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Digital leadership and maturity as drivers of information sharing: building resilience and performance in SMEs

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Abstract

Purpose – This paper explores how digital leadership (DL), digital maturity (DM) and information sharing (IS) influence resilience and performance in small and medium-sized enterprises (SMEs). It presents the concept of SMEs' reliance on digital transformation (DT) capabilities to explain how firms adapt and succeed in volatile markets.

Design/methodology/approach – A structured cross-sectional survey of 623 Finnish SMEs, yielding 130 valid responses. Partial least squares structural equation modelling (PLS-SEM) with mediation analysis was used to analyse relationships among DL, DM, IS, resilience and performance.

Findings – The results suggest that DL and DM are not directly related to resilience. Instead, their associations with resilience appear to be linked through IS, which functions as a central intermediary within the observed network of relationships. Furthermore, resilience demonstrates a positive association with company performance.

Research limitations/implications – The cross-sectional Finnish sample restricts causal inference and generalisability. The study suggests SMEs depend on DT and calls for longitudinal, multi-country research on moderators and adoption barriers.

Practical implications – SME leaders and policymakers should invest in DL and DM and prioritise IS capabilities and governance to enhance resilience and performance.

Originality/value – The study identifies a capability pathway where IS mediates the effects of DL and DM on resilience and performance and presents a model of DT's strategic value for SME adaptability.

Keywords SMEs, Digital capabilities, Digital leadership, Digital maturity, Digital transformation, Information-sharing, Resilience, Company performance

Paper type Research article

1. Introduction

SMEs operate in a rapidly changing digital environment, shaped by Industry 4.0 and the emerging human-centric, sustainability-oriented priorities of Industry 5.0. These developments are reshaping how SMEs create value and manage uncertainty.

Against this backdrop of technological and socio-economic change, digital transformation (DT) has emerged as a critical strategic response for SMEs. DT refers to the strategic integration of digital technologies into organisational processes, business models, and customer interfaces to enhance efficiency, improve customer experiences, and create new value propositions (Kane *et al.*, 2015; Vial, 2019). For SMEs, DT represents a key mechanism for addressing heightened market and technological uncertainty by enabling more agile decision-making, resource optimisation, and the development of scalable value-creating activities, thereby enhancing competitiveness. Technologies including Artificial Intelligence (AI), the Internet of Things (IoT), and advanced data analytics can help SMEs overcome scale

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constraints, reduce information costs, automate decision-making, and expand market reach (Awad and Martin-Rojas, 2024). In this context, agility, innovation, and resilience have become central to sustaining SME company performance.

To explain how SMEs enact DT, this study draws on Dynamic Capabilities (DCT) and Absorptive Capacity (ACAP) theories to examine three interrelated digital capabilities - digital leadership (DL), digital maturity (DM), and information sharing (IS) - that jointly enable firms to sense, seize, and transform digital opportunities by aligning vision, resources, and action (Kane *et al.*, 2015, 2017, 2019). DL provides strategic direction, governance, and a digitally oriented culture that align technological initiatives with business objectives and fosters adaptive capacity (Kane *et al.*, 2015; Khurana *et al.*, 2022). DM reflects the extent to which digital technologies, skills, and routines are embedded across organisational processes, enabling firms to absorb, integrate, and exploit new knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002). IS is conceptualised as an organisation-wide capability rather than merely a technological feature. It governs how information and knowledge are generated, exchanged, and used through timely, rich, and reciprocal information flows, supported by appropriate governance structures, thereby linking digital orientations to coordinated action and adaptive responses (Durst *et al.*, 2023; Awad and Martín-Rojas, 2024).

Despite growing interest in DT, it remains unclear how SMEs convert DL and DM into resilient outcomes (Bharadwaj *et al.*, 2013). Prior research shows that DL supports DT, and digitally mature firms tend to be more resilient (Nambisan, 2017). However, DL and DM are frequently examined in isolation, and digital technologies are often treated as 'black boxes.' Limiting understanding of how DT influences firm-level resilience. IS is often treated as a capability rather than a clearly defined construct, and its role in linking DL, DM, and resilience remains underexplored. IS is also often treated as unidimensional, overlooking its technological, organisational, and governance facets, and the managerial practices that underpin them. These gaps are especially evident in SMEs, where information overload, trust and privacy concerns, and limited resources can significantly constrain the benefits of IS (Durst *et al.*, 2023; Awad and Martín-Rojas, 2024).

Against this backdrop, this study makes two contributions. First, it defines DL, DM, and IS capabilities as an integrated digital capability system within SMEs and, drawing on DCT and ACAP, identifies IS capability as the key mechanism linking DL and DM to resilience. Second, cross-industry SME survey data indicate that DL and DM are associated with IS capability, which, in turn, can enhance resilience and indirectly improve performance. By establishing IS as an organisational capability, the study clarifies how digital DT and digital capabilities contribute to resilience and performance. Accordingly, this study addresses the following research question:

RQ1. How do the combined effects of DL, DM and IS capabilities contribute to SMEs' resilience, company performance, and successful digital transformation?

By explicitly modelling IS capability as a multidimensional mediating capability, this study responds to calls for greater clarity on how digital capabilities generate adaptive outcomes in SMEs. IS is conceptualised through the dimensions of timeliness, richness, reciprocity, and governance, offering a nuanced framework for understanding how information capabilities support coordination, learning, and adaptive capacity in resource-constrained environments (Durst *et al.*, 2023; Awad and Martín-Rojas, 2024). Positioned alongside DL and DM, IS functions as an integrative capability that enables the mobilisation and coordination of digital resources, translating leadership intent and technological readiness into adaptive organisational action. Drawing on empirical evidence from multiple industries, the research integrates DL, DM, and IS within a unified framework and highlights IS as the primary linkage among these capabilities, resilience, and subsequent performance. This approach yields a more process-based view of digital change in SMEs, clarifies the layered structure of digital capabilities and the mediating role of IS, and offers practical insights for phased, evidence-based digital capability development (Kääriäinen *et al.*, 2020).

The remainder of the paper is structured as follows. Section 2 outlines the theoretical foundations. Section 3 reviews the relevant literature and develops the hypotheses. Section 4 describes the research design and data collection procedures. Section 5 reports the empirical findings. Section 6 discusses the results and elaborates on the study's theoretical and practical contributions. Section 7 presents the limitations, proposes directions for future research, and concludes the paper.

2. Theoretical positioning

DCT and ACAP provide the overarching lens for understanding how SMEs leverage DT to enhance resilience and performance. DCT conceptualises DT as a process of sensing, seizing, and reconfiguring resources to address environmental change (Teece *et al.*, 1997; Teece, 2007). ACAP explains how firms acquire, assimilate, transform, and exploit external knowledge to create value (Cohen and Levinthal, 1990; Zahra and George, 2002). Together, these perspectives provide an overarching lens for understanding how SMEs leverage DT to enhance resilience and performance, emphasising that DT outcomes depend not only on technology or leadership intent but on organisational mechanisms for coordination and knowledge mobilisation (Schilke *et al.*, 2018; Teece, 2018). Leadership, routines, and information flows, therefore, emerge as key elements enabling effective DT in SMEs.

While DCT and ACAP are primary lenses, the knowledge-based view (KBV) offers a complementary micro-foundational perspective by conceptualising the firm as creating value by integrating dispersed, specialised knowledge into collective capability (Grant, 1996). From this perspective, IS serves as the mechanism translating sensing and seizing activities into coordinated action, especially in SMEs with limited formal structures.

Within this framework, DL serves as a sensing capability. It involves scanning for digital opportunities and threats, articulating a vision, and mobilising scarce resources. In SMEs, DL substitutes for formal governance by shaping informal routines, shared understanding, and cross-functional collaboration (Murovec and Prodan, 2009). Consistent with DCT, DL enhances strategic awareness and opportunity recognition but alone does not ensure that sensed opportunities translate into coordinated responses (Teece, 2007; Helfat and Peteraf, 2015). ACAP similarly highlights leadership-supported absorptive practices but underscores the need for downstream integration mechanisms (Helfat and Peteraf, 2003).

DM is a seizing capability reflecting a firm's readiness to implement, scale, and routinise digital solutions (Kane *et al.*, 2017). It encompasses technological assets, digital skills, and practices that support the assimilation and transformation of knowledge - key ACAP processes that turn external knowledge into innovation and value (Cohen and Levinthal, 1990; Zahra and George, 2002). In SMEs, DM is path-dependent, shaped by prior investments, experiential learning, and targeted leadership interventions to prioritise resources. However, research indicates that DM and digital infrastructure rarely yield adaptive performance without mechanisms to align knowledge across units (Vial, 2019; Warner and Wäger, 2019). Importantly, DM (embedded digital tools, routines, and skills enabling the operational use of digital technologies) is distinct from ACAP (capacity to acquire, assimilate, transform, and exploit external knowledge); it underpins absorptive processes but is not itself a knowledge-processing capability.

IS is conceptualised as the reconfiguring capability that supports coordination, collective sensemaking, and knowledge use across the organisation. In DCT, reconfiguration is a critical process determining whether sensing and seizing translate into action (Helfat and Peteraf, 2015; Schilke *et al.*, 2018). Effective IS, supported by transparent communication and digital platforms, reduces friction in knowledge flows and strengthens these reconfiguration processes (Waller and Fawcett, 2013). IS is the key organisational manifestation of ACAP, enabling the acquisition, assimilation, and dissemination of external knowledge to support its exploitation (Lane *et al.*, 2006; Flatten *et al.*, 2011). In SMEs, IS often relies on leaders and informal networks rather than formal structures (Murovec and Prodan, 2009).

Alternative mediators such as organisational culture, digital infrastructure, or DM itself have been proposed to link DT initiatives to performance (Kane *et al.*, 2015; Omol *et al.*, 2023), but while culture may foster openness and infrastructure provide access, neither ensures that dispersed knowledge is interpreted consistently or used in a coordinated way (Vial, 2019; Warner and Wäger, 2019). From a DCT and ACAP standpoint, such factors are enabling conditions rather than true mechanisms. Consequently, IS is the key mechanism linking digital capabilities to SME resilience and performance by integrating dispersed knowledge into coordinated action. In SMEs, IS becomes the proximate means through which the potential of DL and DM is realised.

DL, DM, and IS form a causally ordered system rather than interchangeable capabilities. DL directs sensing and resource allocation; DM provides routines for seizing opportunities; and IS reconfigures these into adaptive responses (Teece, 2007; Helfat and Peteraf, 2015). This hierarchy is especially salient in SMEs, where limited hierarchy and resources make deliberate knowledge mobilisation particularly critical.

Prior research links DT-related capabilities to performance (Kane *et al.*, 2017; Vial, 2019), but three gaps remain. First, few studies empirically assess whether IS mediates the effects of DL and DM on SME resilience and performance. Second, DM is often conflated with ACAP, obscuring IS's distinct reconfiguring capability. Third, contextual factors (e.g. industry dynamism, resource endowments) are rarely examined, despite their likely influence on these mechanisms in SMEs (Schilke *et al.*, 2018).

3. Literature review and hypothesis development

3.1 Digital leadership as a driver of information sharing and resilience

DL describes how organisations guide DT by leveraging technology, redesigning processes, and nurturing a learning-oriented culture (Kane *et al.*, 2015; Robertson *et al.*, 2022). Within DCT, DL's primary role is sensing: spotting digital opportunities, interpreting environmental signals, and mobilising resources (Teece, 2007). Empirical work links DL to innovation, agility, and resilience in both SMEs and large firms (Khurana *et al.*, 2022).

In SMEs, where formal governance and specialised digital roles are often absent, leaders strongly shape informal routines, cross-functional collaboration, and shared interpretations of priorities (Murovec and Prodan, 2009; Benitez *et al.*, 2022). DCT clarifies how DL enhances sensing and strategic direction, and ACAP highlights leadership's role in recognising and valuing external knowledge.

Prior work suggests that organisational culture or DM may mediate the link between DL and resilience (Kane *et al.*, 2015). Culture may encourage openness and experimentation, and DM may provide routines, but neither guarantees that dispersed knowledge is actively shared, interpreted, and applied.

IS offers a more direct explanation. From an ACAP perspective, DL shapes the extent to which knowledge is acquired, disseminated, and integrated into collective decision-making processes (Cohen and Levinthal, 1990; Zahra and George, 2002). IS enables SMEs to transform dispersed individual expertise into collective organisational capability (Grant, 1996). IS thus reconfigures leadership-driven sensing into coordinated adaptive action. SMEs with strong DL exhibit faster communication, reduced silos, richer exchanges with partners, and greater resilience during disruptions (Bharadwaj *et al.*, 2013; Robertson *et al.*, 2022; Awad and Martín-Rojas, 2024).

Accordingly:

H1a. DL positively influences SMEs' IS capabilities by enhancing communication channels and fostering a culture of transparency and collaboration.

H1b. DL positively impacts SME resilience by promoting strategic flexibility, innovation, and the effective use of digital tools to navigate disruptions and maintain competitive advantage.

3.2 Digital maturity as a foundation for information sharing and resilience

DM refers to the institutionalisation of digital technologies, skills, and routines within organisational processes (Omol *et al.*, 2023). Digitally mature SMEs tend to exhibit greater adaptability, resilience, and performance in volatile environments (Robertson *et al.*, 2022). However, technology adoption alone does not explain how digital capabilities become coordinated action.

In DCT, DM represents a seizing capability that converts opportunities into scalable routines and integrated digital practices (Teece *et al.*, 1997, 2003). ACAP complements this view by emphasising routinised acquisition, assimilation, and application of external knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002).

Alternative approaches consider digital infrastructure, innovation capability, or staged DT models (Kääriäinen *et al.*, 2020; Omol *et al.*, 2024), often treating IS as a by-product rather than a central mechanism. From a KBV standpoint, DM strengthens IS by enabling the integration and mobilisation of dispersed knowledge and linking digital routines to adaptive performance (Grant, 1996). Similarly, these studies show that digitally mature SMEs depend on systematic information flows rather than technology alone, to respond effectively to disruption (Robertson *et al.*, 2022; Awad and Martín-Rojas, 2024).

Thus, DM enhances resilience primarily through improved IS, which converts digitally embedded routines into coordinated adaptive responses. Accordingly:

H2a. DM positively influences SMEs' IS capabilities by integrating advanced digital tools and fostering a culture of effective data management and communication.

H2b. DM positively impacts SME resilience by enabling the adoption and integration of digital technologies, which enhances the organisation's ability to adapt to disruptions and maintain a competitive advantage.

3.3 Information-sharing as a mediator of resilience and company performance

IS is the systematic exchange of data, knowledge, and insights among organisational units and external partners, supported by digital platforms, governance, and norms (Durst *et al.*, 2023; Awad and Martín-Rojas, 2024). As posited in Section 2, IS acts as a reconfiguring capability by supporting the translation of sensing (DL) and seizing (DM) into coordinated action.

Within DCT, IS supports reconfiguration through collective sensemaking, rapid resource realignment, and the implementation of strategic responses (Teece, 2007, 2018). From the ACAP perspective, structured information flows enhance the firm's ability to assimilate and exploit knowledge, strengthening learning and adaptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002). KBV positions IS as a mechanism that integrates dispersed expertise into organisational capability, allowing SMEs to coordinate effectively despite limited hierarchy (Grant, 1996).

Among potential mediators, IS stands out as the most direct and observable mechanism linking DL and DM to coordinated organisational action. While ACAP, dynamic capability configurations, organisational culture, and digital infrastructure can influence adaptive performance, these mechanisms typically operate at a higher level of abstraction or serve primarily as enabling conditions. ACAP enhances a firm's ability to recognise, assimilate, and apply external knowledge, and DCT frameworks emphasise sensing, seizing, and transforming as core processes (Durman *et al.*, 2025). Although organisational culture may encourage openness (Kane *et al.*, 2015; AlNuaimi *et al.*, 2022) and DM can embed digital routines (Omol *et al.*, 2023; Vial, 2019), these elements do not, on their own, ensure consistent and timely knowledge mobilisation across functions. IS, by contrast, captures the behavioural practices through which higher-order capabilities are enacted and translated into coordinated knowledge use.

This mechanism is especially important in SMEs, where informal routines and resource constraints heighten the need for deliberate knowledge mobilisation to support adaptive

performance (Murovec and Prodan, 2009; Benitez *et al.*, 2022; Robertson *et al.*, 2022). IS is not only an outcome of DL and DM but also the channel through which the digital capabilities they generate are expressed and linked to resilience. SMEs with robust IS practices can achieve faster decision-making, improved coordination, and greater resilience even when operating at similar levels of digital adoption (Robertson *et al.*, 2022; Awad and Martín-Rojas, 2024; Bharadwaj *et al.*, 2013; Nambisan, 2017).

Accordingly:

H3. IS capabilities positively influence SME resilience by enhancing organisational efficiency, facilitating collaboration, and supporting informed decision-making.

H4. IS capabilities positively influence SME resilience and, in turn, enhance SME performance.

4. Research procedure

4.1 Sample description and data collection

This study uses survey data from SMEs located in Finland. SMEs follow the European Commission's definition by headcount: micro-enterprises (fewer than 10 employees), small enterprises (10–49 employees), and medium-sized enterprises (50–249 employees) (European Commission, 2024). Owing to the limited financial data, classification relied on workforce size.

Finland offers a relevant context for examining SME DT, given its advanced digital infrastructure, strong digital skills, and supportive policy environment (European Commission, 2022). It also exhibits notable regional variation in economic structure and innovation capacity, enabling intra-country comparisons without cross-national institutional differences (Autio *et al.*, 2018). Additionally, Finland's SME profile, regulatory environment, and digital adoption are like those of European SMEs. This similarity supports broader analytical generalisability to comparable advanced-economy contexts.

The study focuses on SMEs in South Karelia and South Savo. Both regions share the same national institutional framework but differ in urbanisation, industrial base, and innovation intensity. South Karelia has a stronger industrial and export orientation; South Savo is more rural, with a higher share of micro and service firms. These differences affect access to skills, infrastructure, and knowledge spillovers, thereby shaping DM and DT outcomes (Tödtling and Trippl, 2005).

To capture internal heterogeneity, we included SME size and primary sector (manufacturing vs services) as control variables, reflecting differences in resources, complexity, and operational dynamics (Adams *et al.*, 2016).

A nonprobability sampling strategy was used to ensure that SMEs of varying sizes and industries in the focal regions could participate. An online questionnaire was administered and managed by a professional research company. Local business associations and regional chambers of commerce provided verified SME contact lists, which a commercial data-marketing provider complemented to broaden sectoral coverage. The survey employed open self-reporting of industry to reduce misclassification and accommodate hybrid SME business models (Dillman *et al.*, 2014). Responses were subsequently grouped into standardised categories aligned with a NACE-style classification (Eurostat, 2008).

The survey was distributed to 623 SMEs and yielded 130 usable responses (21%), a rate consistent with that of online surveys targeting SME owner-managers (Pallant, 2007). As participation was voluntary, some degree of self-selection bias is possible, particularly toward firms with a greater interest in digitalisation. To mitigate this risk, the sampling frame was intentionally broad, and invitation materials did not reference digital maturity or digital transformation, reducing the likelihood of over-representing digitally advanced firms (Bethlehem, 2010). The resulting sample comprises SMEs in South Karelia and South Savo

that were reachable via the combined contact lists and were willing to participate in an online survey. Direct comparison with the full sampling frame was not possible because background descriptors were not consistently available for all contacted firms. As a partial diagnostic for non-response bias, early–late respondent comparisons (Armstrong and Overton, 1977) showed no significant differences, suggesting limited evidence of systematic non-response. Non-response may nonetheless correlate with unobserved characteristics. Most plausibly modest over-representation of firms with stronger digital engagement, managerial capacity, or interest in technology-related topics (Robertson *et al*., 2022; Awad and Martín;Rojas, 2024). Such a pattern may inflate average levels of DL, DM, and IS and constrain generalisability to SMEs with lower digital readiness. However, the structural relationships examined remain most applicable to similarly engaged SMEs operating in comparable Finnish and European contexts. Respondent characteristics are summarised in Table 1.

4.2 Statistical analysis

We analysed the data using Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS, which is suitable for complex models and SME-sized samples. The research model was estimated in two stages: the assessment of the measurement model (latent constructs and indicators) and the evaluation of the structural model (path relationships). Constructs and items (21 in total) are presented in Table 2.

Table 1. Respondent profiles

Variable	Group	% Share
Number of employees in the company	Under 10	34.6%
	11–50	41.5%
	51–250	21.5%
	Over 250	2.3%
Share of services in company turnover	<20%	48.5%
	20–40%	13.1%
	40–60%	3.1%
	60–80%	6.2%
	>80%	29.2%
Respondent role	Top management	75.4%
	Middle management	15.4%
	Expert	6.2%
	Other	3.1%

Variable	NACE category	Count
NACE industry categorisation	Manufacturing and Industry	38
	Construction	20
	Trade and Retail	13
	Energy and Utilities	6
	ICT and Software	19
	Transport and Logistics	9
	Business Services	12
	Finance and Retail Estate	7
	Hospitality	3
	Education and Public Sector	6
	Total	*130*

Source(s): Authors' own work

Table 2. Measurement reliability

	Loading	*p*-value	Mean	SD	AVE	CR
Digital leadership					*0.799*	*0.941*
Vision of the digitalisation	0.909	****	2.915	1.023		
Implementation of digitalisation	0.906	****	2.785	1.038		
Planning of IT functions is integrated with the strategic planning	0.891	****	2.869	1.126		
Top management enable digitalisation	0.868	****	3.238	1.149		
Information-sharing					*0.574*	*0.869*
Proprietary information	0.765	****	3.285	1.069		
Risk related information	0.786	****	3.185	1.142		
Real time information on demand	0.819	****	3.331	1.218		
Business related information	0.794	****	3.192	1.031		
Integrated SC information systems	0.600	****	2.585	1.220		
Digital maturity					*0.522*	*0.813*
Production/service control	0.618	****	3.546	1.247		
Sales	0.635	****	3.423	1.149		
Purchasing and supply management	0.589	****	3.162	1.162		
Maintenance and Condition monitoring	0.848	****	2.731	1.340		
Resilience					*0.650*	*0.881*
Cope with disruption changes	0.746	****	3.554	0.878		
Adapt to the disruptions	0.880	****	3.238	0.884		
Quick response to the disruptions	0.821	****	3.223	0.871		
Maintain high situational awareness	0.770	****	3.554	0.993		
Business performance					*0.689*	*0.898*
Profitability	0.897	****	3.223	0.963		
Market share	0.747	****	3.185	0.967		
Equity ratio	0.776	****	3.223	1.017		
Revenue	0.884	****	3.115	1.1		

Note(s): *n* not significant, *Statistically significant at $p < 0.1$, **Statistically significant at $p < 0.05$, ***Statistically significant at $p < 0.01$, ****Statistically significant at $p < 0.001$

Source(s): Authors' own work

Reliability and convergent validity were assessed using Composite Reliability (CR) and Average Variance Extracted (AVE). All constructs exceeded recommended thresholds (CR > 0.70; AVE >0.50), indicating satisfactory internal consistency and convergent validity.

To check for common-method bias, we conducted Harman's single-factor test in SPSS. An unrotated principal component analysis indicated that the first factor accounted for 28.97% of the variance, which is below the 50% threshold. We also applied Kock's (2015) full collinearity test; all within-group VIFs were below 3.3, suggesting no serious common-method or collinearity issues.

Non-response bias was assessed by comparing early and late respondents following Armstrong and Overton (1977) no significant differences were observed. This test provides only an indirect indication and cannot rule out bias related to unobserved firm characteristics (e.g. digital engagement), as discussed in Section 4.1. Organisational size was modelled as a control variable to reduce endogeneity concerns. The main structural model results, including standardised path coefficients, significance levels, and fit statistics, are reported in Section 5.

5. Findings

5.1 Instrument measurement

The theoretical concepts in the research model (Figure 1) were operationalised into a survey instrument covering five latent constructs: (1) DL, (2) DM, (3) IS, (4) resilience and (5) company performance. Items were measured on a five-point Likert scale and adapted from

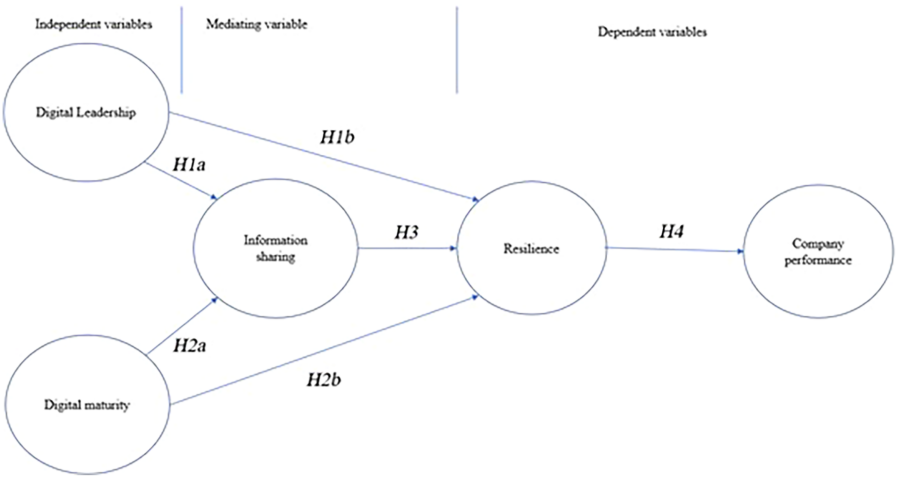

Figure 1. Conceptual model. Source: Authors' own work

prior studies. Following Brislin's (1986) guidelines, the survey was translated from English into Finnish and back-translated by native speakers to ensure accuracy. Respondents were required to answer all items, eliminating missing data.

5.2 Path model analysis

The direct effects of the path model's latent variables are described in Table 3. We estimated the structural model in SmartPLS using non-parametric bootstrapping with 5,000 resamples, which is generally considered sufficient to estimate model parameters (Kline, 2011), and report bias-corrected 95% confidence intervals. Inner-model collinearity was acceptable (all VIF ≤1.52), and global fit was adequate (SRMR = 0.079; RMStheta <0.12). The model explains a moderate share of variance in the endogenous constructs (adj. R^2: DM = 0.28; IS = 0.26; Resilience = 0.11; Company performance = 0.18).

As our primary results, Table 3 (standardised) reports standardised path coefficients (β) with bootstrap *t*, *p*, and bias-corrected CIs. Five paths are statistically significant: DL → DM (β = 0.526, *t* = 7.361, *p* < 0.001, 95% CI [0.391, 0.669]), DL → IS (β = 0.320, *t* = 3.701,

Table 3. Structural model effects to evaluate the main hypotheses of the study

Hypothesis		Path	β	*t*-statistics	*p*-va
Main effects in the research model					
H1a	Direct	Digital leadership > Information-sharing	0.320	3.881	0.000
H1b	Direct	Digital leadership > Resilience	0.163	1.633	0.103
H2a	Direct	Digital maturity > Information-sharing	0.262	2.813	0.005
H2b	Direct	Digital maturity > Resilience	−0.081	0.743	0.458
H3	Direct	Information-sharing > Resilience	0.263	2.583	0.010
H4	Direct	Resilience > Company performance	0.284	3.784	0.000
	Direct	Digital leadership > Company performance	0.145	1.136	0.256
	Direct	Digital leadership > Digital maturity	0.526	7.623	0.000
	Direct	Digital maturity > Company performance	0.155	1.127	0.260

Note(s): *Statistically significant at $p < 0.1$, ** = Statistically significant at $p < 0.05$
Source(s): Authors' own work

$p < 0.001$, [0.147, 0.487]), DM → IS (β = 0.262, $t = 2.771$, $p = 0.006$, [0.083, 0.452]), IS → Resilience (β = 0.263, $t = 2.518$, $p = 0.012$, [0.056, 0.466]), and Resilience → Company performance (β = 0.285, $t = 3.721$, $p < 0.001$, [0.137, 0.437]). Direct effects of Company size, DL, and DM on Company performance, as well as the paths DL → Resilience and DM → Resilience, are not significant (see Table 3).

The pattern of significance is invariant to scaling (e.g. IS → Resilience: B = 0.226, $t = 2.493$, $p = 0.013$, 95% CI [0.050, 0.401]; Resilience → Company performance: B = 0.325, $t = 3.592$, $p < 0.001$, [0.156, 0.513]). We present the standardised coefficients in Table 3 and the unstandardised counterparts for unit-level interpretation.

We report the statistically significant specific indirect effects, with bias-corrected bootstrapped 95% confidence intervals, in Table 4 (mediation summary). Two indirect effects reached conventional significance: DL → DM → IS (ab = 0.138, SE = 0.051, $t = 2.713$, $p = 0.007$, 95% CI [0.053, 0.253], VAF = 30%) and IS → Resilience → Company performance (ab = 0.075, SE = 0.035, $t = 2.136$, $p = 0.033$, 95% CI [0.006, 0.144], VAF ≈ 100%). For IV–DV pairs where the total effect (c) is near zero (e.g. DM → Resilience), the mediated share (VAF = ab/c) is not interpretable and is reported as N/A.

To evaluate the explanatory power and predictive performance of the structural model, we report multiple model quality indicators. Table 5 presents R^2, adjusted R^2, and Q^2_predict values for each endogenous construct. The R^2 values range from 0.11 (Resilience) to 0.28 (DM), indicating small to moderate levels of explained variance. All endogenous constructs exhibit positive Q^2_predict values, which supports out-of-sample predictive relevance. The magnitudes are moderate for DM (Q^2_predict = 0.229) and IS (Q^2_predict = 0.189), and small but still positive for Company performance (Q^2_predict = 0.049) and Resilience (Q^2_predict = 0.039). Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) values are consistent across constructs, indicating comparable levels of prediction error.

To further assess local effect sizes, we report Cohen's f^2 values for each structural path. Based on the conventional thresholds of 0.02 (small), 0.15 (medium), and 0.35 (large), the path from DL to DM shows a large effect ($f^2 = 0.382$). Several paths show small effects, including DL → IS ($f^2 = 0.100$), IS → CP ($f^2 = 0.093$), and DM → IS ($f^2 = 0.067$), while effects below 0.02 are interpreted as negligible.

We also evaluated collinearity and model fit. All latent constructs had VIF values well below the critical threshold of 5, indicating no collinearity issues. The overall model fit was assessed using the standardised root mean square residual (SRMR), which yielded a value of 0.079—below the 0.08 threshold, indicating acceptable model fit. In addition, the model's RMStheta value remained below the critical value of 0.12.

Together, the modest R^2 for distal outcomes, mostly small f^2 values, and consistently positive Q^2_predict indicate that the model captures a meaningful capability pathway with incremental practical impact and out-of-sample relevance. At the same time, resilience and performance remain partly shaped by contextual factors beyond the model.

5.3 Hypothesis testing

The results confirm that both DL and DM significantly enhance IS within SMEs (H1a – β = 0.320, $p > 0.01$; H2a – β = 0.262, $p = 0.005$). Building on existing theory and hypothesis development, the results suggest that the higher the degree of DL, the greater its positive effect on an SME's IS capability. This suggests that DLs recognise the value of IS and that SMEs that excel in DL have access to and share relevant, timely information with their internal and external network partners. Likewise, the results suggest that the greater an SME's DM, the better its infrastructure and IS processes. Thus, DM is crucial for managing an SME's internal functions, customer base, and supply chain, facilitating IS across its business networks and forming an important part of its business model (Westerman *et al.*, 2014).

Table 4. Mediation summary: significant specific indirect effects (bootstrapped 95% CIs) and share of total effect (VAF)

IV	Mediator path	DV	ab (O)	SE (approx)	*t*	*p*	CI 2.5%	CI 97.5%	Total c (O)	% Mediation (ab/total)
Digital leadership	DM→	Information sharing	0.138	0.051	2,713	0.007	0.053	0.253	0.458	30%
Information sharing	Res→	Company performance	0.075	0.035	2,136	0.033	0.006	0.144	0.075	100%

Note(s): Ab = specific indirect effect (point estimate; original sample). Confidence intervals are bias-corrected bootstrapped 95% CIs. VAF = variance accounted for (ab/total effect c). For IV–DV pairs where the total effect c is close to zero (e.g. Digital maturity → Resilience), VAF is not interpretable and is reported as N/A

Source(s): Authors' own work

Table 5. Explanatory and predictive performance of the structural model

Endogenous construct	R^2	Adjusted R^2	Q^2predict	RMSE	MAE
Company performance	0.180	0.154	0.049	0.992	0.778
Digital maturity	0.276	0.271	0.229	0.890	0.716
Information sharing	0.259	0.247	0.189	0.918	0.718
Resilience	0.110	0.088	0.039	0.998	0.830

Source(s): Authors' own work

The results of our hypothesis tests also show that IS positively and significantly affects resilience (H3: $\beta = 0.263$, $p = 0.010$), which, in turn, significantly impacts company performance (H4: $\beta = 0.284$, $p > 0.01$). These results demonstrate a significant correlation between IS and SME resilience. Such capabilities are invaluable for forging a resilient organisation, as effective communication and IS within the SME's internal and external networks are imperative. An organisation's leadership must know who possesses the requisite capabilities for specific tasks or functions and have direct access to pertinent information. This awareness is particularly crucial in the SME context, where SMEs often function as suppliers to larger organisations amidst intense competition.

Moreover, SMEs must obtain timely, reliable information from their networks. IS capabilities enable digital leaders and digitally mature SMEs to bolster their resilience (H3). The results also confirm a strong link between resilience and company performance (H4), especially during periods of disruption (Robertson *et al.*, 2022).

Interestingly, the results show that DL and DM do not have a significant direct effect on resilience (H1b: $\beta = 0.163$, $p = 0.118$; H2b: $\beta = -0.081$, $p = 0.479$). At the same time, both DL and DM are positively related to IS, and IS is positively associated with resilience. Mediation analyses indicate small, positive indirect effects of DL and DM on resilience via IS, although some of these paths are only marginally significant. This pattern suggests that IS functions as a key intermediate capability through which DL and DM translate into SME resilience, rather than exerting a strong direct effect. In other words, robust IS capabilities appear to be an important mechanism for creating and maintaining resilience in SMEs. At the same time, the direct impact of DL and DM on resilience remains limited.

6. Discussion and implications

This study examines the relationships among SME DL, DM, IS capability, resilience, and company performance, with IS specified as a mediating mechanism. The findings indicate that DL and DM are associated with resilience and performance primarily through IS rather than through direct relationships. In contrast to prior studies positing direct relationships between digital capabilities and resilience, the results suggest that these relationships are largely indirect and contingent on the effectiveness of IS processes. DL and DM are associated with greater transparency, collaboration, and more effective information flow, which are linked to SMEs' identification of disruptions, coordination of responses, and operational adjustment. IS emerges as the mechanism linking digital orientations to adaptive outcomes, extending research on strategic digital capabilities by clarifying their relationships with resilience and performance (Robertson *et al.*, 2022). The pattern of these mediated relationships is summarised in Figure 2.

IS capability plays a leading role in understanding how SMEs operate in competitive, turbulent environments. By enabling timely access to information across organisational boundaries, IS is associated with lower organisational silos, stronger coordination, and enhanced collective sense-making, which are widely linked to agility and competitive

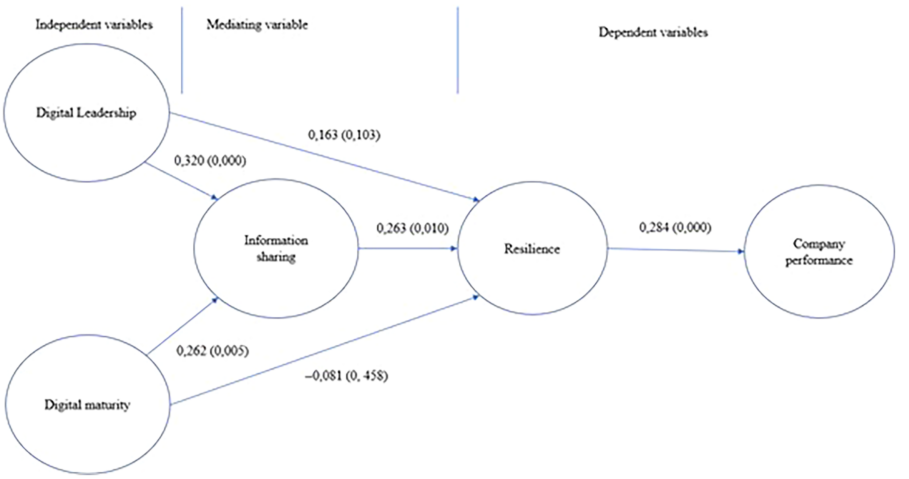

Figure 2. Conceptual model with hypotheses results. Source: Authors' own work

advantage (Myšková and Kubenka, 2019). The findings indicate that resilience is an intermediate outcome through which IS relates to company performance, particularly in disruptive contexts. SMEs with higher resilience are characterised by greater capacity to absorb shocks, reconfigure resources, and sustain performance over time (Omoush *et al*., 2023).

With IS capability included in the model, neither DL nor DM shows a significant direct association with resilience. Instead, their relationships with resilience are observed to operate through IS, suggesting that SME resilience is less directly related to DL or DM alone and more closely linked to the quality of information processes, infrastructures, and governance arrangements (Fatima and Masood, 2023). From this perspective, DL and DM are related to resilience through their association with the development of organisation wide IS capability.

The results indicate that DL is positively associated with IS capability and shows no direct association with resilience or performance. This pattern suggests that the relevance of DL for SME resilience lies primarily in the extent to which leadership practices align with the establishment and formalisation of IS arrangements, including investments in digital platforms, data-oriented decision-making, and cross-functional collaboration. These findings refine DL research by showing that leadership is indirectly linked to resilience through its alignment with IS structures associated with sense-making and coordinated action in disruptive situations.

DM is also positively associated with IS capability, but not with resilience. This indicates that DM is primarily associated with infrastructural and procedural conditions related to information collection, processing, and dissemination, rather than constituting a resilience capability. SMEs with higher DM are more likely to have developed mechanisms for sharing timely, relevant information across internal functions and external networks, including customers and supply-chain partners (Westerman *et al*., 2014). In contrast to studies emphasising direct relationships between DM and resilience or performance, these findings suggest that DM is more linked to resilience via its association with IS capability.

The results further show that IS capability is positively associated with resilience, which in turn is positively associated with company performance. This sequential pattern is consistent with the view that IS constitutes a foundational capability associated with SME resilience, connecting upstream digital orientations (DL and DM) to downstream performance outcomes. IS capability is associated with improved situational awareness, stronger response

coordination, and more effective adaptive processes, particularly for SMEs operating under resource constraints and high external interdependence.

Overall, the findings yield three key insights. First, DL and DM are not directly associated with resilience or performance; rather, their relationships with these outcomes are mediated by IS capability. Second, IS functions as a central integrative mechanism linking DL and DM to resilience and performance, extending beyond technology-centric accounts of digital transformation outcomes. Third, although the model accounts for a moderate proportion of variance in digital capabilities, it explains less variance in resilience and performance, suggesting that contextual and environmental factors interact with IS capabilities to shape SME resilience.

6.1 Theoretical contributions

This study articulates three main theoretical contributions to research on SME digital transformation, dynamic capabilities, absorptive capacity, and organisational resilience.

First, the study elaborates a capability pathway linking DL and DM to resilience and performance via IS capability. The findings show that DL and DM are associated with IS capability, which, in turn, is associated with resilience and performance. When IS capability is included in the model, DL and DM do not exhibit a direct association with resilience, indicating that IS occupies a central connecting position within the capability configuration. By foregrounding mediated capability relationships rather than direct performance associations, the study extends existing discussions in digital strategy and digitalisation research (e.g. Bharadwaj *et al*., 2013; Nambisan, 2017). This perspective offers a more nuanced understanding of how digital orientations relate to adaptive outcomes in SMEs.

Second, the study brings together DCT and ACAP to frame how SMEs engage with uncertainty. DCT concepts of sensing, seizing, and transforming align with ACAP processes of acquisition, assimilation, and application (Cohen and Levinthal, 1990), allowing these perspectives to be considered jointly. Within this framing, IS capability is positioned as the operational layer through which information-related processes are coordinated. A layered configuration of digital capabilities is thereby articulated: DL is associated with strategic direction and governance, DM reflects embedded managerial routines and mindsets, and IS capability constitutes an infrastructural and relational foundation supporting timely, rich, and reciprocal information flows. This configuration resonates with established work on digital strategy and digital maturity (e.g. Kane *et al*., 2015, 2017, 2019; AlNuaimi *et al*., 2022; Benitez *et al*., 2022) and situates these elements explicitly within the context of SME resilience.

Third, the study adopts a resource-sensitive perspective on capability development and further specifies the nature of IS capability. The findings are consistent with a sequencing in which foundational routines associated with DL and IS, such as communication protocols, knowledge-sharing practices, and shared digital infrastructure, are evident earlier than more advanced DM-related processes. This pattern aligns with SME maturity frameworks (Kääriäinen *et al*., 2020; Omol *et al*., 2024) and reflects commonly discussed constraints related to expertise, financial resources, and structured digitalisation pathways (Durst *et al*., 2023). It is also consistent with DCT perspectives emphasising progressive capability accumulation alongside strengthened absorptive and adaptive capacities (Flatten *et al*., 2011). In addition, IS capability is conceptualised as a multidimensional construct encompassing timeliness, richness, reciprocity, and shared infrastructure, highlighting its relevance for addressing information gaps and situational awareness. Positioning IS in this way draws attention to potential boundary conditions, such as technology orientation, environmental turbulence, and data infrastructure, which may shape these relationships (European Commission, 2023).

Taken together, these contributions position IS capability as a central integrative element within SME digital transformation, situate DL and DM within a layered capability

configuration, and connect DCT and ACAP within a coherent analytical framework. The study also offers a cumulative and testable basis for future research, including the use of SME-focused digital maturity assessments (Omol *et al*., 2024), multidimensional IS capability measures capturing timeliness, richness, and reciprocity (Durst *et al*., 2023), and validated ACAP instruments (Flatten *et al*., 2011).

6.2 Practical implications

The findings offer implications for SME managers and policymakers concerned with enterprise information management. Rather than treating DL and DM as independent objectives, the results indicate that these orientations are most salient when considered in relation to the design and sequencing of IS practices. From a managerial perspective, the findings can be interpreted as a structured approach to developing digital capabilities under resource constraints, with implications across short-, medium-, and long-term horizons.

6.2.1 Short-term action (low cost/low effort): establish essential information-sharing routines. In the short term, SMEs may focus on establishing basic IS routines to improve visibility and coordination through low-cost actions, such as clarifying decision rights, instituting regular cross-functional information exchanges, and adopting basic IS tools (e.g. shared repositories, collaboration platforms, simple workflow systems, and standard dashboards). These practices are associated with more consistent access to information without extensive system integration. This stage requires minimal financial investment, primarily staff time and free or low-cost digital tools, and can be implemented within weeks. It is associated with enhanced coordination and decision-making capabilities.

6.2.2 Medium-term action (moderate cost/moderate effort): formalise and integrate IS processes. As DM develops, SMEs may emphasise the formalisation of IS processes, standardisation of data definitions, and integration of information across organisational functions. This stage is typically associated with modular enterprise systems (e.g. ERP or CRM modules) and unified dashboards that support consistency, comparability, and organisational learning. The step requires a moderate investment in software modules and staff training and is typically achievable within several months. As a medium-term priority, it supports stronger system integration, greater process consistency, and broader adoption of best practices across teams.

6.2.3 Long-term action (higher cost/higher effort): build advanced, secure, real-time information capabilities. At more advanced stages, IS capabilities are commonly characterised by real-time monitoring, analytics, and structured information exchange with external partners. These practices are typically associated with formal data governance arrangements, cybersecurity measures, and sustained leadership engagement, and are consistent with more data-intensive approaches to organisational adaptability. Consequently, this phase requires higher investment in analytics tools, cybersecurity, and external interoperability. It establishes a long-term capability with substantial yet scalable costs. It strengthens advanced, data-driven, and secure information capabilities. Enhancing resilience and enabling strategic adaptation.

Together, these three steps offer a prioritised roadmap: begin with lightweight routines, transition to structured integration, and build real-time, secure information ecosystems. Enabling SMEs to progress from foundational routines and simple tools to integrated processes and dashboards, and to analytics-driven and externally connected information sharing. Guided at each stage by leadership, maturity, and resource availability.

For policymakers, the findings underscore the relevance of supporting SME IS capability development in ways aligned with IS maturity stages. Early interventions may prioritise access to affordable digital infrastructure and targeted training, while more advanced initiatives may focus on shared digital platforms, sector-level information hubs, and peer-learning programmes. Overall, the study identifies IS capability as a key mechanism linking DL and DM to SME outcomes, suggesting that incremental development of IS routines and systems is

more associated with improved information quality, decision-making, and organisational adaptability than large-scale or premature digital investments.

7. Conclusion and future research

This study examined the relationships among DL, DM, IS capability, SME resilience, and company performance. The findings indicate that DL and DM are positively associated with IS capability, highlighting the relevance of strategic digital orientations for organisational functioning. Although DL and DM do not exhibit direct associations with resilience, their relationships with resilience and performance are mediated by IS capability, positioning IS as a key intermediary associated with organisational adaptability and performance.

Despite these contributions, several limitations should be acknowledged. First, data were collected from SMEs in Finland via a non-probability sampling approach and an online survey, yielding a response rate of approximately 21%. As a result, the sample may over-represent SMEs with a stronger interest in digitalisation-related practices. The findings should therefore be generalised primarily to Finnish SMEs and comparable digitally advanced contexts rather than to SMEs more broadly. Although early–late comparisons did not indicate systematic non-response bias, this possibility cannot be ruled out. Future research could examine the model in multiple countries. Enabling cross-national comparisons and showing how national digital infrastructure and policy may shape observed associations. Probability-based or stratified sampling could also broaden generalisability.

Second, the cross-sectional design limits understanding of temporal dynamics. Longitudinal designs could follow SMEs over time. This may reveal how DL, DM, and IS capabilities develop and relate to resilience and performance. Panel or repeated-measures data may help identify patterns of change rather than merely suggest causality. Mixed-methods or qualitative approaches could clarify how leaders prioritise digital investments under constraints. The modest sample size ($N = 130$) and R^2 values suggest other factors may matter. Organisational culture, learning orientation, sectoral conditions, or resource endowments might warrant attention in future studies.

Third, industry- and size-related heterogeneity was not examined. Future research could explore whether relationships differ across micro, small, and medium-sized firms or across industry sectors, for example, through multi-group comparisons. Finally, the study did not explicitly examine barriers to digital adoption and implementation. Future research could explore organisational, financial, and cultural constraints that may impede the development of DL, DM, and IS capabilities, as well as strategies to address these constraints. Longitudinal case studies may also help clarify how SMEs sequence or adjust digital investments over time. Addressing these issues would support a more comprehensive and context-sensitive understanding of how SMEs engage with digital transformation in relation to resilience and sustainable performance.

Data availability statement

Survey instrument items and additional robustness checks are available from the corresponding author upon reasonable request. The underlying data is not publicly available due to confidentiality and data protection requirements.

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