

## AN EXPLORATION OF DIGITAL RESILIENCE FOR SMALL AND MEDIUM SIZED ENTERPRISES DURING GEOPOLITICAL SHOCK

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### ABSTRACT

*This study investigates how manufacturing SMEs achieve digital resilience amid geopolitical uncertainty. Drawing on extant evidence from Central and Eastern European manufacturing firms following the 2022 Russia–Ukraine conflict, we examine the puzzling gap between increased digital investments and actual resilience outcomes. While roughly three-quarters of CEE manufacturing SMEs increased digital technology investments post-crisis (EIB, 2023), only about one-third report measurable improvements in operational resilience. Three theoretical perspectives are examined: paradox theory, threat–rigidity theory, and dynamic capabilities, to offer valuable insights into SME digital resilience and construct a novel model. Through a systematic literature synthesis, we develop the PLUS–D framework, which integrates paradoxical leadership, learning capabilities, unabsorbed slack, shock exposure, and digitalization intensity as configurational elements. The synthesis identifies five distinct pathways to digital resilience, demonstrating both equifinality (multiple paths to success) and causal asymmetry (qualitatively different failure patterns). The analysis challenges linear assumptions about technology adoption, suggesting that organizational configurations, rather than investment levels alone, determine resilience outcomes under geopolitical shocks.*

**KEYWORDS:** *causal asymmetry, configurational analysis, digital resilience, dynamic capabilities, paradox theory.*

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### 1. INTRODUCTION

The February 2022 Russian military conflict with Ukraine has created unprecedented disruptions for Central and Eastern European (CEE) manufacturing networks. Energy prices surged between 20% and 45% across different sectors, critical supply chains fragmented as Ukrainian and Russian suppliers disappeared overnight, and cross-border logistics costs tripled due to rerouting requirements and security concerns (European Commission, 2023). For the approximately 1.2 million manufacturing Small and Medium sized Enterprises (SMEs) operating in Poland, Czech Republic, and Romania, representing 68% of manufacturing employment in these countries, these cascading shocks necessitated immediate strategic responses.

Digital transformation emerged as a prominent adaptation strategy. The European Investment Bank's 2023 survey reveals that 78% of CEE manufacturing SMEs increased their investments in digital technologies following the crisis, compared to 52% in the pre-crisis period (EIB, 2023). This

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pattern reflects broader crisis-driven digitalization trends observed during recent global disruptions. Yoo and Ichikohji (2023) demonstrated that during the COVID-19 pandemic, public sector policy initiatives catalyzed private sector digital transformation, with digital transformation activities initially declining but then surging as organizations recognized the permanence of environmental changes. Yet this surge in digital investment has not translated uniformly into improved organizational resilience. Only 34% of firms report achieving measurable improvements in operational resilience through their digitalization efforts, while 41% experienced no significant change, and 25% report decreased resilience due to implementation challenges and resource strain. This substantial digitalization-resilience gap presents a theoretical and practical puzzle. Traditional technology adoption models, rooted in information systems and strategy literature (Baker et al., 2012; Verhoef et al., 2021), predict that greater investment in digital technologies should yield proportional improvements in organizational performance. The empirical reality clearly contradicts these linear assumptions, suggesting that the relationship between digitalization efforts and resilience outcomes is far more complex than current theories acknowledge.

## 2. LITERATURE REVIEW

### 2.1 Paradox Theory

Paradox theory provides a powerful lens for understanding the contradictory demands SMEs face during digital transformation. Four distinct groups are identified by Smith and Lewis (2011). These are learning paradoxes, belonging paradoxes, performance paradoxes and organizational paradoxes as demonstrated in figure 1. While Smith and Lewis (2011) position paradoxical tensions as universal features requiring paradoxical leadership for resolution, our configurational analysis reveals a more nuanced reality. Paradoxical leadership alone proves insufficient as its effectiveness depends on supporting conditions. Fairhurst et al.'s (2016) meta-theoretical insight indicates that paradox research has diverged in management approaches while converging on core tension types.

Nature of paradoxes	Paradoxes identified	SME organizational Specificity
Paradoxes of performing	Need to transform to gain profitability while remaining profitable in its daily activities.	Lack of resources
Paradoxes of learning	The difficulty of adopting new tools is more pronounced for older individuals than for the younger ones. Digital transformation is initiated by the leaders but carried out and embraced by the front-line employees. The approach is top-down for deployment, but there is no bottom-up feedback to ensure user adoption and if training is suitable.	Same for large companies Centrality of leadership Centrality of leadership
Paradoxes of organizing	SMEs to outsource a significant part of their digital transformation implies a lack of data control and dependence on service companies. The goal is to save time resources (time efficiency by optimizing business practices), but digital transformation is limited precisely due to this time shortage.	Lack of resources Lack of resources
Paradoxes of belonging	For a multi-site company: the paradox of standardizing processes while considering cultural aspects. DT's positives global implication VS potential negatives individual implications	Same for large companies Same for large companies

**Figure 1. Paradoxes in Digital Transformation of SMEs.**

Source: *Cagnelle et al. (2024). p.7*

Failure of configurations illuminate paradox theory's boundaries. For example, when resource slack combines with digital maturity, paradoxical leadership enables sophisticated strategies through structural separation (dual systems) or temporal alternation. Or, when a situation reveals an alternative mechanism where paradoxical leadership functions through temporal separation rather than structural solutions. Digital transformation intensifies three core paradoxes for SMEs. These are the efficiency-innovation paradox (Bouwman et al., 2019; Sarkees & Hulland, 2009), the integration-flexibility paradox (Matarazzo et al., 2021), and the global-local paradox (Dzwończyk, 2016; Nambisan & George, 2024).

The efficiency-innovation paradox refers to the emerging of digital technologies which simultaneously promise operational streamlining and require experimental learning. On one hand, enterprise resource planning (ERP) systems, robotic process automation, and AI-driven optimization offer unprecedented opportunities to reduce costs, minimize errors, and accelerate processes. On the other hand, realizing these efficiency gains requires substantial upfront investment, tolerance for implementation failures, and acceptance of temporary productivity declines during learning periods (Bouwman et al., 2019). For SMEs operating with thin margins and limited slack, this creates acute tension: they must reduce costs to survive today while investing in innovations needed for tomorrow's competitiveness.

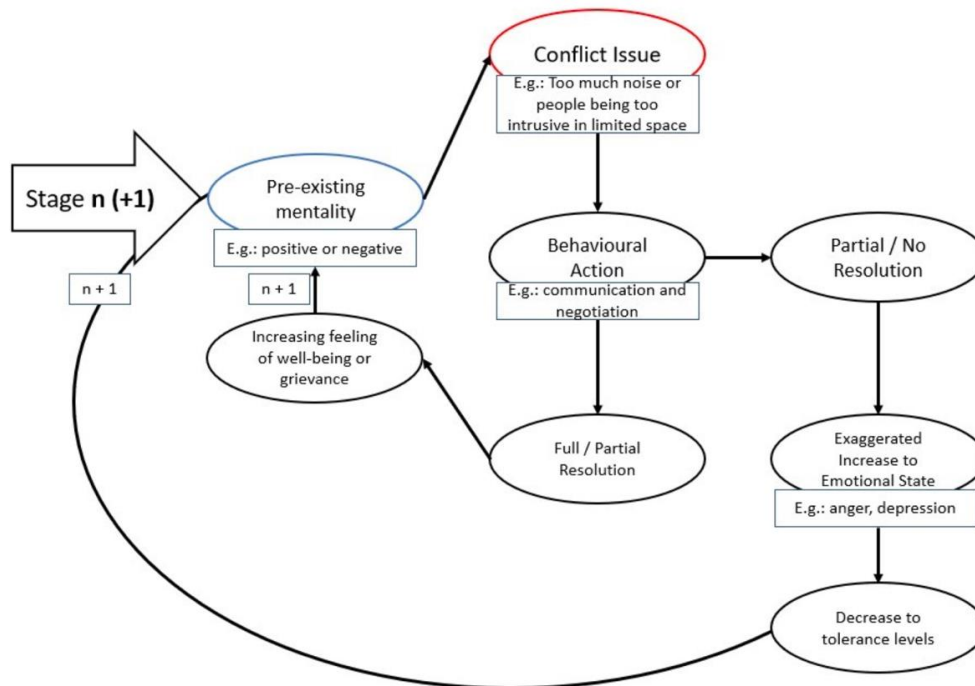
The integration-flexibility paradox surfaces when digital system integration improves coordination but potentially reduces agility. Modern digital technologies excel at creating seamless information flows, synchronized processes, and real-time visibility across organizational boundaries. Cloud-based platforms can integrate previously siloed functions, while APIs enable ecosystem-wide coordination. Yet this very integration can create rigidities that compromise the adaptability SMEs traditionally rely upon for competitive advantage (Matarazzo et al., 2021).

The global-local paradox is demonstrated when digital platforms enable geographic expansion while potentially diluting localized competitive advantages. Digital technologies offer SMEs unprecedented access to global markets through e-commerce platforms, digital marketing tools, and remote collaboration capabilities. Yet these same technologies can commoditize offerings previously differentiated through local knowledge, personal relationships, and cultural embeddedness (Nambisan & George, 2024).

## **2.2 Threat Rigidity Theory**

Threat as defined by Staw et al. (1981), is the reaction to an environmental change brought about by psychological stress. Rigidity in this study refers to organizations' tendency to revert to conventional operations after changes take place. The inter-relation between threat and rigidity is demonstrated in Figure 2. Perceptions of threat cause restriction of information or constriction of control, which leads to rigidity in response (Staw et al., 1981).

Jones et al. (2011) further demonstrated that urgency causes detrimental effects on decision making due to a biological outcome of producing „fast but possibly premature responses”. Additionally, a study by Law et al. (2022) identified that psychological stress can be caused by specific types of work activities, creating both public and personal stigma. These outcomes have negative impacts on work performance. Law (2023) further identifies that employees who experience ongoing negative or difficult work challenges have the tendency to lead to compounding psychological stress as shown in figure 3. The significance therefore is an increasing rigidity in responses that will reinforce the desire to fall back on well learned practices.



**Figure 2. Effects of Occupational Threats as Compounding Psychological Stress**

*Source: Law (2023). p.147*

The essence of rigidity is an obstacle to business adaption, pragmatism and flexibility. This is especially true in the face of long-term shifts in social or market change. This is irrespective to the desire to pivoting due to fundamental changes in market demands (Balta et al., 2023; Golik-Górecka, 2022; Comberg et al., 2014). This has been demonstrated by companies such as IBM which shifted from a technology focus to services (Jetter et al., 2009) and Fujifilm's shift away from its reliance on photographic film (Nishizaki, 2016). The effect of changing the business model has a significant and profound impact on the organization itself in terms of corporate vision and philosophy, as well as operations and organizational behaviour.

### 2.3 Digital Transformation

The European Investment Bank's 2023 survey revealed that 78% of CEE manufacturing SMEs increased their investments in digital technologies following the crisis, compared to 52% in the pre-crisis period (EIB, 2023). This pattern reflects broader crisis-driven digitalization trends observed during recent global disruptions. Yoo and Ichikohji (2023) demonstrated that during the COVID-19 pandemic, public sector policy initiatives catalyzed private sector digital transformation, with digital transformation activities initially declining but then surging as organizations recognized the permanence of environmental changes. Yet this surge in digital investment has not translated uniformly into improved organizational resilience. Traditional technology adoption models, rooted in information systems and strategy literature (Baker et al., 2012; Verhoef et al., 2021), predict that greater investment in digital technologies should yield proportional improvements in organizational performance.

Existing literature offers valuable but partial insights from distinct theoretical perspectives. The technology adoption literature emphasizes resource availability, technological readiness, and organizational capabilities as key determinants of successful digital transformation (Baker et al., 2012; Matarazzo et al., 2021). Crisis management research highlights the critical role of organizational flexibility, leadership quality, and prior crisis experience in determining adaptation success (Bundy et al., 2017). The emerging digital transformation literature focuses on dynamic

capabilities, strategic alignment, and ecosystem embeddedness as crucial factors (Verhoef et al., 2021; Teece, 2007). However, these singular theoretical lenses, when applied independently, fail to explain why SMEs with seemingly similar resource endowments, facing identical external shocks, and pursuing comparable digitalization strategies achieve dramatically different resilience outcomes.

This configurational perspective acknowledges two critical aspects of causal complexity. First, equifinality, the recognition that multiple, equally effective pathways can lead to the same desired outcome (Doty et al., 1993). Second, causal asymmetry, the understanding that causes of success differ qualitatively from causes of failure, not merely in degree but in kind (Fiss, 2011). These insights suggest that understanding SME digital resilience requires analytical approaches that preserve rather than eliminate complexity.

### **3. RESEARCH OBJECTIVES**

This research aims to demonstrate and validate the connectivity between different theories as a more holistic model. To enable this, our new model named PLUS-D is tested to demonstrate such connectivity. Therefore, the research questions for this study are as follows:

1. What organizational configurations connect SME digitalization efforts to digital resilience under geopolitical shock?
2. Under which boundary conditions does paradoxical leadership mitigate threat rigidity and enable the conversion of digital investments into resilience?
3. How do dynamic capabilities interact with organizational slack and shock exposure to generate both successful and failed pathways?

### **4. RESEARCH METHODOLOGY**

This research proposes that explanatory failure stems from a fundamental mismatch between theoretical approach and empirical phenomenon. Current theories examine individual factors in isolation or, at best, their additive effects. Yet organizational phenomena, particularly in crisis contexts, are inherently configurational, emerging from complex interactions among multiple conditions (Meyer et al., 1993). Drawing on configurational theory (Fiss, 2007; Meyer et al., 1993), we propose that digital resilience emerges not from the presence or absence of single conditions but from specific combinations of organizational and environmental factors working in concert. Furthermore, two critical aspects of causal complexity are recognised. Equifinality, which indicates multiple, equally effective pathways can lead to the same desired outcome (Doty et al., 1993). And, causal asymmetry, where causes of success differ qualitatively from causes of failure, not only in degree, but also in kind (Fiss, 2011).

A literature review matrix is constructed to organize, compare and synthesize existing research on the themes of paradox theory, business model innovation, crisis-driven digitalization and dynamic capabilities. This represents a comparative configurational analysis of prior studies. Seven variables are examined. These are the study, year of publication, theoretical focus, data collection method, context, key findings, and addressed gap.

### **5. DATA ANALYSIS**

Table 1 maps our study against related relevant scholarship in digital transformation, paradox management, and crisis adaptation.

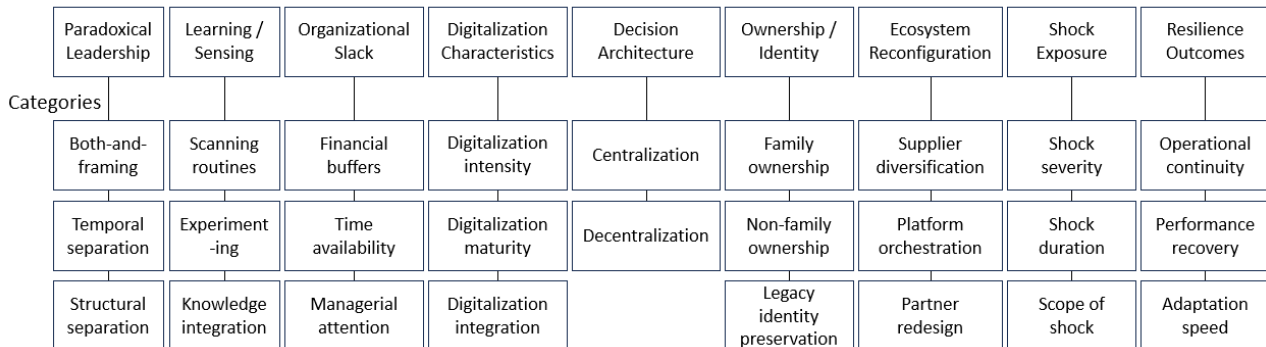
**Table 1. A Sample of Data; Positioning Within Digital Transformation Literature**

Study	Year	Theoretical Focus	Method	Context	Key Finding	Anticipated Gap
Fairhurst, et al.	2016	Paradox meta-theory	Meta-analysis	Multi-domain review	Paradox management diverges despite converging tensions.	Boundary conditions for paradoxical leadership effectiveness.
Soluk & Kammerlander	2021	Paradox theory	Multiple case study (n=42)	Family owned Mittelstand	Family influence shapes dynamic capabilities and digital transformation paths.	Identity as moderating condition in capability-resilience link.
Bouwman, et al.	2019	Business model innovation	Survey (n=337)	Multi-country SMEs	Digitalization reshapes business model components; performance effects are context-dependent.	Shock severity as boundary condition for digital investment returns.
Yoo & Ichikohji	2023	Crisis-driven digitalization	Longitudinal analysis	Japanese organizations	Public sector DX policies preceded private sector adoption during pandemic.	Temporal dynamics in crisis-digitalization relationship.
Matarazzo, et al.	2021	Dynamic capabilities	Multi-case study (n=6)	Italian manufacturing SMEs	Sensing/Learning capabilities trigger transformation.	Configurational role of capabilities with slack resources.
Di Paola, et al.	2024	QCA methodology	Systematic review (n=675)	Business, management	Theory-method integration crucial for QCA success.	Methodological framework for configurational synthesis.

*Source: Authors’ Own Material Adapted from Specified Sources*

From our systematic review of literature, the themes and categories which emerged from the data can be seen in figure 1. Nine overarching themes encapsulated the categories and codes. These were paradoxical leadership, learning or sensing, organizational slack, digital characteristics, decision architecture, ownership or identity, ecosystem reconfiguration, shock exposure and resilience outcomes. These themes will be discussed in more detail in the findings and discussion section.

**Themes**



**Figure 3. Themes and Categories Identified from the Literature**

*Source: Authors’ Own Material*

## 6. FINDINGS & DISCUSSION

The literature review matrix reveals that while recent studies have examined pieces of the digital resilience puzzle, there is a lacking in integrated multiple theoretical perspectives using configurational methods to explain divergent outcomes. Our analysis of the studies synthesized in Table 1 reveals three critical gaps that our study addresses. The literature exhibits theoretical pluralism without integration. Paradox theory studies primarily operate independently from dynamic capabilities research (Soluk & Kammerlander, 2021; Matarazzo et al., 2021), which in turn remains disconnected from business innovation literature (Bouwman et al., 2018). This fragmentation limits understanding of how these mechanisms interact configurationally to produce resilience outcomes. Secondly, while studies identified individual factors influencing digital transformation success, they lacked specificity about under which conditions elevated the factors from sufficient to necessary. For instance, Matarazzo et al. (2021) demonstrated that sensing capabilities trigger transformation, but do not clarify when these capabilities require complementary conditions such as slack resources or paradoxical leadership to translate into resilience. Finally, existing studies implicitly assume symmetric relationships. Factors leading to success are the inverse of those causing failure. This overlooks causal asymmetry, where fundamentally different configurations may lead to failure, as suggested by the divergent findings between Bouwman et al.'s (2018) performance variations and Yoo and Ichikohji's (2023) adoption patterns.

Based on our synthesis of the reviewed literature, we propose five theoretical configurations that address our research questions. These patterns emerge from our analysis of the studies listed in Table 1 and additional literature examining SME digitalization under crisis conditions.

Firstly, a slack-enabled pathway which addresses both organizational configurations connecting SME digitalization efforts to digital resilience under geopolitical shock, and also the boundary conditions in which paradoxical leadership mitigates threat rigidity and enables conversion of digital investments into resilience. The present conditions are a high paradoxical leadership and high unabsorbed slack in the form of financial or time buffers during moderate digitalization. An expected contextual condition is a low-to-moderate shock exposure in an immediate or near-term resilience. As suggested by Smith and Lewis (2011), slack resources may enable both-and strategies through temporal separation.

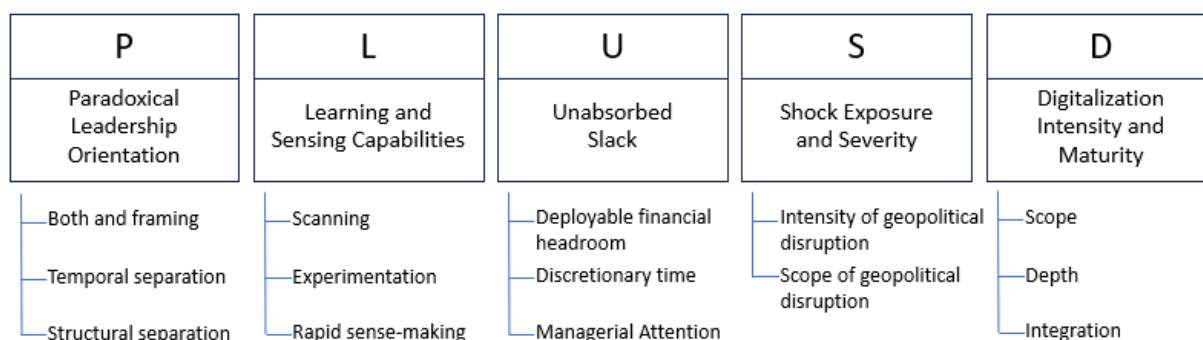
Secondly, a capability driven adaptation addressing organizational configurations connecting SME digitalization efforts to digital resilience under geopolitical shock but also examining the dynamic capabilities' interaction with organizational slack and shock exposure to generate pathways. Presently, there are high learning capabilities such as active environmental scanning, decentralized architecture, such as distributed decision rights, high digitalization and ecosystem reconfiguration as in supplier diversification or platform orchestration. Absent conditions include identity lock-in. An expected theoretical outcome may be a gradual resilience with an initial performance dip. Therefore, a proposed mechanism is distributed sensing, which facilitates rapid reconfiguration consistent with Teece (2007) and Matarazzo et al. (2021).

Thirdly, a crisis-catalyzed transformation addressing boundary conditions where paradoxical leadership mitigates threat rigidity. The present conditions are prior crisis experience, paradoxical leadership, and low initial digitalization. Absent conditions are high centralization. Therefore, an expected outcome is accelerated digital adoption and resilience. The proposed mechanism is a crisis experience which reduces threat-rigidity response as suggested by the contrast between Staw et al. (1981), and adaptive responses documented in crisis literature.

Fourthly, a high-investment trap that addresses dynamic capabilities interacting with organizational slack and shock exposure. The present situation includes high digitalization and centralization, but low slack. Absent conditions are paradoxical leadership. Therefore, an expected outcome is decreased resilience. A proposed mechanism is resource strain without adaptive leadership, which may increase rigidity, consistent with threat-rigidity theory (Staw et al., 1981).

Finally, an identity lock-in which also addresses dynamic capabilities interacting with organizational slack and shock exposure. The present conditions are strong legacy identity such as family ownership an emphasis on tradition, high centralization and low orientation. Absent conditions are external pressure for change. An expected outcome is stalled digitalization. The proposed mechanism is identity preservation which reduces adaptation propensity, as identified by Soluk and Kammerlander (2021) in family-owned firms. This is also consistent with socioemotional wealth preservation priorities (Berrone et al., 2012).

Based on the preliminary patterns identified in our initial literature mapping, we propose the PLUS–D framework as a conceptual model to guide our future systematic investigation of digital resilience pathways. This model shown in figure 4 demonstrates coverage of digital resilience that emerges through configurational alignment rather than individual factor optimization. In this instance, P represents paradoxical leadership, which functions as a crosscutting enabling condition that potentially amplifies the effectiveness of other elements, particularly under high shock exposure (S). L denotes learning capabilities that require either unabsorbed slack (U) or decentralized architecture to translate into resilience outcomes, suggesting potential substitutability. U represents unabsorbed slack, which potentially substitutes for learning capabilities when combined with paradoxical leadership, conceptually illustrating equifinality. S denotes shock exposure, which operates bidirectionally, potentially catalyzing transformation in configurations with enabling conditions while amplifying rigidity in their absence. D categorizes digitalization intensity, which exhibits a non-monotonic pattern consistent with a productivity J-curve (Brynjolfsson et al., 2021), where outcomes depend critically on complementary organizational conditions



**Figure 4. A Representation of the PLUS-D Model**  
 Source: Authors’ Own Material

## 7. CONCLUSION

In this research study, we explored how manufacturing SMEs build digital resilience under geopolitical shocks. We offer the PLUS–D framework and five configurational pathways that illustrate equifinality and causal asymmetry, suggesting that resilience is shaped less by the volume of digital investment than by the alignment of paradoxical leadership, learning capabilities, unabsorbed slack, decision architecture, and shock exposure.

The limitations of the study include a lacking in establishing statistical generalizability given the literature-based design. An inability to calculate precise coverage or consistency metrics, and a dependency on the quality and completeness of the original studies. Future research directions will include achieving greater accuracy through a larger sample size. Future research includes the refining of the configurational propositions and testing them with CEE manufacturing SME data using appropriate set-theoretic methods and triangulate them with qualitative process tracing to unpack mechanisms.

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