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DYNAMIC CAPABILITY IN SMES: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

Dynamic capability has become the dominant lens explaining how small and medium-sized enterprises (SMEs) survive and perform in turbulent environments, yet the literature remains scattered across conceptual labels, contexts, and study designs. Following the PRISMA 2020 protocol, this review addresses four questions: DC's definition and operationalisation, antecedents, relationship with performance, and contextual moderators in SMEs. Scopus searches and citation tracking yielded 303 included studies, 131 of which met the inclusion criteria for thematic synthesis; quality was assessed using the MMAT 2018, with AI-assisted screening reviewed by a single author. Definitions of DC rest on the sensing-seizing-transforming framework but branch into domain-specific labels such as digital platform, green, and knowledge-based dynamic capabilities. Internal antecedents (leadership, entrepreneurial orientation, organisational learning) are more consistently supported than external antecedents (networks, alliances, government support, credit access). A meta-analysis of three studies (N = 1,413) produced a pooled DC-performance correlation of r = 0.43 (95% CI 0.29-0.56; I^2 = 83.6%), while environmental turbulence, credit access, firm size, and digitalisation emerged as significant moderators with inconsistent directions. All findings were rated as low confidence under GRADE-CERQual, mainly due to methodological limitations in the primary studies, indicating a need for an integrated framework and longitudinal testing.

Keywords: : *antecedents; dynamic capability; SME performance; contextual moderation; systematic review.*

INTRODUCTION

Small and medium-sized enterprises (SMEs) are the backbone of the economy in many countries, yet their structural position faces a dual pressure: limited internal resources on the one hand, and a rapidly changing, digitalised, and turbulent environment on the other. Resource ownership alone is no longer sufficient; what matters is the ability to integrate, rebuild, and reconfigure resources in response to opportunities and threats. The dynamic capability framework, which classically emphasises the capacities of sensing, seizing, and transforming, has been widely adopted to explain why some SMEs excel while others stagnate.

The existing literature clusters into four streams of findings. The first positions digitalisation and technology adoption, such as AI, digital platforms, and analytics, as core to the dynamic capabilities that enable SME adaptation, rather than as mere operational tools ((Aghazadeh et al., 2023) ; (Durman et al., 2025) ; (mustapha, 2026) ; (Zhao et al., 2025)). The second stream highlights green dynamic capabilities as a mechanism linking sustainability practices with environmental and economic performance ((Agyapong et al., 2024) ; (Anser et al., 2026) ; (Elizabeth et al., 2025) ; (Karimi et al., 2026) ; (Rahman et al., 2022) ; (Takyi et al., 2024) ; (Xiong & Wang, 2026) . The third stream focuses on organisational antecedents: entrepreneurial orientation, transformational and digital leadership, social capital, organisational learning, and absorptive capacity ((Ahmad et al., 2022) ; (Hernández-Linares et al., 2023) ; (Kusumawijaya & Astuti, 2025) ; (Mishra & Kiran, 2026) ; (Shahzad & Ferreira, 2026) ; (Tran et al., 2022) ; (X. Wang & Sun, 2024) ; (Zahoor et al., 2024)). The fourth stream emphasises networks, partnerships, and innovation ecosystems as sources of external knowledge and resources ((Bouhalleb, 2023) ; (Ghouse et al., 2026) ; (Mehmood et al., 2026) ; (Peng & Chang, 2023) ; (Soluk et al., 2023)). These four streams have developed relatively separately, with differing labels, measurements, and contexts.

Several substantive disagreements remain unresolved. Most studies report a positive relationship between dynamic capability and SME performance, whether direct or mediated by innovation, digitalisation, or strategic orientation ((Aghazadeh et al., 2023) ; (Alshbiel, 2026) ; (Hernández-Linares et al., 2023) ; (Kusumah et al., 2025) ; (Phong & Tam, 2024) ; (Wimpertiwi et al., 2024)), yet a number of studies find non-significant or negative relationships on certain pathways, such as digital transformation (Civelek et al., 2023) . Environmental turbulence sometimes strengthens ((Uzkurt et al., 2023) ; (Waseem et al., 2022) ; (Zheng, 2026)) and sometimes weakens this relationship ((Karimi et al., 2026); (Shatila et al., 2025)). This diversity of findings is not fully explained by differences in country context, sector, or firm size, as the operational definition of dynamic capability itself remains inconsistent ((Engelmann, 2024) ; (Jie et al., 2025)).

A systematic review remains necessary for three reasons. First, the surge in publications between 2022 and 2026 has produced numerous studies in new contexts (digitalisation, AI, sustainability, the post-pandemic period) that have not yet been mapped within a single synthesis. Second, without systematic mapping, the distinction between the generic sensing-seizing-transforming framework and domain-specific labels such as digital platform capability, green dynamic capability, and absorptive capacity risks being treated as equivalent, even though the dimensions measured differ. Third, quantitative and narrative synthesis of studies meeting the inclusion criteria can clarify the direction, magnitude, and boundary conditions of a relationship that appears rhetorically consistent yet empirically fluctuating.

This review aims to systematically map the dynamic capability literature on SMEs published between 2022 and 2026, guided by four research questions: (RQ1) how is dynamic capability defined and operationalised in the SME context; (RQ2) what antecedents influence its development; (RQ3) how does it relate to SME performance; and (RQ4) what contextual factors moderate this relationship. This review provides an evidence map that guides future research and helps practitioners and policymakers assess the conditions under which dynamic capability is most relevant to develop in SMEs.

LITERATURE REVIEW

The concept of dynamic capability (DC) was introduced as a firm's ability to integrate, build, and reconfigure internal and external competences in response to a rapidly changing environment, and was later decomposed into three microfoundations: sensing, seizing, and transforming. This canonical framework is the dominant reference in the DC-SME literature, although its operationalisation branches into domain-specific labels such as digital platform capability and digital resilience (Aghazadeh et al., 2023) , green dynamic capability (Agyapong et al., 2024) , knowledge-based dynamic capabilities (Shatila et al., 2025) , and absorptive capacity (Bouhalleb, 2023) . This shift in labelling reflects efforts to adapt DC to the resource constraints, digital context, and sustainability agenda characteristic of SMEs.

Differences also emerge at the level of analysis: some studies retain DC as an organisational attribute, while others shift it to the individual level as employees' dynamic capability (Wang et al., 2024) . Qualitative approaches offer a reading of DC as a performative practice within social interaction (Engelmann, 2024) or as a microfoundation embedded in small retailers' behaviour (Castaldo et al., 2025) . Some studies treat DC as the outcome of an equifinal configuration of dimensions, such that the presence or absence of DC is more relevant than its degree.

In terms of antecedents, the literature distinguishes internal factors, namely leadership, entrepreneurial orientation, and organisational learning (Kusumawijaya & Astuti, 2025) , from external factors such as business networks and institutional support (Ghouse et al., 2026) . The relationship between DC and performance is generally positive, whether direct or mediated by innovation and strategic orientation (Phong & Tam, 2024) , although a number of studies report non-significant relationships on certain pathways (Civelek et al., 2023) . Environmental turbulence both strengthens and weakens this relationship across different studies (Waseem et al., 2022); (Shatila et al., 2025) : the effectiveness of DC in SMEs is context-bound.

Although the volume of publications continues to grow, no systematic mapping has yet integrated these four aspects (definition, antecedents, performance impact, and contextual moderation) within a single thematic synthesis framework supported by quantitative evidence. This review fills that gap.

METHODS

This review follows the PRISMA 2020 reporting guideline (Page et al., 2021) . The protocol (research questions, eligibility criteria, search strategy, and quality assessment instrument) was established before the search was conducted; this review was not registered with PROSPERO or a similar register. The research questions for this review are: (RQ1) how is dynamic capability defined and operationalised in the SME context; (RQ2) what

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antecedents influence its development in SMEs; (RQ3) how does dynamic capability relate to SME performance; (RQ4) what contextual factors moderate this relationship. The questions were formulated using the PICOS framework: Population of SMEs; the dynamic capability construct as the main variable; Comparator of SMEs with low DC levels; Outcome of SME performance (financial, innovation, competitive advantage); Studies with quantitative, qualitative, and mixed-methods designs.

Eligibility Criteria

Table 1. Study Inclusion and Exclusion Criteria (PICOS)

Criterion	Description
IC1 — Inclusion	SME population based on standard employee count/asset/turnover thresholds
IC2 — Inclusion	Empirical study design examining DC as the main variable
IC3 — Inclusion	Published in English or Indonesian
IC4 — Inclusion	Published between 2022 and 2026
IC5 — Inclusion	Journal article
IC6 — Inclusion	Full text accessible
EC1 — Exclusion	DC discussed only as a minor part of a larger sample without separate analysis for SMEs
EC2 — Exclusion	Purely conceptual/theoretical study without empirical data
EC3 — Exclusion	Focuses on large or multinational firms
EC4 — Exclusion	Insufficient methodological information for quality assessment
EC5 — Exclusion	Editorial, opinion piece, or non-academic report
EC6 — Exclusion	DC used as a control/secondary variable without a clear measure

The search was conducted directly in Scopus (5 September 2026); the results were exported and then screened for deduplication, yielding 355 candidate records (0 duplicates). Citation tracking (snowballing; (Wohlin, 2014)) of the included studies was conducted via OpenAlex (5 October 2026), covering both backward and forward pathways. Title-abstract screening was assisted by a language model (AI) that applied the eligibility criteria and recorded an exclusion code for each decision, which was then reviewed by the author. Eligibility was assessed from the full text where available, or from the abstract where the full text could not be obtained openly. Screening, extraction, and quality assessment were conducted by a single author without an independent second reviewer.

Data Extraction and Quality Assessment

Data were extracted using a structured form (country, context, sample, design, methods and instruments, key findings, limitations) with AI assistance and checked by the author. For the meta-analysis, summary statistics (correlation coefficients and n) were extracted together with verbatim quotations that were automatically verified against the source text; only verified data were included in the quantitative analysis. Methodological quality was assessed using the Mixed Methods Appraisal Tool (MMAT) 2018 (Hong et al., 2018) by study design category, without a combined score, in line with MMAT guidance.

Data Synthesis and Meta-Analysis

Findings were synthesised narratively using a thematic synthesis approach (Thomas & Harden, 2008) . Meta-analysis was conducted for outcomes with at least two studies with verified data, using correlation coefficients transformed via Fisher's z and pooled with a restricted maximum likelihood (REML) random-effects model;

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heterogeneity was assessed using Cochran's Q test, the I^2 statistic (Higgins & Thompson, 2002), and τ^2, with 95% prediction intervals reported. The sensitivity of the results was tested using leave-one-out analysis; publication bias was assessed using a funnel plot and Egger's regression test (Egger et al., n.d.) where at least 10 studies per outcome were available (Sterne et al., 2011) . Calculations used a statistical module replicating the R metafor package (Viechtbauer, 2010) .

Assessment of Certainty of Evidence

Confidence in each thematic synthesis finding was assessed using the GRADE-CERQual approach (Lewin et al., 2018) , based on methodological limitations, coherence, data adequacy, and relevance. The certainty of evidence for the meta-analysis outcome was assessed using GRADE (Guyatt et al., 2008) : evidence from non-randomised studies started at low certainty, and was then downgraded for risk of bias, inconsistency, indirectness, imprecision, and publication bias.

RESULTS AND DISCUSSION

Study Selection and Characteristics

The search yielded 355 records from Scopus. After screening by title and abstract, 107 records were excluded (chiefly EC6, n = 39; IC2, n = 30; EC2, n = 26), leaving 248 reports for eligibility assessment; 36 of these were excluded at this stage. Citation tracking of the included studies yielded 1,256 new records (645 backward, 616 forward); 1,059 were excluded at title-abstract screening and 106 at eligibility assessment. Overall, 303 studies were included in the review (Figure 1), with 131 studies meeting all inclusion criteria extracted in depth for thematic synthesis.

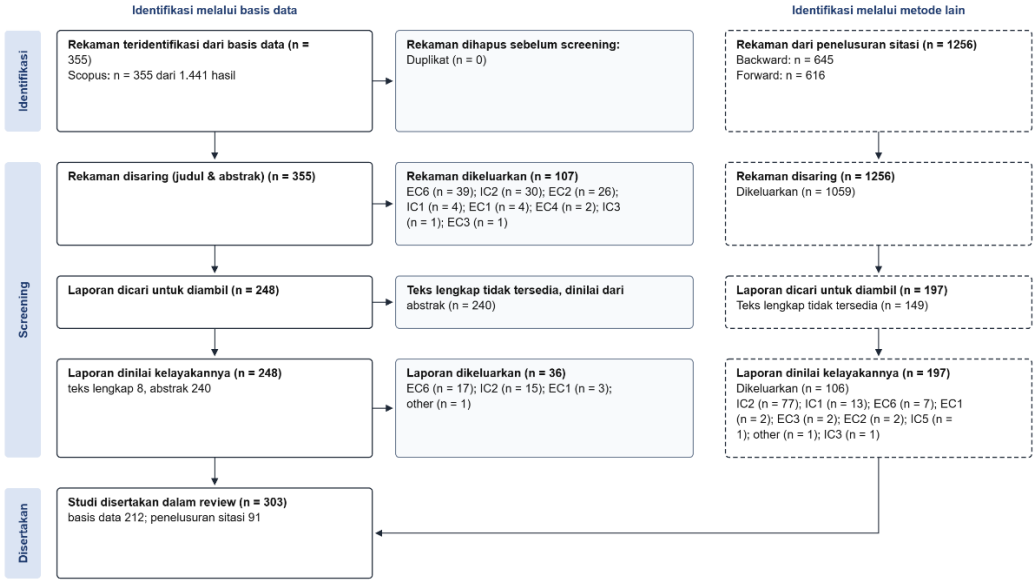


Figure 1. PRISMA 2020 flow diagram of identification, screening, and inclusion of studies.

The publication-year distribution of the 131 studies shows a sharp acceleration: 12 studies in 2022, 16 in 2023, 26 in 2024, 34 in 2025, and 43 in 2026, reflecting continually growing research interest alongside the strengthening themes of digitalisation, artificial intelligence, and sustainability on the SME transformation agenda. In terms of design, most studies rely on a non-experimental quantitative approach (90 studies), followed by qualitative (16), other/unclear category (13), cross-sectional descriptive quantitative (7), and mixed methods (5); this dominance of cross-sectional surveys limits causal claims. The geographical spread is fairly broad but concentrated in developing countries: Indonesia (11), Vietnam (10), China (8), and Pakistan and Turkey (5 each). Publication outlets cluster around a handful of journals, such as the Journal of Open Innovation: Technology, Market, and Complexity (6) and the Journal of Innovation and Knowledge (5).

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Table 2. Themes from the thematic synthesis and representative example studies per theme

Theme	Example Studies	n
Digital and AI as Dynamic Capability	(Aghazadeh et al., 2023) ; (Durman et al., 2025); (Zhao et al., 2025).	16
Green and Sustainable Dynamic Capability	(Aghazadeh et al., 2023) ; (Karimi et al., 2026)	16
Entrepreneurial Orientation and Leadership	(Kusumawijaya & Astuti, 2025) ; (Bouhalleb, 2023)	20
External Networks and Collaboration	(Ghouse et al., 2026) ; (Soluk et al., 2023)	12
Learning and Knowledge Management	(Hernandez-Maskivker et al., 2026)	15
Impact of Dynamic Capability on Performance	(Phong & Tam, 2024) ; (Alshbiel, 2026)	43
Contextual Moderation and Turbulence	(Waseem et al., 2022) ; (Shatila et al., 2025)	32

Note: n indicates the number of studies coded under that theme (a single study may be coded under more than one theme). The full list of supporting studies per theme is available in the data extraction file.

Thematic Synthesis: Addressing RQ1-RQ4

The thematic synthesis of the 131 studies addresses all four research questions (Table 2). For RQ1, definitions of DC rest on the sensing-seizing-transforming framework, but operationalisation branches into domain-specific labels (digital, green, knowledge-based); only a few studies report both explicit definitions and measurement while also achieving a high quality rating (e.g., (Ates & Acur, 2022);(Held et al., 2025)). For RQ2, internal antecedents (leadership, entrepreneurial orientation, organisational learning) are more consistently supported by evidence than external antecedents (networks, institutional support, credit access), which are more fragmented and bound to single-country contexts. For RQ3, the dominant direction of the DC-performance relationship is positive, whether direct or mediated by innovation and strategic orientation, and is confirmed by the meta-analysis below, although several studies report non-significant or negative relationships on certain pathways (e.g., (Civelek et al., 2023) . For RQ4, environmental turbulence, credit access, firm size, and digitalisation emerge as significant moderators with inconsistent directions across studies: the effectiveness of DC in SMEs is context-dependent.

Table 3. Summary of meta-analysis results by outcome

Outcome	k	N	Effect [95% CI]; I^2
SME Performance (correlation r)	3	1,413	0.43 [0.29, 0.56]; I^2 = 83.6%
Competitive Advantage	0	0	Not pooled (< 2 studies)
Innovation Performance	0	0	Not pooled (< 2 studies)

Meta-Analysis

A total of 3 studies ((Agyapong et al., 2024) ; (Fernandes et al., 2024) ; (Hernández-Linares et al., 2023) ; N = 1,413) with verified data were included in the meta-analysis of the SME Performance outcome (correlation r). The random-effects model (REML) yielded a pooled effect of r = 0.43 (95% CI 0.29-0.56; z = 5.43, p < 0.001), indicating a meaningful positive correlation.

Heterogeneity was very high (I^2 = 83.6%, τ^2 = 0.018, Q(2) = 9.33, p = 0.009); the 95% prediction interval ranged from 0.15 to 0.65. Leave-one-out sensitivity analysis produced estimates of 0.36-0.48; no single study altered the conclusion. Publication bias was not formally tested because the number of studies was fewer than 10. The competitive advantage and innovation performance outcomes could not yet be statistically pooled because the available verified data comprised fewer than two studies; these findings are discussed narratively in the Discussion section.

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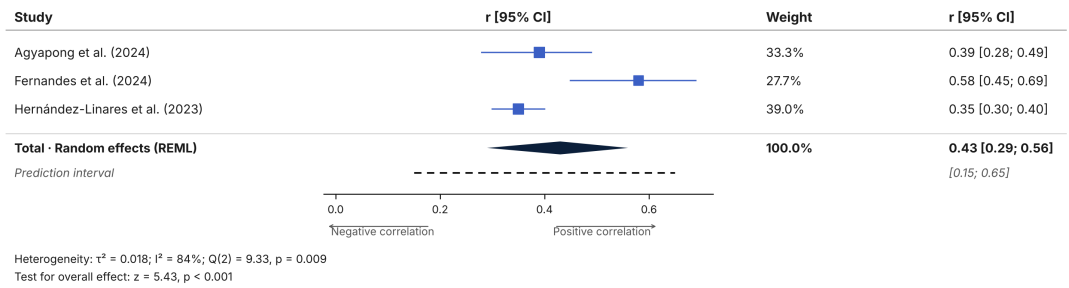


Figure 2. Forest plot of the meta-analysis of SME Performance; random-effects model (REML). Squares indicate the effect per study, horizontal lines the 95% CI, and the diamond the pooled effect

Certainty of Evidence

All synthesis themes were rated as low confidence under GRADE-CERQual, chiefly owing to methodological limitations: many supporting studies were available only as abstracts, so their methodological details could not be verified. Coherence and data adequacy generally showed only minor to no concerns. For the SME Performance meta-analysis outcome, conventional GRADE likewise yielded very low certainty of evidence, downgraded mainly for inconsistency (high I^2), although risk of bias, indirectness, imprecision, and publication bias were judged not serious.

Discussion

The dynamic capability (DC) literature on SMEs is growing rapidly but remains fragmented. Most studies operationalise DC through the sensing-seizing-transforming triad of Teece or its variants, yet contextual labels replace this generic framework without convergence in measurement instruments: digital platform capability (Durman et al., 2025), green dynamic capability (Agyapong et al., 2024), and knowledge-based dynamic capabilities (Hernández-Linares et al., 2023). This shift in labelling adapts DC to the resource constraints and context characteristic of SMEs, but makes it harder to cumulate evidence across studies.

In terms of antecedents, this review identifies two complementary clusters: an internal cluster centred on leadership, entrepreneurial orientation, and organisational learning; and an external cluster centred on business networks, alliances, and institutional support. This finding reinforces the view that DC in SMEs is not merely a matter of internal orchestration, but also a product of relational embeddedness and institutional opportunity structures. However, the evidence for the external cluster is far more fragile and contradictory across contexts: credit access strengthens the conversion of capability into green performance in one study (Bindeeba et al., 2025) , while government support is significant only in a pandemic context in another (Nguyen et al., 2024) .

The meta-analysis of three studies ($k = 3$, $N = 1{,}413$) produced a pooled effect of 0.43 (95% CI 0.29-0.56, $p < 0.001$) with a prediction interval of 0.15-0.65. This magnitude is moderate-to-strong and confirms the positive direction of the DC-performance relationship in the available sample, though with k of only three studies, this estimate should be read as indicative rather than definitive. The very high heterogeneity ($I^2 = 83.6\%$) reinforces this caveat: more than four-fifths of the variation in effects across studies stems from differences in design, context, and construct operationalisation, rather than sampling error. This finding is consistent with the broader narrative pattern: most studies report positive relationships, whether direct or mediated by innovation and strategic orientation (Wimpertiwi et al., 2024) , while a number of studies report non-significant relationships, such as in the relationship between DC and digital transformation (Civelek et al., 2023) .

Regarding moderation, environmental turbulence is the most frequently tested factor, but its direction is inconsistent: strengthening the relationship in some studies (Waseem et al., 2022) , weakening it in others (Shatila et al., 2025) . This inconsistency is likely to stem from differences in turbulence measurement instruments and sample sectors across studies, rather than simply random variation. Credit access also emerges as a significant boundary condition, doubling the impact of capability on green performance in one study (Bindeeba et al., 2025) . The effectiveness of DC in SMEs is context-bound, not merely a consequence of heterogeneity within the SME category alone.

This review confirms two classic propositions of DC theory and opens a question over a third. First, DC functions as a mechanism converting resources into performance, as predicted by Teece's framework. Second, DC is path-dependent and context-dependent, as evidenced by differing effects across countries and sectors. The premise that DC is always firm-specific and difficult to imitate warrants nuance: two studies on SMEs show that some DC is

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in fact built through external scaffolding (Ghouse et al., 2026) and ecosystem intermediaries (Hafeez et al., 2025) . This evidence is still thin (k = 2) to be said to challenge the core assumptions of DC theory, but is sufficient to open a research agenda on externally scaffolded dynamic capabilities that warrants broader testing. The future research agenda includes developing standardised DC measurement instruments, longitudinal designs for causality, an integrated framework of internal-external antecedents, specification of moderation boundary conditions, and extending performance indicators beyond innovation and environmental proxies. For practice, SME managers are advised to prioritise digital leadership, organisational learning, and strategic partnerships, while policymakers can facilitate credit access and digital infrastructure as catalysts.

Limitations

The limitations of the synthesised evidence stem mainly from the reporting quality and design of the primary studies. Most studies were assessed using the MMAT 2018 (Hong et al., 2018) , and this assessment shows that many studies were available only as abstracts, meeting few or none of the quality criteria adequately. The dominance of cross-sectional and non-randomised quantitative designs makes causal conclusions difficult, so the reported DC-performance relationship should be read as an association rather than a cause-and-effect relationship. Heterogeneity in study contexts, spread across more than twelve countries with differing definitions of SMEs, limits the comparability of findings and partly explains the $I^2 = 83.6\%$ observed in the meta-analysis. The number of studies providing a poolable association measure is very small (k = 3 for SME performance), so the pooled effect estimate should be regarded as indicative rather than definitive.

Limitations of the review process itself should also be noted: (1) the search was limited to Scopus, so relevant studies in other databases may have been missed; (2) 240 of the 248 reports were assessed from the abstract only, as the full text was not openly available; (3) screening, extraction, and quality assessment were assisted by a language model (AI) and reviewed by a single author without an independent second reviewer; (4) publication bias could not be formally tested because each outcome had fewer than 10 studies.

CONCLUSION

This review shows that dynamic capability in SMEs has developed into a multidimensional, contextual, and practically relevant construct. Its definition and operationalisation remain varied, but generally refer to the dimensions of sensing, seizing, and transforming or their variants, which are increasingly manifested as digital, green, and knowledge capabilities. DC antecedents can be grouped into internal factors (leadership, entrepreneurial orientation, learning, and absorptive capacity) and external factors (networks, partnerships, and institutional support). The available quantitative evidence supports a positive relationship between DC and SME performance, with a moderate-to-strong pooled effect (r = 0.43); its precise magnitude and causal direction remain an agenda for future longitudinal designs, as outlined in the Limitations section.

Recommendations for future research: (1) developing and validating standardised DC measurement instruments for the SME context; (2) prioritising longitudinal and experimental designs to establish causality; (3) building an integrated framework incorporating internal and external antecedents; (4) clarifying moderation boundary conditions, particularly environmental turbulence, firm size, and credit access. For practice, SME managers are advised to strengthen digital leadership, a learning culture, and strategic partnerships as levers for DC development, while policymakers can facilitate credit access, digital infrastructure, and innovation ecosystems to amplify the impact of these capabilities on performance.

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