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Foundations of business transformation during VUCA times: The role of organizational learning

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ABSTRACT

This study examines how organisational learning fosters dynamic capabilities (DCs) enabling business transformation under volatility, uncertainty, complexity, and ambiguity (VUCA). Drawing on qualitative evidence from 18 UK-based organisations, we explore how organisational context, leadership, structure, systems, and culture, shapes firms' capacity to recognise, absorb, and apply new knowledge for strategic adaptation. Using the Market Intelligence Accumulation and Transformation Model (MIATM) as an integrative framework, we identify three phases: recognition, sense-making and cognitive shifts, and deployment and reconfiguration. MIATM extends sense-seize-transform schemas by foregrounding how contextual levers shape learning routines that convert market intelligence into capability change. Feedback loops, cognitive shifts, and transactive memory systems serve as micro-foundations for dynamic capability development. Our findings distinguish dynamic forerunners from non-dynamic laggards, with implications for leadership, organisational design, and empowerment. The study advances organisational learning theory by detailing how VUCA-focused transformation unfolds through context-sensitive learning mechanisms and by providing a diagnostic framework for transformation readiness.

1. Introduction

Organisations increasingly operate in environments characterised by volatility, uncertainty, complexity, and ambiguity (VUCA), which demand not only incremental adjustment but also deep organisational learning and transformation. The COVID-19 pandemic, geopolitical shocks, climate risks, and AI-driven disruption have amplified the urgency for firms to evolve their products and services and their internal processes and decision-making routines (Schoemaker, Heaton, & Teece, 2018; Bevilacqua et al., 2025; Oludapo et al., 2024). In VUCA conditions, transformation differs from incremental change because signals are noisy, feedback cycles are compressed, and multiple disruptions interact, making continuous learning and reconfiguration central to survival (Furr & Eisenhardt, 2021; Hanelt et al., 2021; Hou & Ma, 2024; Li et al., 2025). While many firms fail to adapt in the face of VUCA, others develop the dynamic capabilities (DCs) necessary to survive and thrive. However, little is known about the key mechanisms through which such capabilities emerge, especially in highly uncertain environments.

A substantial body of research has advanced our understanding of DCs and organisational learning under conditions of environmental change. Seminal contributions by Teece, Pisano, and Shuen (1997), Eisenhardt and Martin (2000), and Zollo and Winter (2002) established that firms develop DCs, higher-order routines that reconfigure operating capabilities, in response to market dynamism. Subsequent work has elaborated the microfoundations of DCs (Felin & Powell, 2016; Teece,

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2007; Pitelis et al., 2024), the role of absorptive capacity (Zahra & George, 2002), and the importance of double-loop learning in enabling strategic renewal (Argyris, 2004; Argote et al., 2021). Most recently, reviews of digital transformation (Oludapo et al., 2024; Hanelt et al., 2021) and AI-enabled leadership (Bevilacqua et al., 2025) have underscored that learning architectures are central to whether technology investments translate into sustained competitive advantage, and systematic reviews of business model innovation have framed capability-building as a recursive, dynamic process grounded in DCs rather than a one-off outcome (Cruz-Sánchez et al., 2026).

However, three gaps limit the practical and theoretical applicability of this body of knowledge. First, the learning mechanisms that translate VUCA signals (volatile, uncertain, complex, and ambiguous environmental conditions) into specific capability changes remain underspecified; sense-seize-transform (SST) schemas (Teece, 2007, 2023) treat the learning process connecting external signals to capability reconfiguration as a largely unexamined black box. Second, prior empirical work has focused predominantly on contexts of moderate or generic environmental uncertainty, leaving open the question of how the distinctive properties of VUCA environments, compressed feedback horizons, interacting disruptions, and signal ambiguity, shape learning architectures differently from uncertainty in its more tractable forms (Furr & Eisenhardt, 2021; Li et al., 2025). Third, no prior study has offered diagnostic criteria for differentiating organisations that successfully develop DCs under VUCA conditions from those that do not, limiting actionability for both practitioners and researchers alike. This study addresses all three gaps by empirically tracing the pathway from VUCA-conditioned organisational context to learning mechanisms to capability outcomes across 18 UK-based organisations spanning knowledge-intensive, entrepreneurial, and traditional industry sectors.

Addressing these gaps requires foregrounding how organisational context, leadership style, structure, systems, and culture, enables or constrains the learning mechanisms through which VUCA-driven transformation unfolds (Atanassova & Bednar, 2022; Atanassova et al., 2025; Forliano et al., 2022; Zhang et al., 2023; Teece, 2023; Li et al., 2025). This contextual architecture has received insufficient attention in both DC and VUCA research streams (Bevilacqua et al., 2025; Dabić et al., 2021; Kane, 2019; Karimi & Walter, 2015; Schoemaker et al., 2018; Hanelt et al., 2021; Kratochvil, 2025). To address this gap, we build on the MIATM model 3.0 (Atanassova & Bednar, 2022), a learning-centred framework that conceptualises transformation as a multi-phase, recursive process through which market intelligence is recognised, interpreted, and translated into reconfigured capabilities (see Fig. 1).

We structure the study around the three phases of the MIATM 3.0 model, which we elaborate in Section 3. By focusing on how organisational context shapes learning routines within and across these phases, MIATM allows us to diagnose where VUCA-driven transformation stalls and how it can be reactivated.

The paper aims to answer the following research questions. First, how does organisational context shape the development of learning capabilities and cognitive shifts necessary for transformation in VUCA environments? Second, how are learning outcomes, particularly feedback loops and DCs, facilitated or hindered by organisational design and culture? Together, these questions trace a pathway from contextual features (leadership, structure, systems, culture, and resource configuration) to learning mechanisms (feedback loops, TMS, cognitive shifts) and, ultimately, to capability change.

Answering these questions requires a qualitative, multi-sector design capable of tracing the causal pathway from contextual features through learning mechanisms to capability outcomes within and across organisations that vary in VUCA exposure and learning maturity. A single-sector or quantitative design would obscure the contextual contingencies that are central to both research questions, cross-sector variation is not a limitation of the study but a key strength, enabling us to identify which mechanisms operate across industry boundaries and which are context-specific. The MIATM framework, deployed abductively as an analytical sensitising device, provides the conceptual structure for data collection and analysis without foreclosing the discovery of mechanisms beyond its original specification, a point we elaborate in Sections 3 and 4.

2. Literature review

2.1. Organisational learning and adaptability in VUCA environments

In today's VUCA environment, organisational adaptability, supported by real-time learning, is critical for maintaining competitiveness (Li et al., 2025; Lin, 2025). Learning processes, particularly those aligned with DCs, enable firms to perform effectively in volatile markets and respond to external shocks. Effective learning supports the development of new competencies that foster resilience and success (Atanassova et al., 2025; Sun & Anderson, 2010; Teece et al., 1997). Unpredictable goals, continuous stakeholder interaction, and everyday operational learning drive responsiveness and strategic agility (Argote et al., 2021; Lin, 2025; Malik et al., 2025; Teece, 2023). Organisations need to embed continuous learning and strategic agility into everyday

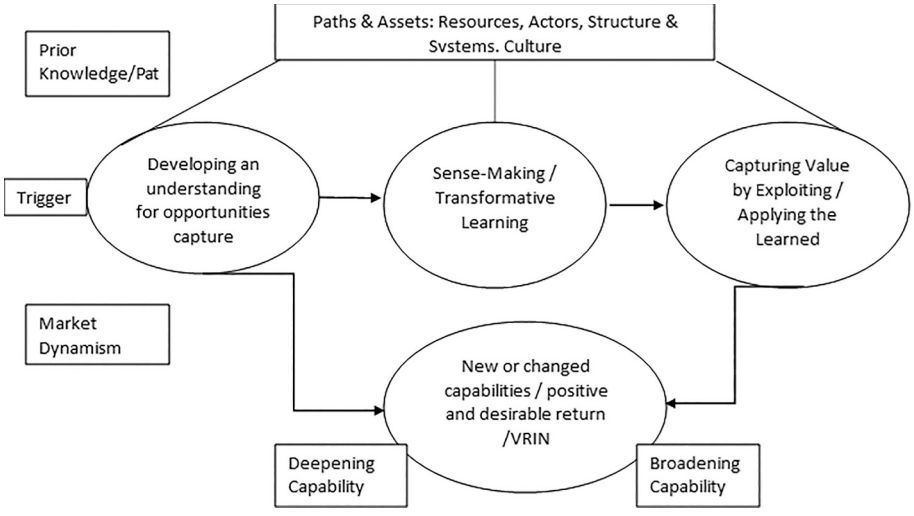

Fig. 1. Market Intelligence Accumulation and Transformation Model (MIATM 3.0). Reprinted from Atanassova & Bednar (2022), with permission. Recognition – Sense-making – Deployment and Reconfiguration as a recursive cycle with bidirectional feedback loops between phases, underpinned by context enablers (leadership, structure, systems, culture) that shape absorptive capacity, cognitive shifts, and the reconfiguration of operating into dynamic capabilities. MIATM Model 3.0.

routines (Caligiuri et al., 2020; Khan & Khan, 2021). Cognitive shifts form the micro-foundations of learning, representing changes in employees' mental models in response to external signals (Argyris, 2004; Alvesson & Spicer, 2012; March 1991). VUCA transformation is thus an ongoing, learning-intensive process rather than a one-off change initiative.

Unlike more conventional transformation, VUCA transformation involves rapidly changing conditions, ambiguous cues that require iterative interpretation, and short feedback horizons that favour experimentation. This makes decentralised responsiveness and well-designed feedback loops a core part of strategy. Recent reviews of digital transformation failures and AI-enabled leadership similarly highlight that, without robust learning architectures, technology investments rarely lead to sustained transformation (Lamarre et al., 2023; Oludapo et al., 2024; Bevilacqua et al., 2025; Li et al., 2025).

A key enabler of cognitive shifts is the feedback loop, which brings market intelligence into adaptive decision-making (Argyris, 1994; Balarezo et al., 2023). Well-structured feedback and decision autonomy support experimentation, facilitating organisational learning and error correction (Argyris, 2004; Balarezo et al., 2023). Adaptive performance in VUCA contexts involves rapid technology learning, shedding obsolete routines, and managing uncertainty/crises (Bednar & Welch, 2020; Gifford et al., 2022; Teece, 2023). In our framework, feedback loops are the primary channels through which VUCA signals are translated into revised operating routines.

Transformation spans strategy (Bharadwaj et al., 2013), structure (Felin & Powell, 2016), work practices (Kane, 2019), resource allocation, culture (Atanassova & Bednar, 2022), and product-service innovation (Chanias et al., 2019). Rather than treating these factors in isolation, we adopt a holistic, contextualised view in which alignment among leadership, culture, structure, resources, and feedback mechanisms is crucial for DCs development in VUCA settings. Whereas Teece, 2023 articulate the strategic value of DCs, MIATM 3.0 emphasises underlying micro-foundational learning routines and contextual factors, enabling a diagnostic view of how operating capabilities are reconfigured under VUCA pressures. Consistent with Alter (2013), De la Boutetière et al. (2018), and Mumford (2006), we argue that transformation efforts often fail when the human learning dimension is overlooked. This also aligns with EU "Industry 5.0" priorities emphasising human-centered, adaptive transformation that integrates technology with human intelligence (Breque et al., 2021) and with recent work on human-centered digital transformation (Hou & Ma, 2024; Kratochvil, 2025). Building on recent synthesis work that conceptualises business model innovation as a recursive, capability-driven process grounded in DCs and their microfoundations (Cruz-Sánchez et al., 2026), we focus on how organisational learning architectures and contextual conditions drive transformation in VUCA environments.

2.2. Organisational Culture, People, and leadership

In VUCA environments, organisations must solve ambiguous problems, remain agile, and continuously adapt, emphasising continuous learning, open-mindedness, and iterative change (Atanassova & Bednar, 2022; Kane, 2019). The organisational context (culture, structure and systems, people, and resources) plays an instrumental role in shaping how firms interpret and respond to external stimuli (Atanassova & Clark, 2015; De la Boutetière et al., 2018; Alter, 2013; Teece, 2023). Among these factors, leadership is particularly pivotal in shaping learning processes and enabling DCs (Argyris, 1994; Kane, 2019; Kratochvil, 2025; Teece, 2023). Leaders, acting as "architects of context" (Dabić et al., 2021; Schoemaker et al., 2018) or "cultivators" (Bednar & Welch, 2020), foster the psychological and structural conditions that allow learning to emerge from daily practice. They provide clear strategic direction, communicate mission/vision compellingly, and empower employees with autonomy in day-to-day roles (Atanassova & Bednar, 2022; Mukaidaira & Sato, 2025). This autonomy is not passive delegation but a deliberate enabler of cognitive experimentation and problem-solving, which forms micro-foundations of DCs (Alter, 2013; Bednar & Welch, 2020; Felin & Powell, 2016; Li et al., 2025). Without clearly articulated goals, organisational efforts lose direction, impairing transformation potential (Cepeda & Vera, 2007; Helfat & Peteraf, 2009). In VUCA conditions, effective leaders orchestrate these contextual levers to convert local learning into organisation-level transformation.

As organisational learning theory suggests, learning becomes strategic when feedback loops and reflective dialogue translate individual insights into organisational routines (Argyris, 1994; Mumford, 2006; Balarezo et al., 2023). By fostering psychological safety and encouraging calculated risk-taking, leaders create space to question norms and experiment (Argyris, 2004; Edmondson, 1999; Kane, 2019; Pulakos et al., 2002). This culture supports ambidexterity (simultaneous exploitation of current operations and exploration of new opportunities) (O'Reilly & Tushman, 2013), which is a critical capability for sustainable business practices during VUCA. Such cultures make MIATM Phase 2 (sense-making) and the associated cognitive shifts more likely to produce reconfigurations of operating routines.

Adaptability also requires unlearning obsolete routines (Nonaka, 1994; Argyris, 2004). Leaders actively break defensive routines and support double-loop learning, where underlying assumptions, and not just actions, are examined and updated (March 1991; Argyris, 2004). Employees, in turn, develop reflexivity skills, flexibility, and resilience, supported by coaching and by leaders who remove structural and cultural impediments such as autocratic leadership, siloed communication, and cultures of blame, thereby establishing a learning-enabling context (Bednar & Welch, 2020; Pulakos et al., 2002; Alvesson & Spicer, 2012; Teece, 2023).

2.3. Structure, Systems, and resources

In VUCA contexts, structure determines how quickly learning travels. Decentralised decision-making, flattened hierarchies, and cross-functional teams accelerate recognition, discussion, and action on new signals (Atanassova & Bednar, 2023; Kane, 2019). Robust communication channels and collaboration platforms disseminate and store knowledge across boundaries (Senge, 1990; Oludapo et al., 2024).

Systems operationalise learning. Organisations need well-designed feedback loops for monitoring and course correction; TMS to encode who knows what; and routines that convert tacit insights into explicit practices (Argote & Ren, 2012; Nonaka, 1994). These mechanisms sustain both single-loop learning (error correction within routines) and double-loop learning (questioning goals/assumptions), enabling timely cognitive shifts and strategic renewal (Argyris, 1994; March 1991; Auqui-Caceres & Furlan, 2023). Within MIATM, these systems connect recognition (Phase 1), sense-making (Phase 2), and deployment and reconfiguration (Phase 3). We return to the role of feedback loops and TMS in Sections 3 and 5 when discussing the MIATM architecture and empirical findings.

Resources, time, skills, incentives, data/analytics, and slack fuel absorptive capacity (recognise-assimilate-apply), a prerequisite for sustained advantage in VUCA settings (Zahra & George, 2002; Teece, 2023). When culture, structure, systems, and resources align, firms accumulate and recombine valuable, rare, inimitable, non-substitutable (VRIN) assets and evolve capabilities through deepening (upgrading existing routines) and broadening (creating new ones) (Pisano, 2017; Atanassova & Bednar, 2022). Agile, team-based designs further support fast decision cycles and cross-department collaboration, enhancing responsiveness (Aghina et al., 2021; Bednar & Welch, 2020; Atanassova & Bednar, 2023).

This study is situated at the intersection of three literature streams. The first is organisational learning theory (Argyris, 1994; Argote et al., 2021; Nonaka, 1994), from which we draw our understanding of the learning mechanisms, feedback loops, cognitive shifts, and TMS, that convert environmental signals into revised operating routines. The

second is DCs theory (Teece et al., 1997; Eisenhardt & Martin, 2000; Helfat & Peteraf, 2009; Teece, 2025), which provides the outcome construct, the intentional reconfiguration of operating routines in response to environmental change. Organisational learning theory provides the how; DCs theory provides the what. The third is VUCA-contextualised strategic management (Furr & Eisenhardt, 2021; Atanassova et al., 2025; Li et al., 2025), which supplies the environmental conditions under which the relationship between learning mechanisms and capability change is most consequential and most difficult to achieve. While each stream has developed largely independently, their integration, which is precisely what the MIATM-VUCA learning architecture enables, addresses the shared limitation that none of the three streams has fully specified how VUCA-specific environmental properties shape the micro-mechanisms through which learning produces capability change. It is this integration that constitutes the theoretical warrant for the study's design and its principal contribution.

3. Theoretical framework

This research consists of three phases aligned with the MIATM model 3.0 (Atanassova & Bednar, 2022), which we extend into an "MIATM-VUCA learning architecture" tailored to volatile, uncertain, complex, and ambiguous environments.

Before elaborating the three MIATM phases, we clarify the theoretical architecture of this study to avoid any impression of theoretical over-reach. DCs theory functions as the primary explanatory framework: it identifies what the study is explaining, namely, how organisations intentionally reconfigure operating routines in response to environmental change (Eisenhardt & Martin, 2000; Teece et al., 1997). Organisational learning theory, specifically feedback loops, cognitive shifts, and transactive memory systems, functions as the mechanism-level lens: it explains how capability reconfiguration occurs at the micro-foundational level (Argyris, 2004; Argote & Ren, 2012; Nonaka, 1994). Two further concepts appear in the study in a supporting rather than co-equal role. Absorptive capacity (Zahra & George, 2002) is treated as a precondition for learning, a capability that enables the recognition, assimilation, and application of external knowledge, rather than as an independent theoretical framework. Organisational ambidexterity (O'Reilly & Tushman, 2013; March 1991) is treated as an empirical manifestation of well-functioning dynamic capability development, observable particularly in forerunner firms, rather than as a parallel theoretical lens. VRIN (Barney, 1991) is used solely as a resource-evaluation criterion for assessing the strategic value of capability outcomes, not as a theoretical driver. This hierarchy ensures conceptual clarity, one primary framework explains the outcome, one mechanism-level framework explains the process, and supplementary concepts serve bounded analytical roles, each entering the analysis at the point where it performs an irreplaceable explanatory function.

The first phase focuses on external market intelligence, contextual triggers such as market dynamism, and internal capabilities, specifically prior knowledge bases, absorptive capacity (Zahra & George, 2002), TMS, and sensing routines that initiate the SST sequence, alongside resources, actors, structure, systems, and culture. The second phase investigates processes of absorptive capacity and individual learning at the operating capability level. It explores the organisation's capacity to proactively recognise, absorb, and integrate new external information and the internal factors enabling or impeding these learning processes. These internal factors encompass resources, organisational structures, systems, culture, and managerial support, which collectively form pathways that either facilitate or constrain learning activation. The third phase examines the deliberate deployment and reconfiguration of operating capabilities in light of new knowledge, tracing how feedback loops, resource re-bundling, and routine modification alter the organisation's capability base over time (Atanassova & Bednar, 2022; Eisenhardt & Martin, 2000; Sheng, 2017).

MIATM details the stages through which market intelligence is absorbed, sense-checked, and transformed into actionable routines and strategic change. In this study, we use MIATM 3.0 abductively, as a sensitising device rather than a closed template. It guided the interview protocol and early coding, while allowing additional mechanisms (such as defensive routines, organisational silence (Morrison & Milliken, 2000), ambidexterity tensions) to emerge inductively and be incorporated into an extended framework. MIATM foregrounds the organisational context (leadership, structure, systems, culture) and learning routines (cognitive shifts, feedback loops, TMS) as enablers of capability reconfiguration, thereby linking individual-level learning to the evolution of operating capabilities through dynamic capability for reconfiguration. We use the MIATM-VUCA learning architecture to distinguish empirically between "dynamic forerunners" and "non-dynamic laggards", a distinction elaborated in Section 5.

Our evidence suggests that MIATM is most useful in settings where local actors have some decision discretion and access to customer and process information, and where leaders support experimentation and reflection. In tightly regulated, highly standardised settings dominated by compliance regimes or algorithmic control, MIATM primarily reveals barriers to learning rather than fully articulated DCs; these boundary conditions are discussed further in Section 6.4.

In Phase 3, we focus on purposeful deployment and reconfiguration of capabilities rather than exploitation in March's (1991) sense of using existing routines more efficiently. Here, deployment and reconfiguration refer to how organisations intentionally alter operating routines, rebundle resources, and create new VRIN combinations in response to VUCA cues (Eisenhardt & Martin, 2000; Newey & Zahra, 2009; Ambrosini & Bowman, 2009; Pisano, 2017). Our qualitative data capture these reconfiguration routines and participants' perceived consequences. We do not claim to measure performance outcomes directly; instead, we theorise how learning mechanisms plausibly underpin capability deepening and broadening.

Whereas SST provides a high-level sequence of sensing, seizing, and transforming, MIATM adds three elements that SST does not specify: explicit contextual levers, leadership, structure, systems, and culture, that enable or constrain learning; a focus on micro-level learning routines such as feedback loops, cognitive shifts, and transactive memory systems; and a diagnostic distinction between dynamic forerunners and non-dynamic laggards. This extension makes MIATM better suited for identifying where transformation stalls and which mechanisms are responsible for blockages. For example, in one non-dynamic laggard retail organisation, senior managers had "sensed" competitive pressures and "seized" them by investing in an online sales platform, yet storelevel staff described their role as "to implement, not question" and reported that feedback "went nowhere". From an SST perspective this appears as a stalled transformation; read through MIATM, the bottleneck sits in Phase 2, where centralised decision rights, weak informal feedback loops, and defensive routines suppress cognitive shifts (see Section 5.5.2).

In the next section, we explain how the MIATM architecture informed our data collection and analysis.

4. Methodology

4.1. Data collection

We conducted semi-structured interviews with employees from 18 UK-based organisations operating in both B2B and B2C sectors. Qualitative interviews were chosen to provide context-specific insights into organisational learning processes in VUCA environments. Interviews lasted between 40 and 60 min and were conducted by experienced academic researchers, informed by the MIATM model 3.0.

4.1.1. VUCA Characterisation of cases

To embed VUCA as an analytical variable rather than a contextual backdrop, each case was assessed against all four VUCA dimensions

using convergent evidence from interview transcripts and researcher field notes. Volatility was assessed by probing whether participants described rapid, unpredictable changes in market conditions, technology, or competitive dynamics within their operating environment. Uncertainty was assessed by examining whether organisations lacked sufficient information to predict outcomes or to interpret external signals with confidence. Complexity was assessed by identifying whether participants described multiple interacting causal factors that resisted straightforward linear analysis. Ambiguity was assessed by probing whether organisations struggled to interpret events because the meaning of signals was contested, under-defined, or subject to multiple plausible readings.

Each case was rated on each VUCA dimension as HIGH, MEDIUM, or LOW based on the preponderance of evidence in the transcript, and these characterisations informed both the forerunner/laggard classification and the identification of which VUCA pressures activated or suppressed specific learning mechanisms. Table 2 (VUCA Characterisation Matrix) summarises these assessments and shows how varying VUCA profiles correspond to differential learning responses across cases. Cases characterised by high scores on two or more VUCA dimensions and classified as dynamic forerunners are those in which the full MIATM cycle (recognition, sense-making, and deployment and reconfiguration) was observable; cases dominated by low VUCA scores or classified as non-dynamic laggards exhibited partial or blocked MIATM phases, particularly in Phase 2 (sense-making) and Phase 3 (deployment and reconfiguration of capabilities).

Importantly, the inclusion of cases with lower VUCA profiles, notably the dental practice cases (DC and DA) and the care home (SW), permits examination of whether laggard characteristics are VUCA-contingent (appearing only under high environmental pressure) or structural features of organisational learning architecture that persist even where environmental demands are modest. Our findings indicate the latter. The absence of feedback loops, decentralised decision rights, and leadership legitimisation of experimentation characterises non-dynamic laggards regardless of VUCA severity, confirming that learning architecture, not environmental pressure alone, determines transformation capacity. Similarly, the entrepreneurial restaurant case (CS) presents a MEDIUM-to-LOW VUCA profile yet exhibits dynamic forerunner characteristics, demonstrating that the learning architecture is generative under modest environmental pressure and does not require high-stakes VUCA conditions to activate.

An interview protocol anchored in MIATM's three phases (recognition, sense-making/assimilation, and deployment & reconfiguration) guided data collection. Although the study followed a primarily inductive approach, it was supplemented by abductive reasoning to iteratively connect emerging empirical patterns with existing theoretical frameworks on DCs and organisational learning. Data collection continued until theoretical saturation was reached, indicated by the absence of materially new codes or themes, consistent with guidance for qualitative process research (Eisenhardt, 1989; Guest et al., 2006).

The use of semi-structured interviews aligns with Langley and Abdallah's (2011) process model and Gioia et al.'s (2013) participant-centred approach, both of which emphasise capturing dynamic change and meaning-making over time. To mitigate researcher bias during data collection, a standardised protocol was used; the guide was piloted and refined after early interviews; and interviewers kept reflexive field notes. Member-checking of key interpretations was undertaken with several informants (see Section 4.2). Retrospective reflections were leveraged to trace cognitive shifts, evolving mental models, and learning responses to external disruptions. Detailed analytic memos were prepared immediately after each interview to support rigorous theme development and data structuring, allowing raw data to be systematised and analysed in line with emergent patterns.

Table 1
Sample characteristics by sector.

Sector	Participants
B2B/Knowledge-Intensive (incl.ICT)	4
Healthcare (public & private)	3
Education (public), Government/Public Safety	2
Manufacturing & Engineering	2
Small Entrepreneurial Businesses	4
Retail & Hospitality (B2C)	3
Total	18

Note: "Organisational type" (knowledge-intensive / traditional / entrepreneurial) was used analytically.

4.2. Coding and analysis

Data analysis was conducted using NVivo software, enabling systematic and rigorous coding of transcribed interviews. Thematic analysis was structured around each construct of the MIATM framework, examining standalone and interactive effects across individual, team, and organisational levels. Initial open coding enabled theme emergence, followed by axial coding to connect categories across levels of analysis. A selective coding phase then integrated categories into higher-order dimensions mapped to RQ1 (context – learning mechanisms) and RQ2 (mechanisms – outcomes). Abductive reasoning was used throughout to iteratively link these themes to theoretical constructs in the literature, refining their conceptual relevance.

MIATM functioned as a heuristic "sensing device", guiding attention to key organisational learning mechanisms such as cognitive shifts, feedback loops, and the codification of tacit knowledge into actionable routines. The analysis examined how contextual enablers (leadership/actors, systems, culture, resources, and structural arrangements) influenced learning activation and DCs development. To enhance analytic transparency, we maintained an audit trail (decision log, codebook, and memo links in NVivo), used matrix queries and case-ordered displays to compare firms, and conducted negative-case analysis. While MIATM 3.0 guided inquiry, defensive routines, organisational silence, and ambidexterity tensions emerged inductively beyond the original model, and negative/borderline cases demonstrate we avoided force-fitting data.

To strengthen coder reliability and mitigate bias, two researchers independently coded an initial subset of transcripts to calibrate code boundaries. Disagreements were discussed and reconciled, and the refined codebook was then applied across all transcripts. All discrepancies were resolved through discussion and reference to operational definitions. Reflexive memos captured assumptions and alternative explanations, and emerging interpretations were shared with several informants (member-checking) to verify accuracy.

To avoid post-hoc labelling, cases were coded a priori as "dynamic forerunners" when interviews evidenced decentralised decision rights used in practice, at least one formal feedback mechanism (such as retrospectives or after-action reviews) and one informal loop (rapid customer or peer checks), visible leadership encouragement of experimentation (as described by the interviewee), and a concrete example of routine modification (single or double-loop; see Table 3 below). Cases were coded as "non-dynamic laggards" when decision rights were centralised with no meaningful delegation; feedback was primarily top-down or compliance-oriented; defensive routines (fear/blame) were reported; and no concrete examples of routine change beyond efficiency tweaks were provided. Borderline cases were flagged and adjudicated during axial and selective coding, with explicit rationale recorded in the audit trails. For example, one manufacturing firm had decentralised structures but no evidence of recent routine modification and strong defensive routines; we therefore coded it as a laggard. A further illustration of how MIATM pinpoints such bottlenecks in Phase 2 sense-making is provided by the non-dynamic retail organisation discussed in Section 5.5.2.

Consistent with the literature, we define operating capabilities as routines that enable "doing" current activities efficiently, and DCs as higher-order routines that purposefully reconfigure operating

Table 2
VUCA Characterisation of Cases Matrix.

Code	Participant / Organisation Role · Org · Sector	V Volatility	U Uncertainty	C Complexity	A Ambiguity	Classification	Key Evidence from Interview Data
1 DD	Assoc. Director of Design & Innovation B2B · Manufacturing/ KIBS	HIGH	HIGH	HIGH	MEDIUM	Dynamic Forerunner	Competing with Chinese rivals; energy/material cost volatility; complete product redesign required; MRP system overhaul
2 LA	Logistics Assistant B2B · ICT/Admin Services	MEDIUM	MEDIUM	MEDIUM	LOW	Non-Dynamic Laggard	Supply/material price changes noted but managed top-down; objectives not relevant to role; stick to plan mentality
3 SA	Sales Advisor / Stockroom Asst B2C · Global Retail	HIGH	HIGH	MEDIUM	HIGH	Non-Dynamic Laggard	Living-crisis demand drop; price increases; strategic direction top-down only; KPI 12% conversion = sole objective
4 SW	Support Worker B2C · Social Care	LOW	LOW	MEDIUM	LOW	Non-Dynamic Laggard	Patient-ageing changes managed via training protocols; top-down policy-driven; Jewish values constrain interpretation
5 CM	Cafe Manager B2C · SME Food & Beverage	LOW	LOW	LOW	LOW	Non-Dynamic Laggard	Stable local market; no IT infrastructure; simple menu/ price adjustments; no formal strategy or feedback loops
6 SSD	Senior Software Developer B2B/B2C · Insurance/ KIBS	HIGH	HIGH	HIGH	HIGH	Dynamic Forerunner	Cyber threats; digital modernisation; data privacy regulation; complex platform interdependencies; vigilant monitoring
7 AM	Assistant Manager B2C · Fast Food Franchise	HIGH	MEDIUM	MEDIUM	MEDIUM	Non-Dynamic Laggard	Fortressing strategy changes from HQ; deal/promotion cycles; no local discretion; higher-ups handle all strategy
8 QAM	Organisational Assurance Manager Gov · Public Safety/ KIBS	HIGH	HIGH	HIGH	MEDIUM	Dynamic Forerunner	Incident/demand volatility; climate change; EV technology; multi-agency complexity; 4-year CNRP horizon scanning
9 NE	Network Engineer Gov · Healthcare/ICT	LOW	LOW	HIGH	LOW	Non-Dynamic Laggard	Clinical system complexity high but role purely reactive; 'when something goes wrong – needs action'; passive orientation
10 CS	Counter Service B2C · SME Chinese Takeaway	MEDIUM	MEDIUM	LOW	LOW	Dynamic Forerunner	Local competitor monitoring; menu/pricing adaptation; informal collaborative learning; established reputation leveraged
11 ET	English Teacher Gov · Public Education	MEDIUM	MEDIUM	MEDIUM	MEDIUM	Dynamic Forerunner	GenAI & EdTech disruption; student behavioural shifts; iterative experimentation with methods; AI visual/voice tools tested
12 HM	Night Manager / Auditor B2C · Tourism & Hospitality	HIGH	HIGH	MEDIUM	MEDIUM	Non-Dynamic Laggard	COVID & seasonal demand shocks; centralised interpretation only; changes passed top-down; single-loop customer review use
13 CSA	Customer Service Advisor B2C · Student Accommodation	MEDIUM	MEDIUM	MEDIUM	MEDIUM	Non-Dynamic Laggard	Staff turnover; digitisation of compliance; Workplace platform for sharing; analysis done by managers not frontline staff
14 SC	Health & Social Care Consultant B2B/B2C · Healthcare Recruitment	HIGH	HIGH	MEDIUM	HIGH	Dynamic Forerunner	Post-pandemic talent market; shifting client priorities; new care models; regulatory changes; continuous unlearning cycle
15 QS	Assistant Quantity Surveyor B2B · Construction/ Engineering	MEDIUM	MEDIUM	HIGH	MEDIUM	Dynamic Forerunner	Material inflation; multi-contractor project complexity; cost intelligence team; tender-return benchmarking; SharePoint systems
16 DC	Dental Consultant B2C · Dental Healthcare	LOW	LOW	LOW	LOW	Non-Dynamic Laggard	Stable clinical protocols; Dentally software only channel; changes communicated by managers; no local strategy involvement
17 DA	Dental Treatment Coordinator B2C · Dental Healthcare	LOW	LOW	LOW	LOW	Non-Dynamic Laggard	No aims/objectives; stable industry self-reported; authoritarian leadership; fear-based culture; no routine change evidence
18 PA	Legal Personal Assistant B2B · Legal/KIBS	LOW	LOW	LOW	LOW	Non-Dynamic Laggard	Administrative diary management only; no strategic visibility; existing routines work smoothly; no environmental scanning

Table note: VUCA dimension severity rated HIGH / MEDIUM / LOW based on convergent evidence from interview transcripts and researcher coding memos, following the operational criteria defined in 4.1.1. Ratings reflect the dominant VUCA pressures operative in each participant's organisational context at the time of data collection. Classification as Dynamic Forerunner or Non-Dynamic Laggard follows the criteria elaborated in Table 3. Participant SW contributed to aggregate pattern confirmation and theoretical saturation; individual attribution is absent from the findings narrative (see 4.3).

capabilities in response to change (Eisenhardt & Martin, 2000; Newey & Zahra, 2009). We coded dynamic-capability evidence when informants described intentional routine modification (deepening or broadening) triggered by external cues and supported by feedback loops. DCs were defined as those that reconfigure or extend operating capabilities by developing VRIN resources, following Eisenhardt & Martin (2000); Helfat & Peteraf (2009), and Pisano (2017). The identification of learning outcomes such as capability deepening and broadening was grounded in participants' descriptions of adaptation pathways and strategic renewal efforts.

Table 3
Classification table for forerunners vs laggards.

Criterion	Dynamic forerunners	Non-dynamic laggards
Decision rights	Decentralised and used in practice	Centralised, little delegation
Feedback	At least one formal or informal feedback loop	Mainly top–down/compliance feedback
Leadership climate	Encourages experimentation, tolerates failure	Defensive, blame–oriented
Routine change	Reported example/s of routine modification	No reported routine change beyond efficiency tweaks

We triangulated interview accounts with reflexive field notes and compared perspectives across hierarchical levels and sectors.

4.3. Participant selection

The sample consisted of 18 participants from diverse sectors and organisational forms. Nine were drawn from knowledge-intensive business services (KIBS), ICT, governmental rescue services, healthcare, human resources, and education, known for developed absorptive capacity routines (Alvesson, 2000). Four participants represented entrepreneurial small businesses, noted for flexibility, experimentation, and informal learning approaches (Carson & Gilmore, 2000; Cope, 2005). Five further participants worked in more traditional, process-heavy industries; together these account for the full sample of N = 18. Table 1 reports the sample in detail.

Participant selection followed theoretical sampling and saturation principles, as recommended by Eisenhardt (1989) and Guest et al. (2006). The sample was sufficient to ensure data saturation, with no new insights emerging in the final interviews. The variation in firm size, industry type, and business model was intentional, designed to uncover patterns across different organisational learning environments rather than to support sector-specific generalisability. While all 18 participants informed the emergent patterns and cross-case comparisons, not every participant is individually cited in the findings narrative; participants contributing primarily to aggregate pattern confirmation rather than distinctive theoretical variation are reflected in the analysis without individual attribution.

Participants represented various hierarchical levels, from frontline employees to senior managers, ensuring a comprehensive, multi-perspective account of learning and adaptation. Employee-level insights were particularly valuable, as they provided ground-level evidence of leadership effectiveness, often more reliable than managerial self-assessment. To mitigate interpretative bias, multiple coding rounds were conducted using NVivo, and analytic decisions were documented through coding memos. Member-checking procedures further reinforced interpretive reliability by allowing participants to validate or amend emergent interpretations (Miles et al., 2018).

Given the diversity of industries, organisational types, and learning maturity levels, a sample of 18 was deemed sufficient to reach theoretical saturation (Eisenhardt, 1989). This decision was further supported by evidence that additional interviews yielded no substantially novel insights (Eisenhardt & Graebner, 2007; Saunders & Townsend, 2016).

5. Findings

This study identified a set of key organisational factors that shape learning and transformation capacity in response to VUCA environments. We organise the findings to mirror the extended MIATM-VUCA learning architecture, moving from contextual enablers through learning mechanisms to capability outcomes. (Operating capabilities and DCs are defined as in 4.2.).

5.1. Leadership as a pivotal Differentiator

Leadership emerged as the primary determinant separating dynamic forerunners from non-dynamic laggards, particularly in how it shaped learning climates and enabled (or inhibited) cognitive shifts. In dynamic forerunner organisations, leaders encouraged experimentation, feedback-seeking, and calculated risk-taking.

Forerunner firms demonstrated decentralised structures. Employees described their autonomy in adapting operational routines based on emerging information and frontline insights. For example, one Quality Assurance Manager at a governmental fire rescue service observed: *"We continuously scan for emerging risks and integrate real-time data into decision-making processes to refine our community risk management plans."*.

By contrast, leadership in non-dynamic laggard firms was more hierarchical and control-oriented. Employees often described a climate of passivity and compliance, where deviation from standardised procedures was discouraged. A Sales Advisor in a traditional retail organisation explained: *"Decisions come from higher up; my role is to implement, not question."* In these contexts, learning was reduced to reactive problem-solving, and feedback was interpreted as critique rather than opportunity. Leadership practices in laggard firms undermined the development of cognitive shifts by prioritising stability over adaptability.

Importantly, the findings show that cognitive shifts, defined as changes in assumptions, mental models, and habitual behaviours, occurred only when leadership created enabling conditions, such as open communication channels, safe-to-fail spaces, and trust-based dialogue. Overall, leadership acted as the gateway through which contextual enablers like structure, systems, and culture translated into actual learning behaviour. When leaders failed to activate these levers, even resource-rich organisations struggled to adapt effectively to VUCA conditions. These leadership differences were particularly pronounced under conditions of high ambiguity (the A dimension of VUCA), where the inability to interpret market signals made decentralised sense-making and leader-legitimised experimentation the primary mechanisms through which organisations converted environmental noise into actionable learning. In high-ambiguity contexts, leadership was not merely a contextual backdrop variable but the primary regulatory mechanism determining whether VUCA signals entered or bypassed the organisation's learning architecture entirely.

5.2. Enabling or Hindering organisational context

Organisational context, including structure, culture, and communication systems, emerged as a second major determinant of adaptive learning in VUCA environments. In dynamic forerunner companies, decentralised structures enabled agile responses by empowering employees to take initiative without awaiting top-down directives. These structures promoted calculated risk-taking, experimentation, and rapid knowledge dissemination, converting tacit individual insights into explicit organisational routines. For instance, a senior English teacher explained how adapting to student behavioural shifts required not only pedagogical knowledge but digital fluency and independent action: *"Basic knowledge in technology and as a teacher, you are to figure out new ways to deal with behavioural changes of students."*.

In contrast, non-dynamic laggard firms exhibited fragmented communication systems and rigid hierarchies that obstructed vertical and lateral knowledge flows. Employees in these firms often expressed detachment from strategic goals and deferred responsibility to senior management. This was reflected in sentiments such as: *"This is not my job." "The manager will let us know."* A Sales Advisor at a retail firm similarly remarked: *"As an assistant manager, I do not detect changes; the higher-up staff like regional managers are supposed to."*.

Critically, the findings demonstrate that organisational structure and cultural norms act as amplifiers or inhibitors of learning capacity. While forerunners used structure and systems to democratise learning and reduce friction, laggards used them to control, constrain, and preserve

the status quo.

Tables 4-5 further elaborate these patterns by mapping contextual levers to specific learning routines, with Table 5 explicitly coding whether Phase 3 routines deepen or broaden capabilities.

5.3. Cognitive orientation and learning readiness

In dynamic forerunner organisations, participants exhibited a strong alignment with strategic goals and demonstrated proactive cognitive flexibility. Cognitive shifts were triggered by exposure to emerging technologies, customer feedback, and competitive shifts. A Senior Consultant in healthcare recruitment highlighted the role of continuous personal development in driving transformation: *"To keep my knowledge and abilities current and useful in a field that is always changing, I am committed to a programme of lifelong learning and growth."* This mindset reflects an internalised orientation toward adaptability, where individuals take ownership of their learning journey and apply insights in real time (Wrzesniewski & Dutton, 2001). Participants in forerunner firms described learning as iterative and integrated with daily action, often reinforced by feedback mechanisms such as client engagement loops, project retrospectives, and team-level experimentation.

By contrast, employees in non-dynamic laggard firms displayed narrow task focus, often viewing organisational change as top-down, episodic, and outside their sphere of influence. They prioritised internal metrics (e.g., KPIs, procedural adherence) over market responsiveness. One participant noted: *"We are told what to do in meetings, and we follow the process. There is no need to change unless the manager tells us so."* Such statements illustrate a disconnect between individual roles and strategic adaptation, with minimal evidence of lateral knowledge flows or cognitive engagement with external dynamics.

The contrast reinforces the argument that learning triggers are not merely informational but contextual. For cognitive shifts to occur, organisations must foster an environment that supports sense-making, psychological safety, and clear purpose alignment.

5.4. Dynamic forerunners

Dynamic forerunners in our sample included technology-intensive manufacturers, KIBS and public–service organisations, public education, and small entrepreneurial firms. Participants described learning as both structured and emergent, rooted in continuous environmental scanning, strong mission alignment, and distributed ownership.

5.4.1. Recognition

The ability to recognise industry trends and evolving customer needs was central to the learning agility of dynamic forerunner organisations. Participants across forerunner firms described a strong drive to align their practices with emerging priorities, often triggering cognitive shifts and leading to the reconfiguration of internal operations, processes, or resources. These actions sustained their organisational agility and responsiveness in fast-changing environments. This proactive orientation was exemplified by the QAM in a rescue service, who emphasised: *"We use a specialist data analysis and modeling organisation to crunch numbers on our current and future risks."* The QAM highlighted how communication platforms like SharePoint, OneNote, Outlook, and MS Teams facilitate real-time information flow and knowledge transfer, forming the digital backbone of agile learning systems. He elaborated: *"These tools facilitated effective transmission and storage of information. Feedback from operational levels fuels appropriate changes in tactics or operations."* This cyclical knowledge flow, from sensing to action and back, formed a closed-loop learning system, reinforcing responsiveness.

Critically, the urgency and sophistication of recognition behaviours were directly proportional to the degree of volatility (V) and uncertainty (U) experienced: cases operating under high-V/high-U conditions, fire rescue (QAM), healthcare recruitment (SC), and precision manufacturing (DD), exhibited the most structured and multi-channel

Table 4
Context levers, learning routines, and representative evidence (Forerunners vs Laggards).

Context lever / MIATM dimension	Case type	Learning routines (synthesised)	Representative evidence (participants' quotes)
Leadership	Dynamic forerunners	Adaptive, empowers employees, encourages experimentation and learning	"Ability to learn on the job is key" (DD).
Leadership	Non-dynamic laggards	Defensive, risk-averse, controls daily routines	"As an assistant manager I do not detect changes, the higher up staff like regional managers are supposed to. I only have to implement and follow the changes made." (AM).
Organisational structure	Dynamic forerunners	Decentralized, facilitates knowledge transfer, supports autonomy	"Everyone is usually involved and inputs their thoughts and ideas collaboratively" (CS).
Organisational structure	Non-dynamic laggards	Hierarchical, restricts information flow, limits employee engagement	"Communication is sent in a clear and easy-to-understand way" (SA) and information "is passed down from management with minimal input from employees."
Recognition of market changes (Phase 1)	Dynamic forerunners	Proactive environmental scanning, aligns strategies with market dynamics	"Detecting changes in costs through search of building magazines is key" (QS); "Physically visiting the place of competitors and purchasing their food" (restaurant owner).
Recognition of market changes (Phase 1)	Non-dynamic laggards	Reactive, limited assimilation of information, focuses on internal targets	"When something goes wrong – needs action…change comes, and it is approved by managers." (NE).
Learning mechanisms (Phase 2: sense-making and cognitive shifts)	Dynamic forerunners	Collaborative efforts, feedback loops, converts tacit knowledge into explicit practices	"We often assemble steering groups/ working groups to identify and define key information, use subject matter experts, produce business cases and technical documentation and then solicit input and further develop the ideas/actions/ strategy with the employees" (QAM); "Training and development programmes help guide this process so that workers acquire the expertise they need" (SC).

(*continued on next page*)

Table 4 (*continued*)

Context lever / MIATM dimension	Case type	Learning routines (synthesised)	Representative evidence (participants' quotes)
Learning mechanisms (Phase 2: sense-making and cognitive shifts)	Non-dynamic laggards	Lacks feedback loops, stifles innovation, culture of fear and blame	"I prefer to stick to the plan as there is not much room for changing strategy unless it is completely necessary" (AM).
Deployment and reconfiguration of capabilities (Phase 3)	Dynamic forerunners	Adapts and reconfigures offerings, applies single and double-loop learning, develops dynamic capabilities	"DD has been tasked to redesign the top 100 products and remove expensive hand work and streamline the manufacturing process. Also, cutting out middlemen increased efficiency and profit." (DD); "Implementing changes while managing everyday operations might be difficult, but it's important" (SC).
Deployment and reconfiguration of capabilities (Phase 3)	Non-dynamic laggards	Maintains existing routines, resists change, lacks agency in strategic decision-making	"Stick to the plan as there are lots of technical and other moving parts to the system" (LA).
Development of VRIN resources	Dynamic forerunners	Focuses on unique know-how, culture, and trust to sustain competitive advantage	"Operating long time and have well established reputation" (CS).
Development of VRIN resources	Non-dynamic laggards	Emphasizes operational efficiencies, neglects development of unique competitive resources	"We value making our customers happy over making money" (SA); "The overall practice is very overwhelming and stressful. The leadership don't allow room for growth or changes to occur. Just expected to keep up with daily work." (DA).

scanning architectures. Cases operating under lower VUCA pressure, particularly small entrepreneurial firms, relied on informal observation and competitor monitoring. However, this informality reflects the structural characteristics of how entrepreneurial organisations operate rather than an absence of environmental awareness (Carson & Gilmore, 2000). The entrepreneurial restaurant case (CS), for instance, operates under a MEDIUM-to-LOW VUCA profile yet exhibits dynamic forerunner characteristics precisely because its informal scanning architecture is well-matched to the scale and nature of its environmental pressures. What the cross-case pattern therefore confirms is that scanning architecture adapts in form and intensity to the type and severity of VUCA experienced, which is itself evidence that VUCA dimensions actively shaped the form and intensity of Phase 1 behaviours rather than merely describing the environment in which those behaviours occurred.

Participants frequently cited formal processes and informal, ad-hoc learning routines that supported "reverse engineering" strategic objectives, where real-time feedback informed top-level strategy refinement. For example, the SC in healthcare recruitment stressed: *"Continuous learning and unlearning are vital to keep up with industry developments."*This reflects a strong feedback culture, allowing for iterative

Table 5
Phase–3 deployment and reconfiguration routines and capability outcomes (deepening vs broadening) Table 5 summarises Phase–3 deployment and reconfiguration routines and codes whether each primarily deepens existing capabilities (D), broadens them into new domains (B), or does both (D/B). Laggard cases, where no meaningful reconfiguration was described, are marked '-'.

Company / industry type	Case type	Phase–3 deployment and reconfiguration routines (participants' quotes)	Capability outcome*
Manufacturing, ICT/KIBS, and Engineering forerunners (DD, SSD, QS)	Dynamic forerunners	"Changes are implemented along with day-to-day activities simultaneously" (QS). "DD has been tasked to redesign the top 100 products and remove expensive hand work and streamline the manufacturing process. Also, cutting out middlemen increased efficiency and profit. Both single and double loop learning."	D/B
Government fire rescue service (QAM); public education (ET); healthcare recruitment (SC)	Dynamic forerunners	"Implementing changes while managing everyday operations might be difficult, but it's important" (SC). "We have no choice but to simultaneously implement changed while implementing operational availability. We proactively measure against our activities and provide regular training and mandatory training for all staff." (QAM). ET: "Implications involve handouts and doing revisions for students, new methods of teaching, testing with one class and not the other classes… Yes, if the reconfiguration results in a better learning experience, the teacher is willing to do so."	D
Fast–food entrepreneurial SME (CS)	Dynamic forerunners	"Typically try the change for a while; if it doesn't work, then revert back" (CS). "Some minor changes are made, then they have to adapt" (CS).	D
Multi–sector non-dynamic laggards (LA, SA, NE, HM, AM, CSA, DA, DC, PA, CM)	Non-dynamic laggards	"Limited, reactive approach: Only minimal single-loop learning." "I prefer to stick to the plan as there is not much room for changing strategy unless it is completely necessary" (AM). Focus on "controlling the store to be able to make maximum profit by lowering labour costs and applying relevant deals" (AM).	–

*Note: *D = capability deepening (refining or upgrading existing routines); B = capability broadening (creating or extending into new routines/markets); D/B = both; "–" indicates no clear capability reconfiguration beyond efficiency tweaks.

strategy refinement. Likewise, the CS in a restaurant noted: *"Visiting competitors allows us to adjust our internal processes and improve product offerings."* Here, simple observational learning enabled frontline-driven innovation. Informal, tacit insights gained through direct observation played a critical role in knowledge refinement and micro-level process innovation, a core element of dynamic capability formation. In education, the ET noted that continuous experimentation with teaching methods was essential: *"I test new ways to engage students and adjust depending on what works. No method is fixed."*Such statements reveal adaptive experimentation, a hallmark of dynamic forerunners, demonstrating their capacity to respond not just through formal systems but also through embedded sensing and reflexive learning at the operational level.

5.4.2. Assimilation and Sense-Making

This section highlights how individual learning episodes informed broader strategic decision-making, marking the interaction between operating and dynamic capabilities. Participants described how cognitive shifts followed exposure to new external intelligence, resulting in revised mental models and updated organisational routines. A key challenge, however, lies in transferring tacit knowledge, context-dependent and hard to codify (Senge, 1990; Pawlowsky, 2001; Li et al., 2025), into collective organisational knowledge systems.

In dynamic forerunners, this was addressed through cross-functional collaboration, transparent feedback loops, and leadership-facilitated sense-making. For instance, the SC from healthcare recruitment detailed: *"Our collaborative recruiting process involves internal staff, clients, and candidates to keep aligned with new trends."*This enabled co-created knowledge and a shared understanding of industry shifts, reinforcing absorptive capacity.

Leaders played a central role in establishing reflexive learning environments, often formally embedding feedback loops into decision-making systems. These mechanisms supported strategy refinement and performance monitoring; as noted in Section 5.4.1, risk teams engaged in continuous horizon scanning using digital tools, and these same systems underpinned cross-functional sense-making.

Despite these strengths, participants acknowledged that converting individual-level insights into formal organisational processes required cultural openness, psychological safety, and active managerial support. Informal communication also played a vital role, as illustrated by the CS: *"Everyone is usually involved and inputs their thoughts and ideas collaboratively. Almost all our communication is done through in-person meetings."* This highlights the value of face-to-face, socialised learning in SMEs where institutional systems may be limited but adaptive responsiveness remains strong. Training and development also reinforced assimilation processes. The ET commented: *"Training and development programmes help guide this process so that workers acquire the expertise they need to do their jobs well."* These investments illustrate the organisational embedding of knowledge routines. The repeated references to experimentation, feedback, and continuous improvement indicate that dynamic forerunners possess institutionalised mechanisms to convert experience into foresight, and foresight into action. Together, these learning processes illustrate aggregation from micro-level cognition (individual shifts) to *meso*-level routines (team knowledge sharing) and macro-level capability reconfiguration, mediated by TMS and feedback architectures.

It is worth emphasising that the challenge of converting tacit knowledge into collective sense-making was most acute under conditions of high ambiguity (A): where the meaning of market signals was contested or under-defined, organisations required not merely information-sharing but active cognitive mediation by leaders and cross-functional groups to arrive at shared interpretations, a mechanism entirely absent in non-dynamic laggards operating under similar VUCA pressures. The distribution of ambiguity across cases, therefore, directly predicted the presence or absence of the collaborative sense-making mechanisms that characterise Phase 2, rendering VUCA analytically constitutive of the learning process rather than its mere context.

5.4.3. Deployment and reconfiguration of Capabilities: Adaptation of products and services

The final phase of the MIATM learning cycle focuses on the operationalisation and institutionalisation of new knowledge, through the implementation of revised practices, processes, and service or product innovations. Organisations with decentralised decision-making and cross-functional coordination consistently excelled in this phase, converting insights into DCs (Atanassova & Bednar, 2022).

Participants in dynamic forerunner firms described how environmental scanning and real-time feedback loops supported the translation of learning into innovation and strategic reconfiguration. Through iterative experimentation and calculated adaptation, they were able to question existing routines (double-loop learning), enhance offerings, and deepen customer engagement. The DD from a precision instruments manufacturer offered a clear example: *"Through research and advancing digital technology, we understood the need to cut the middleman and sell directly to customers through the website."*.

This shift exemplifies capability reconfiguration, as the organisation transitioned from a traditional distribution model to a digitally enabled, customer-centric sales structure, maximising margins and learning from real-time buyer behaviour. Similarly, the QAM from the fire rescue service explained their iterative planning process: *"We scan the environment for changes, contextualize the risk, assess impact, develop options, select a strategy, consult stakeholders, and then implement, monitor, and review the strategy."* This agile learning loop embedded in their four-year community risk management plan represents a dynamic capability in action, ensuring simultaneous operational continuity and strategic responsiveness. In the public education sector, the ET described iterative, student-centered experimentation: *"Revising time, experimenting with technology, and particularly GenAI adapting materials and tailoring teaching styles based on learner feedback and style."*.

This process involved rapid feedback assimilation, trial of emerging tools such as AI-generated visuals and voiceovers, and real-time pedagogical adjustment, a critical example of tacit-to-explicit knowledge conversion and continuous service refinement (Nonaka, 1994). Likewise, the CS in an entrepreneurial restaurant described: *"Depending on their objective, like if they were sampling competitors' food, this information might influence change into internal recipes or processes to improve…"* This ad-hoc approach reflects how frontline observations serve as organisational sensing mechanisms, enabling the exploration of emergent market knowledge through deployment of new capabilities or adaptation of existing ones. In Table 5 these routines are coded predominantly as capability deepening for public-sector and education cases, and as capability broadening in entrepreneurial and ICT cases, where learning triggers the creation of new channels or offerings.

5.4.4. Ambidexterity

A defining capability of dynamic forerunners was their ability to balance exploration (capturing new opportunity) with exploitation (leveraging existing capabilities), commonly conceptualised as organisational ambidexterity (March 1991; O'Reilly & Tushman, 2013). The QAM articulated this strategic tension when stating: *"Our 4-year Community Risk Management Plan is regularly updated…"* This reflects the long-term strategic framing (exploration) combined with real-time operational adjustments. Such temporal balancing ensured the organisation maintained core operations while adapting its strategies in response to fluctuating risks.

Participants emphasised that sustaining ambidexterity required well-developed feedback mechanisms, distributed decision rights, and a

culture that values both stability and innovation. Leadership was central to facilitating this dual orientation, by aligning structural enablers with behavioural flexibility.

5.4.5. VRIN resources

Another critical outcome of dynamic forerunners' learning capability was the development and deepening of VRIN resources (Barney, 1991). These intangible resources, such as expertise, organisational culture, trust, and relational capital, could not be easily replicated by competitors, providing a foundation for sustained competitive advantage in VUCA environments. The SC in healthcare recruitment observed: *"Our expertise in healthcare, our network, our culture, and reputation are intangible assets that give us a competitive edge."*.

This statement reflects the organisation's strategic investment in human and relational capital, accumulated through consistent engagement with external actors and internal knowledge development routines.

Participants across dynamic forerunners repeatedly highlighted how feedback loops, collaborative routines, and cultural alignment helped transform tacit knowledge into shared routines, producing VRIN outcomes. These included: organisational trust built through participatory decision-making; collective expertise developed through cumulative problem-solving and mentorship; adaptive culture grounded in open communication, experimentation, and reflection. As these VRIN resources were reinforced through ongoing learning and adaptation, they not only enabled operational agility but also fortified strategic positioning. The ability to continuously revisit assumptions, reframe problems, and institutionalise learning solidified the firm's ability to respond effectively to future challenges.

5.5. Non-Dynamic laggards

Non-dynamic laggards exhibited a marked lack of flexibility and were unable to effectively adapt to rapidly changing environments. These organisations typically struggled with rigid hierarchical structures, an entrenched reliance on established routines, and minimal engagement in cognitive shifts. Participants from these organisations often displayed passivity in the face of external changes, relying on top-down communication from leadership rather than proactively engaging with their external environments.

5.5.1. Background

Non-dynamic laggards, primarily traditional, often larger businesses operating in the B2C sector, adopted a conservative, stability-driven approach to learning and change. Employees in these firms concentrated on enhancing operational efficiency within predefined routines, showing limited alignment with organisational strategy or active involvement in transformation initiatives. This disengagement signified a failure to foster the cognitive shifts required for strategic adaptability and innovation. Leadership was generally seen as the sole source of guidance, with employees dependent on top-down channels for information, direction, and adaptation.

This category of laggard organisations included a diverse set of companies and participant roles: a Logistic Assistant (LA) in a B2B IT solutions firm, a Sales Advisor (SA) in a global retail company, a Cafe Manager (CM) in a small entrepreneurial food service business, an Assistant Manager (AM) in a fast-food franchise, a Network Engineer (NE) in an NHS hospital trust, a Hotel Manager (HM) in the tourism and hospitality sector, a Customer Service Advisor (CSA) in a student accommodation company, a Dental Consultant (DC) and a Dental Treatment Coordinator (DA) at private dental clinics, and a Personal Assistant (PA) at a corporate law firm.

5.5.2. Recognition

Communication practices in non-dynamic laggards were predominantly hierarchical and unidirectional, with employees heavily reliant on managers for updates and decisions. This communication model reflected the absence of TMS, absorptive capacity routines, and closed-loop feedback mechanisms, all critical enablers of organisational learning and adaptability. As a result, employees remained task-focused, adhering to narrowly defined responsibilities and individual performance metrics, rather than engaging with the wider organisational strategy or market environment.

This detachment from sense-making activities and broader strategic goals inhibited the development of DCs.

The retail organisation introduced earlier in Section 5 exemplifies this pattern clearly. Although senior management had "sensed" and "seized" a digital market opportunity by investing in an online platform, frontline staff reported that feedback "went nowhere" and that they were "not supposed to question the process." From an SST perspective, the transformation appeared simply to have stalled. Viewed through the MIATM lens, however, the bottleneck is located more precisely in Phase 2: sense-making and cognitive shifts were constrained by hierarchical decision rights, defensive routines, and weak informal feedback loops.

Resistance to change, a recurrent theme in participant narratives, further constrained adaptive capacity. The SA, for instance, remarked: *"No, to convert walk-ins into sales with a KPI of 12%,"* illustrating a focus on short-term, efficiency-based targets rooted in single-loop learning, disconnected from long-term strategic positioning.

The DA similarly described a stressful and disempowering work environment, where *"leadership doesn't allow room for growth or changes to occur,"* revealing a lack of developmental opportunities and exclusion from organisational adaptation processes. An assistant manager (AM) echoed this passive orientation, stating: "As an assistant manager, I do not detect changes; the higher-up staff like regional managers are supposed to. I only have to *implement and follow the changes made."* Their statement, *"When something goes wrong-needs action,"* encapsulates a reactive, event-driven mindset that fails to leverage proactive learning from market intelligence, leaving the organisation vulnerable to disruption.

The DA further revealed the absence of strategic clarity, noting: *"There were no aims and objectives. No targets. Receiving feedback from the manager based on changes that need to occur, such as packages and prices. It's a stable industry."* However, this perceived stability was undermined by a punitive and opaque leadership culture, with employees reporting: *"No, leadership is very strict. The manager makes changes without speaking to employees on decisions."* This authoritarian environment suppressed employee voice and innovation, replacing proactive learning with defensive routines and a pervasive sense of fear. As one DA shared: *"Being able to maneuver in a negative environment, keeping to yourself more often and speaking less,"* this illustrates how employees were systematically disempowered, alienated, and discouraged from experimenting or contributing to adaptive change.

Ultimately, non-dynamic laggards lacked the internal infrastructures and leadership support necessary to initiate or sustain meaningful transformation, rendering them ill-equipped to respond to market turbulence.

Paradoxically, many laggard organisations faced VUCA environments of comparable or greater severity to forerunners, notably retail (SA) and hospitality (HM), which confronted high volatility and high uncertainty during the data collection period, yet the structural suppression of bottom-up feedback rendered VUCA signals invisible to those with decision authority. This confirms that VUCA severity alone does not determine transformation outcomes; rather, it is the presence or absence of learning architectures designed to process VUCA signals that separates forerunners from laggards. Empirically, this confirms that VUCA functions not as a uniform environmental pressure that deterministically produces adaptive responses, but as a signal generator: its output is amplified into learning by forerunner architectures, or settled into strategic inertia by laggard ones.

5.5.3. Assimilation and sense-making

In non-dynamic laggards, the combination of rigid hierarchies, autocratic leadership styles, and siloed departmental boundaries severely constrained the assimilation of new knowledge and the collective sense-making required for strategic learning. The absence of TMS and weak absorptive capacity routines meant that organisational knowledge remained dispersed, tacit, and underutilised, resulting in fragmented learning processes and an inability to align operational activity with strategic goals.

Sense-making, defined as the collective interpretation of new or ambiguous information, was largely absent, with employees often unable to contextualise changes or understand their implications. Feedback loops, critical for enabling reflection and recalibration, were underdeveloped or nonexistent. Participants described a communication culture dominated by top-down directives, reinforcing task execution over strategic alignment. As such, employees were ill-prepared to detect environmental signals, engage in double-loop learning, or initiate change.

Defensive reasoning, a mechanism for avoiding blame or dissonance (Argyris, 1994), emerged as a significant barrier. It protected individuals and groups from acknowledging performance gaps or confronting inefficiencies, but in doing so, it also blocked cognitive shifts, suppressed open dialogue, and undermined adaptive learning. These defensive routines further entrenched organisational rigidity, weakening resilience and increasing vulnerability to external shocks.

For example, the Logistic Assistant (LA) stated that communication was *"clear and easy to understand,"* but simultaneously admitted being unaware of the organisation's *"goals, mission, and vision,"* indicating a disconnect between the clarity of instructions and the depth of strategic understanding. This highlights the illusion of communication effectiveness in organisations where information is transmitted but not internalised or connected to larger strategic frameworks.

Employees functioned in a passive-receptive mode, receiving instructions without being invited to question, reflect, or co-create meaning. This unidirectional approach to communication and decision-making eroded employee agency and fostered a compliance culture that prioritised routine execution over strategic thinking.

The lack of integrated sense-making frameworks, weak feedback systems, and minimal cross-functional dialogue severely compromised the ability of these organisations to make sense of complex, dynamic environments. Consequently, opportunities for innovation, capability development, and long-term strategic renewal were routinely missed. The inability to integrate individual or team-level insights into broader organisational narratives reflected a breakdown in vertical and horizontal knowledge integration, one that ultimately rendered the organisation strategically inert.

5.5.4. Deployment and reconfiguration of capabilities in Laggard organisations

Non-dynamic laggards exhibited a pronounced emphasis on preserving existing business models and reinforcing operational predictability, reflecting an organisational orientation that prioritised short-term efficiency over long-term adaptability. Across cases, participants described environments in which risk-aversion, centralised control, and procedural rigidity dominated decision-making. Rather than exploring opportunities to renew or adapt capabilities, these firms focused on incremental refinements within tightly defined parameters, effectively stalling the development of DCs. Learning remained narrowly confined to single-loop processes, where feedback was used to correct deviations from pre-set goals without reconsidering the goals themselves (Argyris, 1994). Double-loop learning, central to DC development, was almost entirely absent, as employees were rarely invited to reflect critically on assumptions or propose new strategic pathways.

This was clearly illustrated by a Logistics Assistant (LA), who noted: *"Prefers to stick to the plan as there are lots of technical and other moving parts to the system that could then lead to bigger mistakes down the line."*.

Only the Hotel Manager (HM) reported single-loop adjustments based on customer feedback: *"Through closely monitoring customer reviews, services are improved."* Furthermore, leadership behaviours in these organisations reinforced the path dependency of existing routine exploitation rather than strategic reconfiguration and capabilities renewal. Participants reported that decisions were frequently made without consultation and implemented without explanation, further distancing frontline workers from the organisational mission. In such settings, employee contributions to knowledge generation or operational improvement were minimal, with most reporting a reliance on managerial instruction to guide their day-to-day actions.

The institutionalisation of low-discretion roles also contributed to stagnation. As the Personal Assistant (PA) and Dental Assistant (DA) interviews suggest, employees were disconnected from higher-order strategic dialogues and lacked opportunities for professional development or cross-functional learning. This isolation from both vertical and lateral knowledge-sharing networks significantly diminished the organisation's capacity to sense, seize, and reconfigure assets in response to environmental change, the core tenets of DCs deployment (Teece, 2007).

The lack of reflexivity in routines and leadership's failure to foster psychological safety curtailed the emergence of meaningful learning loops. Employees described an unwillingness to speak up, a fear of blame, and a prevailing norm of silence that rendered upward feedback loops virtually nonexistent. In such contexts, learning was not a shared endeavour but an individual burden, often relegated to compliance with minimal space for experimentation or adaptation.

Thus, non-dynamic laggards were characterised by exploitative learning locked into rigid routines, with little or no effort to translate new insights into renewed operational practices. The organisational culture was steeped in hierarchy, conformity, and ambiguity aversion (March 1991), and acted more as a significant barrier to the development of exploratory capabilities, leaving these firms strategically brittle and operationally inflexible in the face of environmental volatility.

5.5.5. Ambidexterity

In non-dynamic laggards, the ability to simultaneously pursue operational efficiency (exploitation) and explore new opportunities (exploration), commonly referred to as organisational ambidexterity, was notably absent. Instead, these organisations exhibited a pronounced tendency toward rigid adherence to established procedures, favouring stability over strategic adaptability. Employees across sectors described environments where deviation from the plan was neither encouraged nor permitted, reinforcing a culture of predictability, control, and status quo maintenance.

A recurring theme was the lack of autonomy and strategic agency among middle and junior employees, which hindered both cognitive and operational flexibility. As one Assistant Manager (AM) explained: *"I prefer to stick to the plan as there is not much room for changing strategy unless it is completely necessary, as I do not have a lot of influence on the strategy."* This admission reflects a deeply embedded norm of task execution without critical engagement, characteristic of organisations in which ambidexterity has not been cultivated as a leadership or organisational priority.

The leadership models in these firms lacked the structural and cultural mechanisms to enable ambidexterity, such as distributed decision-making, cross-functional learning, or iterative experimentation. Top-down control replaced entrepreneurial initiative, and performance metrics focused narrowly on efficiency, not on adaptive capacity or innovation. This imbalance between exploitation of existing routines and exploration of new opportunities weakened the firm's DCs and made it more vulnerable to external shocks and shifts in the competitive environment.

Moreover, the cognitive dimension of ambidexterity, employees' ability to hold multiple perspectives, reconcile short-term demands with long-term visions, and embrace uncertainty, was underdeveloped. Participants were rarely exposed to divergent viewpoints or given the

opportunity to question dominant logics, leading to mental models that favoured repetition over novelty.

The absence of learning mechanisms that foster exploration, the narrow definition of employee roles, and the prioritisation of immediate efficiency over long-term resilience created an environment ill-equipped to manage the tensions inherent in dynamic markets. These firms, by failing to integrate both adaptive and efficient responses into their routines, risked organisational obsolescence in an increasingly VUCA world.

5.5.6. VRIN

In non-dynamic laggard organisations the development of VRIN resources was limited, fragmented, and reactive. While some employees acknowledged the importance of customer understanding and occasional improvements to service delivery, these efforts were largely confined to single-loop learning and lacked integration with broader strategic aims or long-term value creation.

Rather than cultivating intangible assets such as organisational culture, trust-based relationships, or cross-functional expertise, these firms tended to focus on narrowly defined operational goals, such as efficiency, compliance, or cost control. This orientation inhibited the emergence of distinctive capabilities that competitors would find difficult to replicate. For example, while frontline staff might develop valuable experiential knowledge, there were few mechanisms to codify, share, or scale that knowledge across the organisation, severely limiting its potential to become a firm-level resource.

Participants consistently described environments where learning was not institutionalised, and feedback rarely translated into action, let alone strategic renewal. One Sales Advisor (SA) shared that feedback loops were limited to minor adjustments in sales tactics, with no real understanding of how this linked to broader value propositions or long-term differentiation. A Dental Assistant (DA) also noted that, despite individual efforts to improve service quality, leadership did not provide platforms for knowledge sharing or professional growth. As she remarked: “No, leadership is very strict. The manager makes changes without speaking to employees on decisions.” Such closed systems not only stifled innovation, but also undermined the accumulation of unique organisational knowledge.

Furthermore, resources that might have held VRIN potential, such as customer proximity, tacit know-how, or employee loyalty, were neither strategically developed nor protected. The absence of absorptive capacity routines (Zahra & George, 2002), transactive memory systems (Argote & Ren, 2012), or continuous learning infrastructures (Senge, 1990) meant that these organisations failed to convert dispersed insights into scalable competitive assets. In contrast to dynamic forerunners, who intentionally developed and safeguarded such capabilities, non-dynamic laggards remained dependent on commoditised processes and interchangeable skills, eroding any chance of sustaining a long-term strategic edge.

6. Discussion and Conclusions

The findings demonstrate that organisational learning architecture, rather than VUCA severity, determines transformation outcomes: dynamic forerunners with decentralised, feedback-rich structures develop adaptive capabilities, while laggards with rigid hierarchies remain trapped in reactive routines. The following sections develop the theoretical, practical, and boundary implications of this central finding.

6.1. Theoretical implications

This study makes four specific contributions to DCs and organisational learning theory. First, we advance DCs theory by unpacking the micro-level learning mechanisms, feedback loops, cognitive shifts, and transactive memory systems, that translate VUCA-specific environmental signals into operating capability reconfiguration; prior sense-seize-transform (SST) schemas (Teece, 2007, 2023) did not specify these mechanisms, treating the sensing-to-transforming pathway as a black box, and existing organisational learning research had not connected these mechanisms specifically to the four-dimensional structure of VUCA environments.

Second, we extend MIATM 3.0 (Atanassova & Bednar, 2022) into a VUCA-specific learning architecture, the MIATM-VUCA architecture, through four additions absent from the original model: embedding VUCA-dimension analysis as a formal analytical component, enabling assessment of which VUCA pressures activate or suppress specific learning mechanisms; specifying the contextual levers (leadership, structure, systems, and culture), that enable or constrain each MIATM phase under VUCA conditions; incorporating inductively discovered mechanisms (defensive routines, organisational silence, and ambidexterity tensions) that emerged beyond the original model's specification; and developing a priori diagnostic criteria that differentiate dynamic forerunners from non-dynamic laggards, enabling the framework to be used predictively rather than merely descriptively.

Third, we specify boundary conditions for the MIATM-VUCA architecture by identifying the organisational properties (decision discretion, information visibility, and leader legitimisation of experimentation) that determine whether the full learning cycle is expressed or suppressed, thereby establishing where and when organisational learning translates into dynamic capability development under VUCA conditions and where it does not. This boundary specification transforms the framework from a universal claim into a contingent, falsifiable theoretical statement that is both theoretically rigorous and practically actionable.

Fourth, this study reveals how informal, tacit knowledge at the operational level, often overlooked in traditional capability research, can be institutionalised into collective, explicit knowledge through mechanisms such as TMS (Argote & Ren, 2012).

Together, the finding that retail (SA) and hospitality (HM) laggards face VUCA severity comparable to forerunners yet still fail to transform, as confirmed by the VUCA Characteristics of Cases Matrix, confirms the core theoretical claim: VUCA is not a deterministic cause of adaptation failure, but a condition whose consequences are wholly mediated by the organisation's learning architecture.

6.2. Practical and policy implications

This research offers important insights for both practitioners and policymakers. For managers, the findings underscore the need to design organisational systems that support decentralised, learning-focused operations. This includes flattening hierarchies, investing in collaboration technologies, and promoting cross-functional teams that can respond quickly to emerging information. Leaders are encouraged to cultivate environments of psychological safety, where experimentation and failure are seen as necessary elements of learning. MIATM can be adopted as a diagnostic and planning tool to identify where learning blockages occur and what organisational elements require reconfiguration. This is particularly relevant for traditional, bureaucratic firms and public-sector organisations facing digital and market pressures. From a policy perspective, the study emphasises the importance of incentivizing continuous learning, leadership renewal, and organisational transformation. Policymakers should consider promoting innovation ecosystems and capability-building grants, particularly for SMEs, to support agile responses to uncertainty. Cross-sector partnerships and knowledge-sharing platforms may further enhance the agility of entire industries in the face of systemic shocks.

6.3. Limitations and future research

While retrospective interviews offer deep insight into learning routines, the cross-sectional design limits observation of the temporal evolution of capabilities. A follow-on longitudinal design could track

changes in the allocation of decision rights, the cycle time and density of feedback loops, evidence of single- versus double-loop learning in the codebook, and subsequent alterations in operating routines and VRIN resources, thereby establishing processual links between learning mechanisms and capability outcomes. Future research should adopt longitudinal or process-tracing approaches to examine how learning loops mature over time and how organisations cycle through the MIATM phases as they evolve. Second, although the sample was diverse across sectors, differences in institutional constraints, regulatory environments, and digital maturity suggest that learning mechanisms may function differently across contexts. Comparative case studies could help clarify how contextual factors shape learning trajectories and DCs development. A further boundary condition concerns the hierarchical level of informants. Across cases, lower-level employees consistently reported greater strategic disconnect than senior and specialist informants, reflecting the structural limits of positional visibility rather than individual capability. This study deliberately drew on frontline accounts as ground-level validation of leadership effectiveness (Section 4.3); however, a multi-level design pairing senior and frontline informants within the same organisation would allow future research to disaggregate whether learning architecture differences reflect genuine organisational capacity or the positional constraints of single informants at varying hierarchical levels. Additionally, the impact of emerging technologies, particularly AI and data-driven decision systems, warrants further investigation. Moreover, our qualitative data capture intentional reconfiguration routines and participants' perceived effects but do not directly measure performance outcomes. Future research using panel data or archival performance indicators could test whether the routines we identify translate into sustained competitive advantage.

Future studies should explore how digital transformation reshapes transactive memory systems, sense-making routines, and feedback architectures in organisations operating under heightened volatility. Finally, autonomous or decentralised organisations (such as, DAOs or holacracies) represent a fertile context for future research. Understanding how these entities develop knowledge systems, distribute authority, and embed feedback into workflows could extend the applicability of MIATM.

6.4. Scope and boundary conditions

Our evidence suggests that the extended MIATM-VUCA learning architecture is most diagnostic in organisational settings where local actors have some decision discretion and visibility into customer and process information, and where leaders actively legitimise experimentation and reflection. Under these conditions, we observe the full cycle from recognition through sense-making to deployment and reconfiguration of capabilities, and MIATM helps distinguish dynamic forerunners from non-dynamic laggards. In tightly regulated, highly standardised contexts dominated by compliance regimes, high information asymmetry, or algorithmic control, MIATM mainly reveals blockages to learning rather than fully articulated DCs. In such settings, Phase 2 sense-making and Phase 3 deployment/reconfiguration are frequently muted or blocked, and the framework should be interpreted as identifying latent learning constraints rather than as evidence of absent adaptation per se.

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CRediT authorship contribution statement

Iva Atanassova: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft. **Peter Bednar:** Investigation, Data curation. **Huda Khan:** Writing – review & editing. **Zaheer Khan:** Supervision, Writing – review & editing. **Benjamin Laker:** Supervision, Writing – review & editing. **Adeel Khalid:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Benjamin Laker undertakes interdisciplinary research funded by grantors—including The Leverhulme Trust and The British Academy—that examines the macro-level impact of societal and environmental perturbations on organisations in conjunction with the micro-level, intra-firm strategies leaders employ to address the resulting demands. His findings have been published in the Journal of Consumer Research, Journal of Management Studies, Human Resource Management, Organizational Research Methods, Harvard Business Review, and MIT Sloan Management Review. Managerial insights derived from these findings have engendered five bestselling books, including Closing The Service Gap (Financial Times, 2023), Job Crafting (The MIT Press, 2024) and Advanced Strategic Management (Palgrave Macmillan). The latter, a textbook coauthored with the Editor-in-Chief of *Long Range Planning,* was accessed 10,000 times within its first three months of release. Benjamin is an Associate Editor at the *Journal of Business Research* and an expert panellist for the Research Council of Norway and the Economic and Social Research Council (ESRC), recently contributing to the allocation of £15 million in research funding. Benjamin also writes for *The Washington Post* and *Forbes*, where he interviews politicians—most recently Malaysia's Prime Minister—on socio-environmental strategy.

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