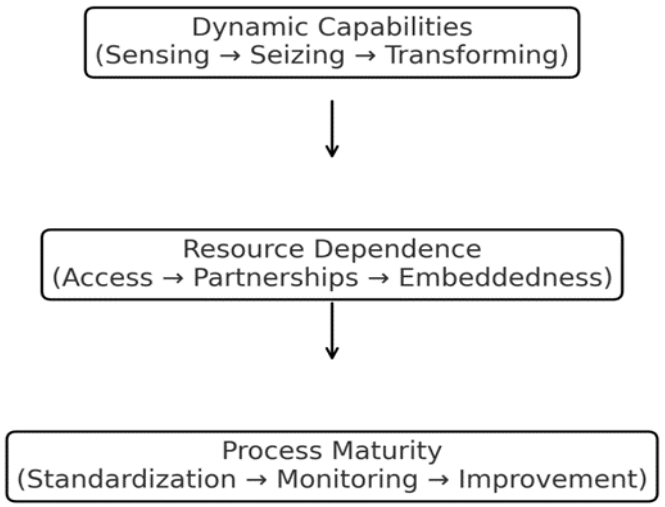

Figure 1: Digital Maturity Integrative Model (Figure by authors)

4. Comparative Analysis of Digital Maturity Frameworks

This section provides a structured comparative evaluation of the eight firm-level maturity frameworks included in the analytical corpus. The analysis follows a two-stage logic. First, the frameworks are compared according to their conceptual orientation, structural dimensionality, methodological design, and practical relevance for SMEs. Second, a prescriptive selection logic is developed to support context-dependent adoption of maturity frameworks based on organizational constraints and transformation trajectories.

4.1 Structural and Methodological Comparison

Firm-level digital maturity frameworks differ substantially in their foundational assumptions and intended use. Foundational organizational alignment frameworks, such as Capgemini–MIT (Westerman et al., 2014) and McKinsey 7S (Cox et al., 2019; Awino, 2017), emphasize leadership, culture, and internal coherence. These models are valuable for diagnosing readiness but do not inherently guide resource prioritization or sequencing of transformation activities, which limits their effectiveness in resource-constrained SME contexts.

General benchmarking frameworks, including Deloitte DMM (Teichert, 2019; Marks and Al-Ali, 2022) and DX-SAMM (Haryanti et al., 2024), offer clear staged progression logic and enable comparative maturity assessment. However, without complementary implementation mechanisms, they risk becoming static diagnostic snapshots rather than instruments for capability building.

In contrast, SME-adaptive models such as DASAT (Kahveci, 2025), DAMA-AHP (Krulčić et al., 2025; Saaty, 1980), and Tailored DMAM (Omol et al., 2024) explicitly address resource scarcity, sequencing, and external dependency management. These models align maturity progression with the practical tempo of capability accumulation in SMEs.
Finally, DREAMY (Silva et al., 2021) is a domain-specific Industry 4.0 operational readiness tool, appropriate primarily for manufacturing settings rather than general digital transformation contexts.

Table 5: Comparative Structural and Methodological Evaluation of Firm-Level Frameworks

Framework	Conceptual Foundation	Structural Dimensions	Methodological Design	SME Applicability
Capgemini–MIT (Westerman et al., 2014)	Dynamic Capabilities & Leadership Capability	2D: Digital Capability & Leadership Capability	Empirical diagnostic	Requires scaling for SMEs
McKinsey 7S (Cox et al., 2019; Awino, 2017)	Organizational Effectiveness Theory	7 organizational alignment elements	Diagnostic, non-prescriptive	Broad applicability; requires facilitation
Deloitte DMM (Teichert, 2019; Marks & Al-Ali, 2022)	Capability Maturity & Governance Logic	Multi-domain staged model	Benchmarking & progression tracking	Adaptable to SMEs with scaling
DX-SAMM (Haryanti et al., 2024)	SPICE Maturity Standard	7 holistic digital capability dimensions	Standardized self-assessment	High, requires internal facilitators
DASAT (Kahveci, 2025)	Dynamic Capability Cycle	4 iterative development phases	Cyclical continuous improvement	Designed for SMEs
DAMA-AHP (Krulčić et al., 2025; Saaty, 1980)	Multi-Criteria Decision-Making (AHP)	Strategic & Operational prioritization	Weighted decision scoring	Ideal when resources are limited
Tailored DMAM (Omol et al., 2024)	Resource Dependence Theory	Dependency & ecosystem linkage	Dependency mapping & governance	Highly relevant in resource-scarce ecosystems
DREAMY (Silva et.al., 2021)	Industry 4.0 Operational Readiness	5 production system domains	Process maturity continuum	Sector-specific to manufacturing SMEs

4.2 Critical Evaluation

The comparative analysis indicates that strategic alignment-oriented frameworks primarily emphasize cultural, leadership, and organizational readiness conditions; however, they do not inherently address the critical challenge of investment prioritization that characterizes most SME transformation environments. Benchmarking-oriented maturity models offer structured and repeatable assessment mechanisms, yet they risk functioning as static evaluative scorecards when not accompanied by guidance for capability sequencing or implementation pathways. In contrast, SME-adaptive models are distinguished by their explicit consideration of resource scarcity, pacing, and dependency conditions, aligning maturity

development trajectories with the practical and temporal constraints that small firms encounter during transformation.

Furthermore, the widely assumed linear and incremental progression embedded in many maturity frameworks is not consistently supported by empirical evidence. Research increasingly shows that SMEs often follow iterative, cyclical, or U-shaped maturity trajectories, in which operational performance may initially decline during the early phases of capability acquisition before stabilizing at a higher level of competence (Mustafa et al., 2025). These patterns reflect the temporary coordination costs, learning frictions, and adaptation delays that accompany digital restructuring. Accordingly, the findings reinforce the need for maturity models that support paced and iterative capability building, rather than accelerated or one-directional transformation logic.

4.3 Prescriptive Selection Matrix

The selection of an appropriate maturity framework is inherently contingent on the organization's initial conditions, resource capacity, and dependency structure. Prior research emphasizes that digital transformation outcomes vary depending on the firm's strategic readiness, internal capability base, and access to external technological and institutional support (Verhoef et al., 2021; Warner and Wäger, 2019). In SMEs, where financial and human resources are often constrained, maturity progression requires sequencing and prioritization, rather than simultaneous capability development (Li et al., 2017). Accordingly, the choice of framework should align with the tempo, constraints, and ecosystem position of the firm rather than assume a uniform transformation pathway. The following prescriptive matrix synthesizes these contextual conditions and links them to the frameworks best suited to address them.

Table 6: Prescriptive Framework Selection Matrix

SME Context Scenario	Recommended Framework	Rationale	Illustrative Example
Low digital awareness, fragmented processes	DASAT	Builds maturity iteratively and strategically	Micro-manufacturing firm beginning ERP deployment
Limited investment capacity requiring prioritization	DAMA-AHP	Enables weighted resource allocation	Textile SME choosing between automation vs. digital upskilling
Heavy dependence on external digital platforms	Tailored DMAM	Governs external resource dependencies	Tourism SME dependent on OTA platforms
Strategic intent but operational lag	DREAMY	Diagnoses I4.0 production readiness	Food processing SME implementing batch traceability
Need for benchmarking and progress monitoring	DX-SAMM / Deloitte DMM	Supports repeatable maturity assessments	Regional SME network maturity heatmapping

5. Contextual Determinants of SME Digital Maturity

Digital transformation maturity in SMEs is shaped by a combination of internal and external determinants. Beyond the development of internal digital and organizational capabilities, maturity progression depends on governance alignment, leadership commitment, cultural readiness, strategic sustainability orientation, and the enabling conditions of the broader digital ecosystem. These factors influence not only where an SME begins its transformation journey, but also the pace, sequencing, and stability of maturity advancement over time (Warner and Wäger, 2019; Westerman et al., 2014). Recent research highlights that SMEs experience maturity as a path-dependent and iterative process, shaped by resource constraints, managerial cognition, and institutional support environments rather than linear technological adoption (Mustafa et al., 2025). Consequently, understanding SME digital maturity requires a multi-level analytical perspective that considers the interplay between internal capability-building and external ecosystem readiness.

5.1 Governance, Leadership Alignment and Cultural Readiness

Governance coherence and leadership alignment consistently emerge as foundational enablers of digital transformation maturity in SMEs. Research in organizational digitalization shows that transformation efforts advance effectively only when strategic intent, managerial commitment, and operational practices are aligned around shared priorities (Westerman et al., 2014; Warner and Wäger, 2019). In SMEs, where decision-making structures are typically centralized and resource slack is limited, leadership vision directly shapes the allocation of attention, investment, and capability-building activities (Li et al., 2017). Cultural readiness further mediates this process: organizations with open learning norms, cross-functional communication, and tolerance for experimentation are more likely to successfully internalize new digital routines and move beyond isolated tool adoption (Kane et al., 2015). Conversely, cultural resistance, low digital awareness, and organizational inertia can slow or destabilize transformation, even when technological resources are available (Susanti et al., 2023). Accordingly, governance and cultural alignment function not as outputs of maturity but as preconditions that determine whether maturity progression can be initiated, sustained, and institutionalized over time.

5.2 Sustainability Orientation and the European Twin Transition

Digital transformation in European SMEs increasingly intersects with sustainability objectives, particularly within the strategic policy framing of the European Twin Transition, which promotes the simultaneous advancement of digitalization and environmental sustainability (European Commission, 2021; Prendeville and Hartung, 2023). Empirical work indicates that higher levels of digital maturity are associated with improved sustainability performance, enhanced resource efficiency, and measurable contributions to SDG-related targets (Jaciow et al., 2025). In manufacturing and regulated sectors, sustainability metrics are now being actively

integrated into maturity assessments to inform investment sequencing and capability prioritization under conditions of regulatory pressure and market accountability (Fortier et al., 2025). As a result, digital maturity development shifts from a narrowly technological process toward a strategic reconfiguration of how firms create, capture, and justify value in socio-environmentally responsible terms. This alignment underscores that sustainability is not an external complement to digital transformation, but a structural dimension of maturity progression within contemporary European SME contexts.

5.3 Ecosystem-Level Enabling Conditions

SME digital maturity is further conditioned by the strength of the surrounding innovation ecosystem, including digital infrastructure, advisory networks, financial instruments, and regional support organizations. Macro-level tools such as the Digital Acceleration Index (DAI) (Heinrichs et al., 2022) and the Digital Maturity Assessment Tool (DMAT) associated with the EDIH network (Mazgajczyk et al., 2024; Katehakis et al., 2024) evaluate the extent to which the external environment enables or constrains maturity development. These frameworks do not assess internal capabilities directly; rather, they capture transformation feasibility, influencing whether and how SMEs can mobilize resources, reduce learning costs, and access digital expertise.

Table 7: Ecosystem-Level Digital Readiness Tools and Their Role in SME Transformation

Tool	Assessment Scope	Primary Purpose	Target Level	Role in SME Transformation	Key References
Digital Acceleration Index (DAI)	National/sector digital readiness	Measure digital velocity and structural readiness	Macro (economy/ sector)	Indicates enabling or constraining transformation conditions	Heinrichs et al., 2022
Digital Maturity Assessment Tool (DMAT) (EDIH Network	Regional support and innovation services	Match SMEs to advisory, training, and funding programs	Meso (regional ecosystem)	Reduces capability-building costs through ecosystem support	Mazgajczyk et al., 2024; Katehakis et al., 2024

5.4 Integrative Interpretation

Taken together, governance readiness, sustainability orientation, and ecosystem support conditions reveal that SME digital maturity is best understood as a multi-level developmental process. Internal transformation depends on the presence of coherent strategic leadership and cultural alignment that supports experimentation, learning, and capability renewal, while sustainability priorities shape the direction and legitimacy of maturity investments, particularly in sectors influenced by environmental and regulatory transitions (Jaciow et al., 2025; Fortier et al., 2025).

At the same time, the broader digital ecosystem—comprising infrastructure, advisory networks, skills development actors, and regional innovation intermediaries—affects the feasibility, pacing, and stability of capability implementation (Heinrichs et al., 2022; Mazgajczyk et al., 2024). The resulting maturity trajectory is therefore non-linear, with periods of consolidation, reconfiguration, and learning, rather than continuous upward progression (Mustafa et al., 2025). Sustainable digital maturity in SMEs emerges when these internal and external dimensions are aligned, enabling firms to maintain strategic coherence while progressively expanding their digital capabilities over time.

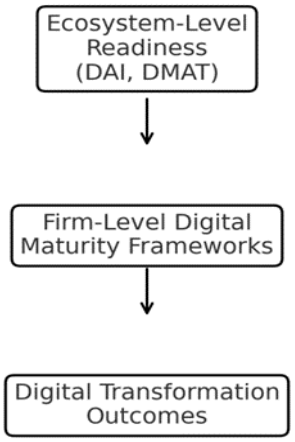

Figure 2: Digital Transformation Pathway (Figure by authors)

6. Discussion

The comparative analysis reveals that digital maturity frameworks differ not only in their structural architecture and methodological logic, but also in the assumptions they make about how transformation unfolds within organizations. A key insight emerging from this synthesis is that there is no single maturity framework that serves as a universal solution. Instead, the effectiveness of a maturity model depends on its alignment with the specific resource environment, strategic intent, organizational culture, and ecosystem conditions faced by SMEs. Digital maturity should therefore be viewed not as a linear technical progression, but as a context-dependent developmental pathway shaped by internal alignment and external enabling conditions.

Foundational maturity frameworks, such as Capgemini–MIT (Westerman et al., 2014) and the McKinsey 7S model (Cox et al., 2019; Awino, 2017), emphasize leadership coherence, organizational culture, and strategic alignment. These models

are particularly effective in diagnosing capability fragmentation, cultural resistance, or gaps in strategic coordination. However, they provide limited prescriptive guidance regarding the sequencing of transformation activities. As a result, SMEs are often required to translate alignment insights into their own staged implementation strategies, which can be challenging in environments characterized by limited managerial bandwidth and resource constraints. By contrast, SME-oriented frameworks such as DASAT (Kahveci, 2025) and DX-SAMM (Haryanti et al., 2024) embed iterative learning and capability-building into the maturity logic itself, making them more suitable for gradual transformation processes that require pacing and continuous feedback.

Resource scarcity emerges as a central structural condition shaping SME transformation. Frameworks that implicitly assume sustained investment capacity or uninterrupted transformation cycles do not reflect the realities faced by smaller firms. Models such as DAMA-AHP (Krulčić et al., 2025; Saaty, 1980) and Tailored DMAM (Omol et al., 2024), which incorporate multi-criteria prioritization and external dependency management, respond more directly to these constraints. They reposition maturity development as a sequence of strategic resource allocation decisions rather than a pursuit of an idealized capability end-state. This shift is particularly relevant for SMEs operating in regions with limited access to digital advisory networks or innovation support infrastructures.

Sector-specific operational maturity frameworks also play a critical role in achieving meaningful transformation outcomes. DREAMY (Silva et al., 2021), developed for Industry 4.0 readiness, illustrates that digital adoption in production-intensive environments cannot be separated from the configuration of workflows, compliance requirements, and process integration. This implies that general maturity frameworks perform best when complemented with sector- or domain-specific operational diagnostics to ensure alignment between technological ambition and production feasibility.

The systemic digital environment further conditions maturity trajectories. Tools such as the Digital Acceleration Index (DAI) and the Digital Maturity Assessment Tool (DMAT) reflect the enabling capacity of the broader digital ecosystem, including infrastructure, skills development institutions, and regional innovation networks (Heinrichs et al., 2022; Mazgajczyk et al., 2024; Katehakis et al., 2024). SMEs embedded in strong support ecosystems are more likely to sustain transformation momentum, whereas those in peripheral or resource-scarce contexts may experience stagnation or fragmented progress. Therefore, maturity assessment must be interpreted not as an isolated organizational property, but as an outcome of multi-level interaction between firm capabilities and ecosystem enablers.

The overall implication is that maturity frameworks should be selected and adapted based on strategic fit rather than model familiarity or availability. Effective application requires that organizations begin with a clear understanding of their governance coherence, resource constraints, and ecosystem dependencies. Meanwhile, research should focus on the non-linear and iterative nature of maturity development, as evidence increasingly shows that SMEs often experience

transitional performance declines or capability instability before realizing sustained capability gains (Mustafa et al., 2025). Future maturity frameworks should therefore incorporate adaptive sequencing mechanisms, learning loops, and longitudinal reinforcement, shifting away from static linear progressions toward dynamic and resilience-oriented maturity pathways.

This discussion positions digital maturity frameworks not as prescriptive templates dictating how transformation must occur, but as guiding instruments that help organizations navigate context-dependent transformation journeys shaped by evolving strategic, operational, and ecosystem conditions.

7. Conclusion

This study provided a structured synthesis and comparative analysis of digital transformation maturity frameworks, with particular attention to their applicability within Small and Medium-sized Enterprises (SMEs). By distinguishing among foundational organizational alignment models, general diagnostic maturity assessments, SME-adaptive capability-building frameworks, domain-specific operational readiness tools, and macro-level digital ecosystem indicators, the analysis clarified the conceptual assumptions and functional purposes of each framework category. The findings illustrate that digital transformation is not a linear or uniform process; rather, SMEs progress through iterative capability development shaped by governance alignment, cultural readiness, resource availability, and contextual ecosystem conditions.

Foundational models such as Capgemini–MIT emphasize leadership and cultural readiness as prerequisites for transformation (Westerman et al., 2014). However, SMEs typically require frameworks that embed prioritization logic and adaptive sequencing to navigate resource constraints. Models such as DASAT, DAMA-AHP, Tailored DMAM, and DX-SAMM provide structured pathways for staged capability development, resource-weighted decision making, and dependency management (Kahveci, 2025; Krulčić et al., 2025; Omol et al., 2024). In production-intensive settings, sector-specific models such as DREAMY enable alignment between digitalization and operational workflows (Silva et al., 2021). Meanwhile, macro-level readiness tools such as DAI and DMAT situate firm-level maturity within broader national and regional ecosystem capacities (Heinrichs et al., 2022; Mazgajczyk et al., 2024).

Emerging empirical evidence also suggests that higher levels of digital maturity contribute to improved sustainability performance and organizational resilience (Jaciow et al., 2025). Overall, effective digital transformation in SMEs depends on selecting maturity frameworks that align with organizational conditions and ecosystem context, ensuring that diagnostic clarity is combined with actionable, incremental progression pathways. Future research should prioritize longitudinal maturity-pathway evaluation, cross-sector validation, and the integration of sustainability metrics to advance maturity frameworks from static diagnostic instruments toward dynamic strategic transformation systems.

7.1 Limitations and Future Research Agenda

Several limitations frame the interpretation of this study. First, the selection of maturity frameworks was based on the availability of documented structure, theoretical grounding, and demonstrated relevance to organizational transformation. While this ensured analytical coherence, it may have excluded emergent, proprietary, or practitioner-oriented models with limited methodological transparency. Second, the heterogeneity of maturity models in terms of dimensional granularity, purpose, and methodological rigor restricts the extent to which direct comparison is possible. Although this synthesis addressed variation through categorical grouping and contextual framing, underlying assumptions and intended use-cases differ and cannot be fully standardized.

Third, while maturity frameworks frequently propose staged developmental pathways, empirical evidence confirming the relationship between maturity progression and performance outcomes remains limited. Existing research suggests that SMEs often experience non-linear or cyclical maturity trajectories, yet longitudinal studies quantifying operational, financial, or sustainability impacts are still scarce. Fourth, the generalizability of the findings is influenced by sector-specific process environments and regional digital ecosystem conditions. Although macro-level tools were included to acknowledge contextual variability, adaptation remains necessary when applying frameworks across diverse SME settings. Finally, the interpretive synthesis approach involves researcher judgment in framework classification and conceptual integration; alternative categorizations may be possible, particularly where documentation is incomplete.

These limitations do not diminish the value of the comparative analysis, but rather underscore the need for future research to incorporate longitudinal performance measurement, empirical validation of maturity pathways, and context-sensitive model adaptation. Advancing maturity frameworks will require moving beyond static diagnostic models toward dynamic, evidence-based instruments capable of guiding sustained and contextually aligned digital transformation in SMEs.

8. Practical and Policy Implications

The findings of this review underline that effective digital transformation in SMEs depends on aligning maturity framework selection with organizational conditions, resource environments, and sector-specific operational requirements. For practitioners, this means that maturity assessment should not be approached as a one-time diagnostic exercise, but as a structured progression mechanism that supports iterative capability-building. SMEs benefit from frameworks that explicitly guide prioritization and pacing rather than those that assume continuous or uniform advancement. For example, in a micro-manufacturing firm beginning ERP deployment, the DASAT framework can be used to structure the transformation into sequential phases—awareness, strategic planning, adoption, and iterative improvement—ensuring that capability development remains feasible and aligned with daily operational constraints.

For SMEs with limited financial or human resources, integrating prioritization logic into the maturity process becomes critical. Models such as DAMA-AHP enable managers to identify which digital investments yield the greatest strategic value relative to organizational constraints. A textile firm deciding between new digital production machinery and workforce upskilling, for instance, can use weighted decision criteria to identify training as the more impactful first step, thereby preventing resource misallocation and capability stagnation. Similarly, firms operating in tourism or hospitality, where business models depend heavily on external booking and data platforms, can apply Tailored DMAM to map dependency structures and negotiate more balanced data-sharing arrangements, reducing external lock-in and strengthening internal decision-making capacity.

Sector-specific and production-oriented SMEs may require additional technical depth when evaluating Industry 4.0 readiness. DREAMY provides this function by linking maturity assessment to operational workflows such as process standardization, batch traceability, equipment connectivity, or maintenance routines. This helps prevent digital adoption from occurring in isolation from actual production conditions, reducing the risk of disruption or underutilization of new technologies.

At the policy and ecosystem level, the presence of macro-level maturity instruments such as DAI and DMAT demonstrates that digital transformation outcomes are structured not only by firm capabilities but also by infrastructure availability, innovation networks, skills ecosystems, and regulatory frameworks. Regional clusters, European Digital Innovation Hubs (EDIHs), and chambers of commerce can play a coordinating role by offering shared training programs, digital advisory services, and cooperative procurement models that reduce cost and knowledge barriers for SMEs. Policymakers should therefore prioritize strengthening regional ecosystem density, promoting interoperability standards, and supporting multi-firm collaboration mechanisms, rather than focusing solely on subsidizing technology acquisition.

Taken together, these implications emphasize that digital transformation in SMEs is most effective when guided by frameworks that combine diagnostic clarity, structured capability development, resource-aware prioritization, and alignment with broader ecosystem support structures. SMEs, advisors, and policymakers should view maturity progression as a collaborative and context-dependent process rather than a standardized linear journey.

9. Overall Contribution and Conceptual Synthesis

This study advances the understanding of digital transformation maturity in SMEs by integrating theoretical, methodological, and practical perspectives into a unified explanatory framework. Conceptually, the review clarifies how digital maturity is shaped by dynamic capability development, external resource dependencies, and the degree of process standardization and continuous improvement. Methodologically, it consolidates maturity frameworks into five functional

categories—foundational organizational alignment, general capability benchmarking, SME-adaptive progression models, domain-specific operational readiness tools, and macro-level ecosystem instruments—providing a structured basis for model selection according to organizational conditions. Practically, the analysis demonstrates how SMEs can align maturity progression with resource constraints, operational priorities, and dependency structures, emphasizing staged capability building rather than linear acceleration. At the policy level, the study highlights the importance of regional digital ecosystems, shared support infrastructures, and coordination mechanisms such as EDIH networks in shaping the feasibility and speed of transformation.

Taken together, these contributions position digital maturity not as a static organizational state, but as a dynamic trajectory unfolding at the intersection of internal capability development and external enabling conditions. The resulting synthesis offers both a clarified conceptual foundation and a practical roadmap for selecting and applying maturity frameworks in diverse SME contexts.

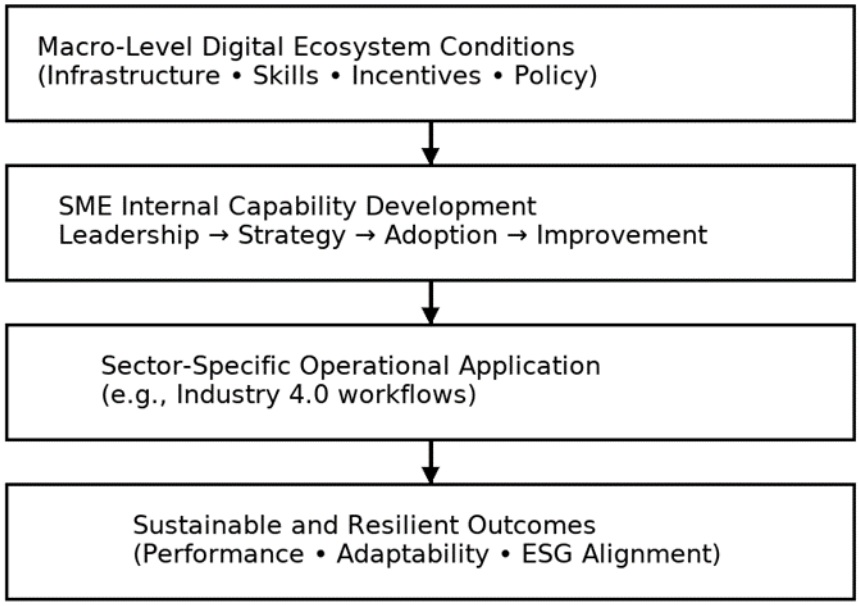

Figure 3: Integrated Digital Maturity Progression Model (Figure by authors)

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