Trapped by Success – A Path Dependence Perspective on the Digital Transformation of Mittelstand Enterprises

Research Paper

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Abstract. Mittelstand enterprises (MEs) often implement incremental rather than radical digital transformation (DT). This study applies the path dependence theory to explore why MEs remain cautious despite abundant digital opportunities. Through a multiple-case study, we find that self-reinforcing mechanisms anchor strategic decisions in established business models, limiting radical DT even when potentially lucrative digital options emerge. Our analysis reveals normative, cognitive, and resource-based lock-ins that culminate in a 'functional lock-in'—a lock-in that stabilizes the established strategic behavior and diminishes incentives for radical change. By uncovering these mechanisms, our study contributes to understanding why MEs remain on an incremental DT trajectory despite emerging digital opportunities.

Keywords: Digital Transformation, Path Dependence, Mittelstand Enterprises

1 Introduction

Digital transformation (DT) has become a critical challenge for many organizations, particularly Mittelstand enterprises (MEs). Prior research shows that MEs approach DT cautiously, typically implementing incremental rather than radical digital change (Soluk and Kammerlander, 2021). Unlike large corporations, which often pursue large-scale transformation, MEs primarily use digital technologies to incrementally enhance existing processes and make only marginal adjustments to their business models, if any (Fabian et al., 2023). This cautious approach to DT is well-documented by a growing body of literature that attributes MEs' DT patterns to their distinctive characteristics. Several explanations have been proposed. Resource constraints, often rooted in historically developed financial and investment strategies, limit their ability to engage in large-scale DT initiatives (e.g., Li et al., 2018). Ownership structures—particularly in family businesses—reinforce a preference for stability and continuity, which has evolved over time (e.g., Soluk and Kammerlander, 2021). Further studies highlight that MEs' strong, historically grown customer orientation and niche market specialization influence how they approach DT processes (e.g., Becker and Schmid, 2020).

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However, while the characteristics are widely acknowledged as influencing DT, research does not fully explain *why* MEs' commitment to an incremental approach persists. To better understand the underlying mechanisms of MEs' DT, path dependence theory offers a promising perspective. Organizations, particularly those with established businesses, are shaped by historical decisions that create self-reinforcing mechanisms influencing future strategic choices (Sydow et al., 2020). MEs, in particular, exhibit characteristics that suggest a strong path dependence: their strategic persistence, long-term orientation, and deep-rooted organizational structures make them highly influenced by their past (de Groote and Kammerlander, 2022). Therefore, path dependence theory provides a structured lens to understand how past decisions shape present strategic behavior, emphasizing mechanisms that narrow the scope of available strategic options over time (Sydow et al., 2020). Building on this perspective, we examine whether path dependence theory can explain why MEs predominantly engage in incremental rather than radical DT. We address the following research question: *"How does path dependence shape the digital transformation of Mittelstand enterprises?"*

To answer this question, we apply path dependence theory as an analytical lens in a multiple-case study of MEs undergoing DT. We explore how self-reinforcing mechanisms embedded in established business models shape strategic decision-making in DT. Our findings reveal that MEs' realized strategic options primarily reinforce their established business model rather than drive fundamental DT. Even when digital technologies are adopted, they predominantly serve to optimize processes, increase efficiency, or enhance product performance within the traditional business framework. By analyzing the persistence of strategic lock-in, we contribute to a deeper understanding of *why* MEs remain on an incremental DT trajectory.

2 Theoretical Background

2.1 Digital Transformation in Mittelstand Enterprises

The rapid advancement of digital technologies has reshaped industries by altering customer behavior and competitive landscapes. As a result, organizations increasingly engage in DT to remain competitive (Verhoef et al., 2021). Unlike the earlier IT-enabled change, DT involves holistic organization-wide shifts driven by digital technologies rather than isolated process improvement (Hess et al., 2016, Markus and Rowe, 2023). Incremental DT focuses on optimizing existing operations—for instance, by refining processes or digitally enhancing products—while radical DT aims to create new revenue streams through digital business models (Li, 2020). From a strategic perspective, DT extends beyond merely adopting digital technologies (Sciuk et al., 2023), requiring changes in an organization's strategic orientation, capabilities, and business logic (Chanias et al., 2019). These more ambitious initiatives require rethinking organizational capabilities, leadership, and governance to sustain ongoing change (Hess et al., 2016). However, the scope and depth of DT can vary based on firm size and structural factors (Alves et al., 2016).

MEs present a distinctive context for DT (Lischke et al., 2025, Kraft et al., 2024), as they differ from both large corporations in their size, structure, and decision-making processes. Defined by up to 3,000 employees and €600 million in revenue (Becker et al., 2008), MEs frequently operate in niche markets, balancing high specialization with flexibility (Nagahawatta et al., 2021). Their strategic decisions are shaped by strong customer relationships and established market positions (Lischke and Hess, 2025). Although this long-term orientation fosters stability, it also generates temporal dependencies that shape how MEs approach DT.

Existing research highlights several factors shaping DT in MEs. Their long-term investment strategies and financial conservatism often lead to cautious decision-making and limited resources for large-scale transformation (Li et al., 2018). Being predominantly family-owned, MEs favor stability and continuity, influencing their strategic orientation (Soluk and Kammerlander, 2021). Additionally, their strong customer ties and specialization in niche markets shape their priorities, often aligning digital initiatives with existing capabilities and relationships (Becker and Schmid, 2020). Consequently, these constraints make it challenging for MEs to pursue more significant DT.

2.2 A Path Dependence Perspective

Path dependence theory explains how historical decisions influence present and future strategic choices by creating self-reinforcing mechanisms that narrow the range of available strategic options (Sydow et al., 2009). Initially developed in economics to describe technological lock-ins (Arthur, 1989), it has since been applied in organizational and management research to analyze how firms become constrained by their past (Schreyögg and Sydow, 2011). The theory is beneficial for understanding organizational rigidity, strategic persistence, and challenges in adapting to technological change.

At its core, path dependence theory posits that organizations do not operate with unlimited strategic options. Instead, early decisions shape trajectories that become increasingly difficult to reverse due to self-reinforcing mechanisms such as learning effects, sunk costs, and coordinating dependencies (Sydow et al., 2020). These mechanisms incrementally channel future decisions toward an established path. This process unfolds in three phases (**Figure 1**). In the *preformation phase*, organizations still have multiple strategic options, though early choices begin shaping their trajectory. The *formation phase* introduces self-reinforcing mechanisms that progressively narrow options, consolidating a dominant path (Sydow et al., 2009). Eventually, the *lock-in phase* is reached, where the organization becomes highly optimized within its established path, making deviation increasingly tricky. While this enhances efficiency in stable environments, it reduces adaptability when external conditions shift (Rothmann and Koch, 2014). Lock-in can manifest in three forms, each of which impedes strategic change. *Normative lock-in* stems from ingrained norms and routines that solidify structures and practices. *Cognitive lock-in* arises when deeply held assumptions and mental models anchor a firm to its established business model. Finally, *resource-based lock-in* occurs when financial and human resources are systematically allocated to reinforce existing capabilities rather than explore new opportunities (Sydow et al., 2009). A critical aspect of lock-in is the *rationality shift*, where self-reinforcing mechanisms that

initially enhance efficiency become dysfunctional constraints when external conditions change. Organizations continue to follow these mechanisms, perpetuating a no longer optimal path. This dynamic diminishes strategic flexibility and stalls necessary transformation (Rothmann and Koch, 2014).

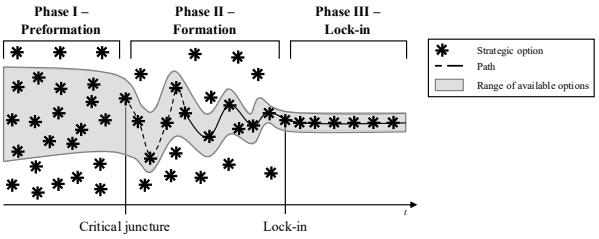

Figure 1. Formation of Organizational Paths (adapted from Sydow et al. (2009), p. 692)

Information systems (IS) research widely applied path dependence theory to examine how historical choices shape IT adoption and technological rigidity (e.g., Bharadwaj, 2000), how firms become locked into outdated IT infrastructures (e.g., Sambamurthy et al., 2003), or how digital ecosystems reinforce existing strategic paths (e.g., Yoo et al., 2012). However, IS research has often focused on technological constraints rather than the strategic persistence that underlies DT efforts.

While existing studies explore how firms struggle with technological lock-in, less attention has been paid to *how* strategic paths become entrenched over time and *why* firms remain committed to incremental change. Strategic path dependence, widely studied in firm strategy, provides a promising perspective for addressing this gap. However, its application to DT—especially in MEs—remains largely unexplored.

3 Methodology

To understand why MEs primarily pursue incremental rather than radical changes in their DT efforts, we conducted a qualitative multiple-case study (Dube and Pare, 2003, Yin, 2018). The *path dependence theory* guided our analysis to analyze how historical decision-making patterns and self-reinforcing mechanisms shape MEs' strategic options in DT. A multiple-case design is well suited for investigating complex organizational phenomena where context matters (Eisenhardt, 1989). By comparing different cases, we aim to identify common mechanisms that influence MEs' DT trajectories and explain why they engage in incremental rather than large-scale transformation.

To capture variations in how path dependence influences DT initiatives, we selected three distinct MEs for a *multiple-case study design* (**Table 1**). These firms vary in size, industry, and digital maturity, but all rely on long-established processes that have strengthened their competitive positions over time— a typical feature of MEs (Becker and Schmid, 2020). Following Eisenhardt's (1989) logic of theoretical sampling, we selected cases with differing strategic adaptations to DT but a shared context: owner-led governance, strong niche positions, and manufacturing-based value logic. This allowed us to identify recurring mechanisms and contingencies shaping path-dependent

DT strategies in MEs. For conceptual clarity, we applied Drechsler et al.'s (2022) IS scoping approach. Based on Becker et al. (2008), all MEs need to meet three criteria: revenue < €600 million, < 3,000 employees, and independent ownership; private equity or corporate-owned firms were excluded. While all firms are from the industrial machinery sector, the identified lock-ins reflect general Mittelstand patterns. We still encourage future sector-specific research. Theoretical saturation was reached, with no open theoretical questions arising in the final coding cycles.

Between January 2024 and August 2024, we conducted 16 semi-structured interviews with strategic and operational roles within the MEs to understand how path-dependency plays a role in their DT processes. Owners and top executives were prioritized, as they are central to shaping the strategic direction of MEs (Becker et al., 2018). The interviews focused on several topics, including the informant's background, role in the DT process, organizational objectives, the influence of established business models on DT, and the challenges encountered. The interviews, which averaged 55 minutes, were conducted via online meetings and transcribed verbatim to ensure accuracy.

Table 1. Case Description

	Alpha	**Beta**	**Gamma**
Industry	Professional grinding equipment	Industrial knitting machines	Seed breeding machines
Revenue	€ 345 MM	€ 110 MM	€ 250 MM
Number of employees	2,100	470	1,060
Interview partners	6 interviews with directors and department managers	3 interviews with CDO/owner and one manager	7 interviews with owner, executives, and directors

For data analysis, we followed a structured qualitative coding approach, organizing interview data into the key constructs of path dependence theory. We began with a *within-case analysis*, using three predefined categories—(1) self-reinforcing mechanisms, (2) strategic options, and (3) strategic path—to organize findings within each case. Next, we conducted a *cross-case analysis* to detect patterns, similarities, and differences across cases (Eisenhardt, 1989). We realized that all cases exhibited similar tendencies, suggesting strategic lock-ins. We synthesized the findings into overarching categories by iterating between empirical data and theoretical constructs. These categories collectively elucidate why MEs pursue incremental rather than radical DT.

4 Findings

In this chapter, we present the empirical results of our multiple-case study, illustrating how path dependence shapes MEs' DT. Our findings indicate that self-reinforcing mechanisms steer MEs toward stability rather than radical change. We begin with a within-case analysis of Alpha, Beta, and Gamma to capture each firm's unique path-dependent dynamics. We then provide a cross-case comparison highlighting a shared constraint limiting the potential for radical DT across all three cases.

4.1 Within-Case Analysis

Alpha. As a manufacturer of industrial grinding equipment, Alpha focused on optimizing grinding efficiency and precision, continuously improving machine reliability and performance. Thus, Alpha ensures stable revenue streams and retains loyal customers, creating a *self-reinforcing mechanism* where product excellence drives market success. Within this mechanism, Alpha pursued *strategic options* to standardize production processes that enhance quality consistency and reduce inefficiencies. The Director of Global Sales stated: *"We have standardized the products according to catalogs to ensure that each component meets the same standards, thus reducing the production efforts."* Additionally, Alpha introduced agile working methods and lean management practices to improve internal efficiency and support digital adoption. He explained: *"We've done a large-scale implementation of agile working […] starting step by step with the development […]. Now we're gradually pulling in other departments."* Although Alpha explored AI-driven process optimization, digital initiatives remained confined to transforming existing workflows. Instead of opening up digital business options, the company continued refining core processes and product capabilities, ensuring that digital tools align with its established operational framework. As the Director of Quality Management explained: *"We had the option to dynamically adjust the speed of the angle grinder […] via digital controls, but we did not see any benefit in that."* Consequently, Alpha remains on a *strategic path* of incremental change, focusing on refining existing processes and strengthening core product offerings while selectively integrating digital tools that align with its established operational framework.

Beta. As a manufacturer specializing in industrial knitting machines, Beta prioritizes machine standardization and modular designs to achieve seamless workflow integration, boost efficiency, and foster customer loyalty. Over time, this approach has generated a *self-reinforcing mechanism* centered on machine productivity and operational simplicity, with continuous improvements reinforcing their competitive edge. Beta prioritized *strategic options* within this mechanism that harmonized the bill of materials across subsidiaries, reducing inefficiencies while maintaining the existing manufacturing approach. The Chief Digital Officer (CDO) of Beta explained: *"We said we need to harmonize the 'bill of materials structure'. And for me, that's cost reduction because the complexity in the processes disappears."* Beta successfully automated and digitized internal processes by integrating an ERP tool to optimize workflows between development and sales. However, Beta attempted to develop standalone digital products, including a platform-based solution. Despite initial optimism, the company struggled to generate user interest and commercial viability. The CDO noted: *"We created a platform with great hopes, but we couldn't attract enough users who saw a value to pay for it. Eventually, we had to pull back."* Therefore, Beta remains on a *strategic path* of process optimization and selective digital integration, selectively incorporating automation tools while maintaining its core mechanical expertise as a market differentiator.

Gamma. By focusing on automating seed breeding processes to improve data accuracy and efficiency, Gamma has triggered a *self-reinforcing mechanism* that supports market leadership and long-term profitability. Within this mechanism, Gamma emphasizes *strategic options* that aim to automate precision agriculture technologies. The company sustains its market leadership and long-term profitability by relying on continuous technological advancements within its existing business model. To strengthen workflow efficiency, Gamma introduced global process owners who are responsible for cross-departmental process optimization. As the Director of Product Innovation explained: *"We have a new role […], called Global Process Owner. It comes from the swap history from earlier times. It's […] about focusing on processes, which often involve multiple modules, and for this, we want to have a responsible person."* Gamma also enhanced machine functionalities through software integration, increasing operational efficiency and product value. The Chief Executive Officer (CEO) highlighted: *"We have invested quite a lot in automating our machines for setup, assistance systems, steering systems, GPS, and implemented semi-automatic self-driving machines."* The hesitation to embrace digital business models is further reflected in Gamma's broader strategic outlook. The company struggles to move beyond incremental product improvements, as its engineering-driven divisions remain strongly machine-focused. As the CEO noted: *"We have too few ideas for thinking about business models. [...] We still think in terms of mechanical engineering."* Gamma's *strategic path* continues to integrate automation while selectively exploring digital solutions that align with its existing business model. Instead of pursuing radical strategies, it focuses on incremental advancements to sustain market relevance without altering its core value creation approach.

4.2 Cross-Case Comparison

The Self-Reinforcing Mechanism of MEs' Established Business Model. Our analysis shows that self-reinforcing mechanisms play a central role in how MEs approach DT. While the specific manifestations of these mechanisms vary, they consistently strengthen the established business model and thereby narrow the range of available strategic options. Across all cases, MEs focus on process and product optimization, prioritizing efficiency, cost-effectiveness, and/or incremental product improvements to strengthen their competitive advantage. This success reinforces a positive feedback loop, further solidifying their market position.

However, the exact mechanisms differ. Some MEs emphasize standardization and lean management, while others rely on long-established product logic or interorganizational structures to sustain growth. As this mechanism operates, MEs refine their core strengths, continuously improving traditional product lines to enhance customer satisfaction and loyalty. This ensures stable sales and market share, creating a predictable environment where incremental improvements dominate. However, this self-reinforcing cycle also limits radical DT by discouraging strategic experimentation and reinforcing a focus on optimizing existing business models rather than exploring new digital options. While the specific constraints differ, the shared outcome is that transformative innovations remain unrealized, keeping MEs on a path of incremental change.

Realized Strategic Options Strengthening the Established Business Model. The MEs under study realized strategic options to strengthen their established business model, allowing them to build on their strengths and continue thriving in their niche markets. We identified a set of strategic options aimed at using established technologies and practices to strengthen common reinforcing mechanisms. Therefore, we aggregated them as ***established strategic options***. One identified strategic option is *standardization and process harmonization* to improve efficiency and reduce costs. The MEs often consolidate disparate procedures, particularly across international subsidiaries, into uniform processes. For example, the CDO of Beta emphasized the need to harmonize the bill of materials structure to reduce process complexity and achieve cost savings. Standardizing processes across subsidiaries enables MEs to improve operational consistency and reduce inefficiencies to maintain their established manufacturing approach. This option strengthens the established business model by focusing on internal operations without altering the company's core products or market offerings. Another frequently observed strategy is *reducing product variety* to concentrate on core product lines. This helps control costs and reduce complexity, as the CDO of Beta stated: *"We also see it with our core product, the knitting machine […]. We don't need to offer 50 machines on the market if one machine type is only sold twice a year […]. A lot of money and effort is saved if we focus on the core and then complement it with meaningful add-ons."* Simplifying the product portfolio allows MEs to streamline production and reduce operational complexity. This strategy supports the established business model by focusing on core products that provide the most value, reducing distractions from low-demand or niche items. Similarly, MEs develop *new process responsibilities*, such as global process owners, to optimize processes. Gamma's Director of Product Innovation described how they set up the Global Process Owner as a new role to assign responsibility for global process automation. Establishing process-focused roles enables MEs to drive process improvements across departments and plants. This option strengthens the established business. Some MEs also *diversify markets to reduce risk*, expanding geographically or into new business fields that align with their established competencies. The CEO of Gamma highlighted their approach: *"[…] Diversification, we are globally positioned. […] We are 40% independent from the Eurozone. That's a very broad setup for a Mittelstand enterprise with a quarter billion in revenue."* Entering new markets allows MEs to reduce reliance on a single region and mitigate risks associated with regional economic downturns. This option supports the established business model by extending the company's reach without deviating from its core product lines.

In addition to the established strategic options, we identified a set of strategic options that aimed at using digital technologies to strengthen the established business model. Therefore, we aggregated them as ***digital strategic options***. One of them is the *automation and digitization of existing processes* to improve efficiency. Beta, for example, implemented a tool in its ERP system to optimize internal workflows between the development and sales departments. Their CDO mentioned: *"For example, when my designer starts working on a [product], it immediately gets the status 'Item in Progress,' and […] the service employee can no longer order it for delivery […]. That's cost reduction because the complexity in the processes disappears."* Automating and consolidating processes into uniform workflows enhances productivity while maintaining

MEs' established manufacturing and service approach. Another widely observed digital strategic option, strengthening the established path, is the *enhancement of existing products with digital services* that add value without changing the fundamental business model. For instance, Gamma optimized its machines by integrating software-based functionalities such as automation, assistance systems, and GPS control. Enhancing core products with digital technologies improves performance and adds customer value while ensuring alignment with the company's traditional business focus. Lastly, some MEs incorporate *new digital process capabilities* like agile working methods or lean management to master digital tools. For example, Alpha implemented agile practices across multiple departments, starting with development and gradually expanding to other areas. Such approaches allow MEs to enhance efficiency in digital tool usage and optimize established business processes.

Not Realized Digital Strategic Options. While identifying digital strategies to enhance their business models, MEs considered but ultimately rejected several options that did not align with their core products or business processes. MEs acknowledged the potential of digital strategic options but chose not to pursue them due to ***misalignment within the existing operational practices***. A notable example comes from Beta's CDO, who discussed the strategic option of implementing smart glasses for remote service: *"Service via smart glasses […]. In theory, it sounds wonderful. But no one adopted it. […] How did the reality look? Service employees at customer sites would [simply use their phone to call and] film things using their phones, asking for help."* The rejection of smart glasses illustrates that digital innovations must seamlessly integrate into existing workflows to be effectively adopted by MEs.

Similarly, the MEs saw the potential of digital strategic options but chose not to pursue them when they ***did not align with the core function of their products***. A notable example comes from Alpha's Director of Quality Management, who discussed the strategic option of integrating digital controls into an angle grinder: *"An angle grinder must work as such. You can't just attach data or digital functions to it."* This case reflects a broader tendency among MEs to adopt digital enhancements selectively, ensuring they provide clear functional value to industrial tools before implementation. These cases illustrate that while MEs value digital technologies, alignment with existing business models, processes, and product functions remains a key criterion for implementation. Digital strategic options are pursued selectively to ensure practical and effective integration with well-established operations. Therefore, the past success of MEs inhibits the consideration of more radical strategic options within their DT efforts.

Established Strategic Path of MEs. The strategic path of MEs is defined by a strong commitment to their traditional business model, prioritizing gradual improvement over radical change. Findings across cases show that this path is shaped by core process optimization, product refinement, and cost efficiency, reinforcing their competitive position over time. MEs strategically select options that align with their existing competencies, focusing on enhancing internal operations, streamlining production, and strengthening customer relationships. Rather than pursuing radical innovations, they

prioritize stability and predictability, ensuring that improvements build upon proven strengths rather than introducing uncertainty. This strategic pattern relies heavily on reinforcing existing practices. By continuously refining existing practices, MEs create a self-reinforcing loop that supports long-term growth without fundamentally altering their strategic direction. As a result, MEs rarely deviate from their traditional path but instead leverage incremental advancements to strengthen their market position.

5 Discussion

Our study aimed to understand why MEs primarily pursue incremental rather than radical DT. While existing research highlights MEs' cautious approach to DT, it remains unclear *why* they continue to follow this path despite evident opportunities. Using path dependence theory, we examined whether self-reinforcing mechanisms shape strategic decision-making and limit the radicality of MEs' DT. Our data reveal that MEs engage in DT, including product adaptations, primarily to reinforce their traditional business model rather than to develop new digital businesses. Even when digital options emerge, they are deprioritized if they do not reinforce the existing strategic path.

Building on these insights, we conclude that MEs exhibit ***strategic lock-in*** by selectively embracing digital options that reinforce rather than challenge their established path. Even promising digital business models are deprioritized if they are not on the established strategic path and do not align with the core business. For instance, Alpha briefly explored a digital grinding tool with advanced control capabilities but dismissed it due to little added value for its established business model—fitting a central lock-in indicator (Sydow et al., 2012). Similarly, Beta continued to rely on traditional sales representatives instead of restructuring its distribution channels via digital platforms, thereby preserving its established sales model. This decision aligns with a lock-in indicator (Sydow et al., 2012), as Beta's interorganizational ties—particularly with customers—was largely unquestioned, hindering any shift toward digital sales. These cases show how self-reinforcing mechanisms and taken-for-granted assumptions create a strategic lock-in that shapes DT in MEs. Rather than consciously rejecting radical DT, MEs become unwittingly bound by historically successful practices and values, which channel their strategic behavior toward strengthening established business models rather than establishing new digital businesses. Once a competitive advantage, these path-dependent success patterns now constrain how MEs perceive and prioritize emerging digital strategic options. Subsequently, they not only assign lower priority to radical ideas but also reframe them to entrench existing trajectories, ultimately constraining DT. We consequently propose:

> ***P1****: "MEs do not intentionally reject radical DT, yet a strategic lock-in confines DT efforts to incremental improvements. By prioritizing options that align with the existing business model, they unintentionally limit the potential for radical DT."*

By consistently prioritizing stability, efficiency, and incremental improvements over radical change, MEs show specific types of lock-in that influence how they interpret and implement DT. Gamma, for instance, emphasizes self-sufficiency and internal ex-

pertise, rejecting external collaboration even when it could expedite DT. The firm insists on developing all competencies in-house, reinforcing its established independence. Although this stance once conferred a competitive advantage, it now inhibits Gamma's integration into digital ecosystems and partnership-based business models. This behavior illustrates a ***normative lock-in*** (Sydow et al., 2009), in which ingrained routines and established norms guide decision-making and make deviations from the existing path appear misaligned or implausible. By contrast, Beta struggles with DT because its leadership lacks a fundamental understanding of DT, which leads to an overwhelming perception of cross-functional IT integration. As a result, the firm confines digital initiatives to process optimization rather than exploring new business models. Since Beta does not challenge its operational paradigm, its digital strategy remains incremental. This scenario reflects a ***cognitive lock-in*** (Sydow et al., 2020): deeply embedded assumptions limit decision-making and discourage considering alternative strategic paths. Likewise, Alpha exemplifies how resource allocation cements existing trajectory. The firm prioritizes investments in legacy IT over pursuing new digital opportunities, ensuring stability while limiting strategic renewal. DT thus remains reactive, addressing internal constraints instead of fueling value creation. This situation represents a ***resource-based lock-in*** (Sydow et al., 2020), in which financial and human resources systematically reinforce the current course, making it difficult to deviate from the established path. This leads us to the following proposition:

P2*: "In MEs, lock-in manifests in normative, cognitive, and resource-based forms, each of which constrains the potential for radical digital transformation."*

Our study reveals that the lock-in in MEs' DT occurs before the rationality shift, described in path dependence theory (Rothmann and Koch, 2014, Sydow et al., 2020). Unlike prior research, which primarily examines lock-ins after this shift—when reinforcing mechanisms turn dysfunctional—we conceptualize our findings as a ***'functional lock-in'*** that stabilizes the existing business model through established norms, cognitive frames, and resource-allocation routines. MEs pursue DT while their profitable, effective business model remains intact. Their strong niche market position and limited competition foster stability and reduce pressure for radical change. This stability, reinforced by self-reinforcing mechanisms, does not constrain adaptation or lead to inefficiency, as seen in dysfunctional lock-ins (Sydow et al., 2020). Instead, it incentivizes an incremental rather than disruptive approach to DT. Rather than challenging their established path, MEs use DT primarily to optimize and extend their current business model. From a path dependence perspective, the mechanisms at play in this stage remain performance-enhancing rather than restrictive. However, because these mechanisms reinforce the existing business model's success, they reduce the incentive to explore digital strategic options that could open up digital business models—a contrast to studies on dysfunctional lock-ins after the rationality shift (e.g., Rothmann and Koch, 2014). Therefore, we propose:

P3*: "A functional lock-in strengthens an established business model and makes radical digital transformation unlikely unless a significant contextual shift occurs."*

Consequently, the absence of external pressures or crises delays more radical DT in MEs. Without clear incentives, they reinforce existing strategies instead of pursuing fundamental DT. This raises the question of how MEs can proactively engage in DT

despite functional lock-in. Future research should examine mechanisms enabling this shift—such as external collaborations, dual transformation strategies, or fostering a change in managerial cognition toward digital-first thinking. Furthermore, our cases involve MEs with strategic goals beyond efficiency, forming the basis for Proposition 3. Such ambitions are rarer in smaller MEs (<€50M revenue, <250 employees), which focus on core optimization. Thus, while Propositions 1 and 2 may apply broadly, Proposition 3 might be specific to larger MEs. Future research should test this across firm sizes and explore sectoral differences, as our study focuses on industrial firms.

6 Contribution and Practical Implications

This study contributes to IS literature by explaining why MEs engage in incremental rather than radical DT, not merely because of external constraints but a functional strategic lock-in that limits flexibility. While previous research has primarily highlighted external barriers, our findings demonstrate that normative, cognitive, and resource-based lock-ins reinforce stability over transformation, leading MEs to prioritize strategic options that optimize existing business models rather than finding new digital ones.

By adding to the discussion on path dependence theory in IS research, we demonstrate that lock-in occurs at the strategic level, not just in technology choices (e.g., QWERTY). Even without external pressures, MEs remain anchored in their traditional business models, using digital tools to refine operations rather than develop new revenue models. This suggests that self-reinforcing mechanisms sustain the existing trajectory while constraining strategic choices. Rather than external inhibitors, entrenched routines, cognitive frames, and resource allocation patterns limit transformation, reinforcing incremental change.

From a practical standpoint, our findings show that functional lock-ins, which constrain MEs' DT, are rooted in decision-making structures, often rendering transformation reactive instead of proactive. To overcome such functional lock-ins in a way that remains consistent with the path breaking litterature (Sydow et al., 2020), MEs must first identify the underlying reinforcing mechanisms—such as routines, ingrained assumptions, or resource allocation patterns. This awareness helps loosen the lock-in and foster digital ambidexterity—balancing efficiency-driven digitalization with explorative digital innovation. To do so, leaders must rethink managerial assumptions and see digital technologies not only as tools for optimization but also as enablers of new value creation. A guiding question is: Are we pursuing DT for efficiency—or for renewal? For firms aiming to move beyond 'more of the same,' structural solutions such as dual transformation, external partnerships, or dedicated teams can create space for innovation without destabilizing the core business. In addition, policymakers should complement financial support with mentorship and strategy-oriented programs that help firms address path-dependent constraints and build long-term digital capabilities.

By uncovering how path dependence shapes MEs' strategic DT, this study offers insights into the strategic inertia rooted in MEs' past success. While we offer an initial indication of escaping such lock-ins, future research should explore more deeply how firms can overcome such constraints and engage in radical DT.

References

Alves, M. F. R., Salvini, J. T. S., Bansi, A. C., Neto, E. G. & Galina, S. V. R. (2016), 'Does the Size Matter for Dynamics Capabilities? A Study on Absorptive Capacity', *Journal of Technology Management & Innovation* **11**(3), 84-93.

Arthur, W. B. (1989), 'Competing Technologies, Increasing Returns, and Lock-In by Historical Events', *The Economic Journal* **99**(394), 116-131.

Becker, W. & Schmid, O. (2020), 'The Right Digital Strategy for Your Business: An Empirical Analysis of the Design and Implementation of Digital Strategies in SMEs and LSEs', *Business Research* **13**(3), 985-1005.

Becker, W., Schmid, O. & Botzkowski, T. (2018), Role of CDOs in the Digital Transformation of SMEs and LSEs. An Empirical Analysis, *in* 'Proceedings of Hawaii International Conference on System Sciences', Hawaii, USA.

Becker, W., Staffel, M. & Ulrich, P. (2008), *Mittelstand und Mittelstandsforschung.* Deloitte Mittelstandsinstitut. Bonn, Germany.

Bharadwaj, A. (2000), 'A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation', *MIS Quarterly* **24**, 169-196.

Chanias, S., Myers, M. D. & Hess, T. (2019), 'Digital Transformation Strategy Making in Pre-digital Organizations: The Case of a Financial Services Provider', *The Journal of Strategic Information Systems* **28**(1), 17-33.

De Groote, J. K. & Kammerlander, N. (2022), 'Breaking With the Past to Face the Future? Organizational Path Dependence in Family Businesses', *Organization Studies* **44**(5), 713-737.

Drechsler, A., Hönigsberg, S. & Watkowski, L. (2022), What's In an SME? Considerations for Scoping Research on Small And Medium Enterprises and Other Organisations in the IS Discipline, *in* 'Proceedings of European conference on information systems', Timișoara, Romania.

Dube, L. & Pare, G. (2003), 'Rigor in Information Systems Positivist Case Research: Current Practices, Trends, and Recommendations', *MIS Quarterly* **27**, 597-635.

Eisenhardt, K. M. (1989), 'Building Theories from Case Study Research', *The Academy of Management Review* **14**(4), 532-550.

Fabian, N. E., Dong, J. Q., Broekhuizen, T. & Verhoef, P. C. (2023), 'Business Value of SME Digitalisation: When Does it Pay Off More?', *European Journal of Information Systems* **33**(3), 383-402.

Hess, T., Matt, C., Benlian, A. & Wiesböck, F. (2016), 'Options for Formulating a Digital Transformation Strategy', *MIS Quarterly Executive* **15**(2), 123-139.

Kraft, T., Lischke, L. & Kranz, J. (2024), How are Mittelstand enterprises navigating the digtal transformation process? An exploratory study in Germany, *in* 'Proceeding of European Conference on Information Systems', Paphos, Cyprus.

Li, F. (2020), 'Leading Digital Transformation: Three Emerging Approaches for Managing the Transition', *International Journal of Operations & Production Management* **40**(6), 809-817.

Li, L., Su, F., Zhang, W. & Mao, J.-Y. (2018), 'Digital Transformation by SME Entrepreneurs: A Capability Perspective', *Information Systems Journal* **28**(6), 1129-1157.

Lischke, L. & Hess, T. (2025), Stuck With Tradition – Unpacking Digital Transformation Strategies of German Mittelstand Enterprises, *in* 'Proceedings of the European Conference on Information Systems', Amman, Jordan.

Lischke, L., Kraft, T., Kranz, J. & Hess, T. (2025), Contextualizing the Digital Transformation for SMEs-Insights from a Systematic Literature Review, *in* 'Proceedings of the Hawaii International Conference on System Sciences', Hawaii, USA.

Markus, M. & Rowe, F. (2023), 'The Digital Transformation Conundrum: Labels, Definitions, Phenomena, and Theories', *Journal of the Association for Information Systems* **24**, 328-335.

Nagahawatta, R., Warren, M., Salzman, S. & Lokuge, S. (2021), Security and Privacy Factors Influencing the Adoption of Cloud Computing in Australian SMEs, *in* 'Proceedings of Pacific Asia Conference on Information Systems', Dubai, UAE.

Rothmann, W. & Koch, J. (2014), 'Creativity in Strategic Lock-Ins: The Newspaper Industry and the Digital Revolution', *Technological Forecasting and Social Change* **83**, 66-83.

Sambamurthy, V., Bharadwaj, A. & Grover, V. (2003), 'Shaping Agility Through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms', *MIS Quarterly* **27**, 237-263.

Schreyögg, G. & Sydow, J. (2011), 'Organizational Path Dependence: A Process View', *Organization Studies* **32**(3), 321-335.

Sciuk, C., Engert, S., Gierlich-Joas, M., Wagner, T. & Hess, T. (2023), A Journey, not a Destination—A Synthesized Process of Digital Transformation, *in* 'Proceedings of International Conference on Information Systems', Hyderabad, India.

Soluk, J. & Kammerlander, N. (2021), 'Digital Transformation in Family-Owned Mittelstand Firms: A Dynamic Capabilities Perspective', *European Journal of Information Systems* **30**(6), 676-711.

Sydow, J., Schreyögg, G. & Koch, J. (2009), 'Organizational Path Dependence: Opening The Black Box', *Academy of Management Review* **34**(4), 689-709.

Sydow, J., Schreyögg, G. & Koch, J. (2020), 'On the Theory of Organizational Path Dependence: Clarifications, Replies to Objections, and Extensions', *Academy of Management Review* **45**(4), 717-734.

Sydow, J., Windeler, A., Müller-Seitz, G. & Lange, K. (2012), 'Path Constitution Analysis: A Methodology for Understanding Path Dependence and Path Creation', *BuR - Business Research* **5**(2), 155-176.

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N. & Haenlein, M. (2021), 'Digital Transformation: A Multidisciplinary Reflection and Research Agenda', *Journal of Business Research* **122**, 889-901.

Yin, R. K. (2018), *Case Study Research and Applications.* Thousand Oaks, CA, Sage.

Yoo, Y., Boland, R., Lyytinen, K. & Majchrzak, A. (2012), 'Organizing for Innovation in the Digitized World', *Organization Science* **23**, 1398-1408.