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Theoretical reflections on resilience as a strategic capability of supply chains in the age of polycrisis

Teoretyczne refleksje nad odpornością jako strategiczną zdolnością łańcuchów dostaw w epoce polikryzysu

Keywords:
resilience, polycrisis,
supply chain management,
uncertainty, adaptive
capability, dynamic
capabilities

Abstract: The article explores resilience as a strategic capability of supply chains in the era of permanent polycrisis. Drawing upon organisational theory, systems thinking, and supply chain management, it develops a conceptual model integrating four interdependent dimensions of resilience – anticipation, absorption, adaptation, and transformation. The study positions resilience not as an operational mechanism but as a dynamic meta-capability enabling organisations to learn, reconfigure, and evolve under conditions of structural uncertainty. By linking the global polycrisis framework with capability-based theories of resilience, the article bridges macro-systemic turbulence and firm-level strategic renewal. The findings contribute to the theoretical consolidation of resilience research and highlight its systemic nature as an emergent property of inter-organisational networks. Managerial implications emphasise the shift from risk control to adaptive capacity building, while theoretical implications suggest resilience as a cornerstone of sustainable competitiveness and institutional viability in complex environments.

Słowa kluczowe:
odporność, polikryzys,
zarządzanie łańcuchem
dostaw, niepewność, zdolność
adaptacyjna, zdolności
dynamiczne

Streszczenie: W artykule autor analizuje odporność (*resilience*) jako strategiczną zdolność łańcuchów dostaw w warunkach permanentnej polikryzysowości. Wykorzystując dorobek teorii organizacji, podejścia systemowego oraz zarządzania łańcuchami dostaw, opracowano model koncepcyjny integrujący cztery współzależne wymiary odporności: przewidywanie, absorpcję, adaptację i transformację. Odporność ujęto nie jako mechanizm operacyjny, lecz jako dynamiczna

metazdolność umożliwiającą organizacjom uczenie się, rekonfigurację i ewolucję w warunkach strukturalnej niepewności. Łącząc ramy analizy polikryzysu z teoriami zdolności dynamicznych, artykuł tworzy pomost między turbulencją systemową a strategicznym odnowieniem przedsiębiorstw. Wyniki przyczyniają się do konsolidacji teoretycznej badań nad odpornością oraz podkreślają jej systemowy, sieciowy charakter. Implikacje menedżerskie wskazują na konieczność przesunięcia akcentu z kontroli ryzyka na rozwijanie zdolności adaptacyjnych, zaś implikacje teoretyczne – na rolę odporności jako podstawy trwałej konkurencyjności i stabilności instytucjonalnej w złożonych środowiskach gospodarczych.

JEL:
M11, L21, D81

Introduction

The early 2020s have been marked by what Adam Tooze [2022, p. 13] famously described as a *polycrisis* – a state in which multiple, interlocking crises in geopolitics, health, energy, climate and finance reinforce one another in unpredictable ways. This condition has challenged not only governments and societies but also the foundations of global business systems. The World Economic Forum's *Global Risks Report 2023* similarly refers to a “permacrisis” environment characterised by systemic shocks and chronic uncertainty, arguing that such conditions “undermine resilience and long-term planning” [WEF, 2023, p. 7]. Likewise, the OECD [2023, p. 4] has emphasised that global supply chains are increasingly exposed to “compound disruptions” – cascading events that simultaneously affect production, logistics, and market stability.

Within this environment, the traditional assumptions of linearity and predictability in supply chain management have been profoundly undermined. The dominant *lean* and *just-in-time* paradigms, which prioritised efficiency and cost minimisation, proved fragile when confronted with global turbulence [Sheffi, 2020, pp. 24–26]. Disruptions caused by the COVID-19 pandemic, the war in Ukraine, and extreme weather events have demonstrated how tightly coupled supply networks can propagate shocks across sectors and continents. Christopher and Peck [2004, p. 3] already warned two decades ago that supply chains were evolving into “complex adaptive systems” vulnerable to both internal and external volatility. These warnings now appear prophetic.

The cumulative impact of multiple overlapping crises has moved scholarly attention from *risk management* to *resilience*. While risk management focuses on identifying and mitigating known vulnerabilities, resilience concerns the systemic ability to absorb shocks, adapt, and continue functioning under conditions of uncertainty [Hollnagel, 2011, p. xxix]. As Folke et al. [2010, p. 3] argue, resilience thinking requires recognising organisations and supply chains as dynamic socio-ecological systems capable of

transformation, not merely recovery. Consequently, resilience has emerged as a central theoretical construct for understanding how supply chains can survive – and even evolve – in an era of permanent polycrisis.

The concept of uncertainty has long occupied a central position in economic and management theory. At the beginning of the twentieth century, Willet [1901, p. 6] distinguished between measurable risks and unmeasurable uncertainties, highlighting the limits of rational calculation in environments characterised by imperfect information. Knight [1921, p. 20] formalised this distinction, defining *risk* as a quantifiable probability of loss and *uncertainty* as an immeasurable state where “there is no valid basis of any kind for classifying instances.” For Knight [1921, p. 199], it is precisely this fundamental uncertainty that constitutes the “true domain of entrepreneurship”, as decisions are made without objective probabilities. The contemporary condition of overlapping crises mirrors this Knightian uncertainty, in which linear models of prediction fail to capture systemic interdependence.

Bauman [2012, pp. 49–51] described our present moment as a *time of interregnum* – a period in which the old order has lost its capacity to shape the future, while a new one has yet to emerge. This interregnum, he argues, generates a deep structural uncertainty: social, political, and economic institutions continue to operate, but without the assurance of stability or continuity. The notion aptly characterises the environment of permanent polycrisis, where organisations and supply chains must function amid collapsing frameworks of predictability. In Bauman’s [2012, p. 53] words, we live in “an in between time of no longer and not yet,” in which uncertainty is not a deviation but the defining condition of modernity.

In response to this condition, scholars have moved beyond the notion of robustness towards the paradigm of *resilience*. Yet Taleb [2012, p. 3] argued that resilience – understood as the capacity to return to a prior state after disturbance – is insufficient. Instead, systems should exhibit *antifragility*, that is, the ability to gain and evolve from volatility and shocks. This reconceptualisation reframes organisational survival as a process of learning and adaptation rather than recovery alone. In supply chain theory, a similar shift can be observed in the relational perspective of Wieland and Wallenburg [2013, p. 301], who view resilience as a capability arising from trust, flexibility, and information sharing among partners. Wieland [2021, pp. 45–47] further develops this idea, proposing that resilience should be embedded in the design principles of supply chains as a strategic capability balancing efficiency and adaptability.

Recent contributions extend this understanding into the domain of uncertainty management. Marzantowicz [2017, p. 63] emphasises that unpredictability and uncertainty are intrinsic characteristics of supply chain systems, not temporary disruptions, and that resilience requires synchronising responses across strategic, operational, and relational levels. This interpretation aligns with the systemic view articulated by Folke et al. [2010,

p. 3], according to which resilience reflects a system's ability not only to absorb shocks but to transform under sustained pressure. Collectively, these perspectives suggest that resilience is best understood as a dynamic, multi-level capability enabling supply chains to survive – and evolve – amid permanent uncertainty and complexity.

Although the concept of resilience has gained significant attention across disciplines – from ecology [Folke et al., 2010, p. 3] to organisational studies [Hollnagel, 2011, p. xxix] – its application within supply chain management remains fragmented. Much of the existing literature addresses resilience either as a reactive operational mechanism or as a subcomponent of risk management [Christopher, Peck, 2004, p. 3; Sheffi, 2020, pp. 24–26]. Yet, as the recent cascade of global crises demonstrates, supply chains are not merely technical or logistical entities; they are socio-economic systems embedded in environments of enduring uncertainty [Knight, 2006, p. 199; Marzantowicz, 2017, p. 63]. Despite increasing recognition of the need for adaptive capacity, there remains a conceptual gap in understanding resilience as a strategic, integrative capability – one that enables survival and renewal under conditions of permanent polycrisis.

This gap is especially visible in the limited theoretical integration between the macro-level phenomenon of polycrisis [Tooze, 2022; OECD, 2023, p. 4] and the micro-level capabilities of organisational resilience [Wieland, 2021, pp. 45–47]. Existing studies often focus on individual disruptions – pandemics, wars, or natural disasters – while neglecting the compound and systemic nature of overlapping crises [WEF, 2023, p. 7]. Consequently, managerial discourse continues to rely on the language of “risk mitigation” rather than on frameworks that acknowledge the structural unpredictability of contemporary systems [Bauman, 2012, p. 53; Taleb, 2012, p. 3]. This theoretical fragmentation underscores the need for a more holistic understanding of resilience that encompasses both the operational and strategic dimensions of supply chain survival.

Despite the growing body of literature on supply chain resilience, existing research remains conceptually fragmented. Most studies address resilience either as an operational response to discrete disruptions or as an extension of supply chain risk management, often focusing on isolated events rather than on persistent and interconnected crises. At the same time, recent discussions on polycrisis highlight that contemporary disruptions are systemic, cumulative, and structurally embedded in global business environments. However, the integration of the polycrisis perspective with capability-based approaches to resilience remains underdeveloped, particularly in relation to the strategic role of supply chains operating under conditions of permanent uncertainty.

This paper addresses this gap by conceptualising supply chain resilience as a strategic meta-capability embedded in the context of permanent polycrisis. Drawing on organisational theory, systems thinking, and supply chain management, the article develops an integrative framework that links macro-level systemic turbulence with firm – and network-level adaptive capabilities. Specifically, it proposes a conceptual model com-

prising four interdependent dimensions of resilience – anticipation, absorption, adaptation, and transformation – through which supply chains can sustain functionality and evolve under conditions of structural uncertainty. By positioning resilience as a dynamic, learning-oriented capability rather than a reactive operational mechanism, the paper contributes to the theoretical consolidation of resilience research and advances understanding of long-term supply chain viability in complex environments.

The remainder of the paper is structured as follows. Section 2 introduces the concept of polycrisis as a new paradigm of the global business environment and discusses its implications for systemic uncertainty. Section 3 reviews the evolution of supply chain risk and resilience research, highlighting the shift from risk control to adaptive capability. Section 4 synthesises key theoretical perspectives on resilience, while section 5 develops a conceptual model of resilience as a strategic capability of supply chains. The paper concludes with theoretical and managerial implications and directions for future research.

Accordingly, the aim of this paper is to develop a theoretical framework for understanding resilience as a strategic capability of supply chains operating under conditions of permanent polycrisis. The paper argues that resilience should not be conceptualised merely as a response to disruption but as an evolving capability that integrates anticipation, absorption, adaptation, and transformation. From this perspective, resilient supply chains are not simply robust – they are capable of learning, reconfiguring, and renewing themselves in the face of systemic instability.

The thesis advanced in this paper is that:

Resilience constitutes a strategic capability that enables supply chains to sustain and evolve within environments defined by continuous uncertainty and interdependent crises.

To support this argument, the paper seeks to address the following research questions:

1. How can the phenomenon of permanent polycrisis be defined and understood in relation to global supply chains?
2. What theoretical dimensions of resilience (anticipation, absorption, adaptation, transformation) are most relevant to survival in polycrisis conditions?
3. How can resilience be conceptualised as a strategic capability rather than a reactive operational mechanism within supply chain management?
4. What integrative framework can link resilience theory with the systemic nature of contemporary crises?

This article adopts a conceptual research design grounded in integrative literature analysis and theoretical synthesis. Rather than testing empirical hypotheses, the paper aims to develop a coherent conceptual framework by critically interpreting and integrating existing theories from organisational studies, systems thinking, and supply chain management. The methodological approach focuses on theory building through abstraction, comparison, and conceptual modelling, with the objective of clarifying the strategic nature of supply chain resilience under conditions of permanent polycrisis.

The Polycrisis as a New Paradigm of the Global Business Environment

The early twenty-first century has witnessed a convergence of crises – financial, environmental, geopolitical, and technological – that have exposed the fragility of the global economic system. Tooze describes this condition as a *polycrisis*: a configuration of multiple shocks that “interact in ways that make the whole more dangerous than the sum of its parts” [Tooze, 2022, p. 2]. Unlike discrete or cyclical crises, the polycrisis represents a qualitatively new paradigm of global interdependence, where disruption in one domain rapidly cascades through others. For business systems, this implies that risk can no longer be treated as an isolated event but must be understood as an emergent property of complexity.

From risk society to systemic complexity

The theoretical roots of the polycrisis idea reach back to Beck’s *Risk Society*, where modernity itself generates new, “manufactured uncertainties” [Beck, 1992, pp. 21–23]. Beck argued that industrial and technological progress expands the scope of risk beyond calculable probabilities, producing interlinked hazards that defy linear management. Morin extends this argument through the theory of complexity, proposing that crises in interdependent systems are “recursive” – they both result from and feed into the same networks that sustain them [Morin, 2008, pp. 99–101]. Bauman later captured this state as a *time of interregnum* – “a condition of permanent temporariness” [Bauman, 2012, p. 53] in which social and economic structures persist but have lost their stabilising functions. Together these thinkers delineate the epistemological landscape of the polycrisis: an environment where uncertainty is endogenous, systemic, and self-perpetuating.

Empirical manifestations of the polycrisis

Empirical evidence of this interdependence is well documented in global risk analyses. The *World Economic Forum* [WEF, 2023, pp. 7–11] identifies five categories of interconnected risk – geoeconomic confrontation, climate change, societal polarisation, technological vulnerabilities, and supply chain breakdowns – that reinforce one another through feedback loops. The report concludes that the “erosion of resilience and long term outlook” [WEF, 2023, p. 7] has become a defining feature of the global economy. Similarly, the *OECD* [2023, pp. 4–8] observes that global supply chains are simultaneously exposed to climate-related disasters, geopolitical fragmentation, and digital interdependencies, creating a “compound-risk environment” that no single policy instrument can address.

Building on this, the *OECD* [2024, pp. 3–5] introduces the concept of *strategic foresight for resilience* – a policy approach that recognises the need to prepare for *inter-connected crises* rather than discrete shocks. The Organisation notes that systemic vulnerabilities originate in the same networks that provide efficiency and growth, echoing Morin’s [2008] observation that complexity breeds both strength and fragility. This diagnosis underscores the challenge facing global business: the structures that generate value simultaneously propagate instability.

Supply chains as amplifiers of systemic risk

In this environment, supply chains epitomise the mechanisms through which the polycrisis materialises. Hynes, Lees, and Müller [2023, pp. 2–4, 10] demonstrate empirically that dense global value-chain networks amplify disruptions through nonlinear propagation effects. Their analysis shows that even minor disturbances – whether logistical bottlenecks or policy shifts – can produce systemic consequences across industries due to the high degree of interconnection. The authors argue for a shift from *risk mitigation* to *resilience building* as the central managerial logic under conditions of complexity.

This insight resonates with Taleb’s [2012, p. 3] argument that resilient systems must not only endure volatility but *benefit* from it through adaptive learning. The notion of *antifragility* thus provides a conceptual bridge between systemic theory and organisational practice: supply chains must evolve into entities capable of absorbing and transforming shocks rather than merely resisting them. Folke et al. [2010, p. 3] describe this as the ability of a system to “persist, adapt and transform” under disturbance – a definition that captures the essence of resilience in the polycrisis era.

Towards a systemic understanding of global business resilience

The recognition of the polycrisis as a structural feature of the global economy compels a reconceptualisation of business resilience. Traditional frameworks of risk management – premised on prediction, control, and redundancy – are increasingly inadequate in environments where the sources of disruption are endogenous to the system itself. The shift from a “risk society” [Beck, 1992] to a “complexity society” [Morin, 2008] requires organisations to cultivate dynamic capabilities that integrate foresight, flexibility, and collective learning.

From this perspective, resilience emerges as a *meta – capability*: a higher order competence that enables continuous adaptation across interconnected domains. As the *OECD* [2024, p. 5] notes, the capacity to “anticipate, absorb and recover from inter-connected shocks” has become a precondition for competitiveness. For supply chain systems, this entails moving beyond efficiency-based models toward architectures that

are diverse, modular, and responsive. The polycrisis thus represents not merely a challenge to existing managerial paradigms but a transformation of the very conditions under which global business operates.

Supply Chains under Uncertainty and Disruption

Modern supply chains have evolved into globally distributed, tightly coupled systems that balance efficiency with responsiveness. Yet, this very interconnectedness amplifies exposure to uncertainty and disruption. Since the early 2000 s, scholars have increasingly recognised that traditional risk management approaches – focused on probability estimation and mitigation – are inadequate in such environments. Instead, supply chains must be understood as *complex adaptive systems*, characterised by nonlinearity, feedback, and emergent behaviour [Jüttner et al., 2003, p. 199].

The evolution of supply chain risk management

The seminal work of Jüttner et al. [2003, pp. 198–201] established the foundations of supply chain risk management (SCRM), identifying three central constructs: *supply chain vulnerability*, *risk sources*, and *risk consequences*. They argued that globalisation, outsourcing, and lean operations increased systemic exposure to both internal and external disruptions. Tang [2006, pp. 453–454] later expanded on this framework, distinguishing between operational risks arising from day-to-day variability – and strategic risks – rooted in long term structural dependencies. Tang’s contribution was to reframe SCRM as an integrated managerial discipline that must balance efficiency with robustness.

Christopher and Peck [2004, p. 3] introduced the concept of *resilience* into the SCRM discourse, defining it as “the ability of a system to return to its original state or move to a new, more desirable state after being disturbed.” Their model emphasised flexibility, redundancy, and collaboration as levers of resilience. This perspective represented a paradigm shift: from controlling risks to managing uncertainty. As they observed, “in a world of turbulence, it is not the strongest supply chain that survives, but the most adaptable one” [Christopher, Peck, 2004, p. 8].

From vulnerability to capability: The resilience turn

Subsequent research has advanced this line of thought by framing resilience as a *dynamic capability*. Ponomarov and Holcomb [2009, p. 130] proposed that resilience represents an organisation’s ability to prepare for, respond to, and recover from disruptions while maintaining control over function and structure. Similarly, Pettit, Fiksel,

and Croxton [2010, p. 3] identified six drivers of resilience – *flexibility, visibility, velocity, collaboration, adaptability, and redundancy* – and argued that the balance among them determines the overall resilience capacity of a supply chain.

Empirical studies support these theoretical propositions. Blackhurst, Dunn, and Craighead [2011, p. 377] found that visibility, velocity, and collaboration explain a significant portion of variance in supply chain recovery performance following disruptions. Brusset and Teller [2017, pp. 61–63] further demonstrated that organisational capabilities such as process integration and information sharing enhance both resilience and performance. Their findings underscore the argument that resilience is not merely a reactive property but a proactive, learning-based capability.

Duchek [2020, pp. 220–223] provides a conceptual refinement by identifying three stages of organisational resilience: *anticipation, coping, and adaptation*. This capability based view links resilience to the theory of dynamic capabilities, as articulated in strategic management, positioning it as a higher order function that enables continuous learning and renewal. Such an interpretation marks a decisive move away from static definitions of robustness toward a developmental, process oriented view.

Systemic disruptions and adaptive architectures

The past decade has exposed the limits of conventional supply chain models. The COVID-19 pandemic, geopolitical tensions, and digital dependencies have revealed that disruptions are no longer isolated shocks but systemic phenomena [Craighead, Ketchen, Darby, 2020, p. 841]. Ivanov [2020, pp. 2907–2909] observes that traditional linear planning approaches fail under such conditions, as the effects of a disruption propagate nonlinearly through global networks. He proposes a *viable supply chain* model grounded in systems theory, integrating predictive analytics and adaptive control to enhance resilience.

Dolgui, Ivanov, and Sokolov [2020, pp. 4142–4145] introduce the *reconfigurable supply chain* concept, or *X-network*, which allows structural adaptation in real time through modularity and redundancy. Their research demonstrates that resilience emerges not from redundancy alone but from the capacity to reconfigure resources dynamically. This aligns with Pettit et al.'s [2010, p. 6] assertion that the most resilient supply chains are those that “maintain their identity while transforming their configuration.”

The pandemic era has also reignited interest in the *relational dimension* of resilience. Wieland and Durach [2021, pp. 317–318] argue that resilience results from both structural features (redundancy, diversity) and relational mechanisms (trust, collaboration). They identify two complementary perspectives: the *engineering view*, which focuses on efficiency restoring mechanisms, and the *ecological view*, which emphasises adaptability

and transformation. The coexistence of these perspectives mirrors Taleb's [2012, p. 3] idea of *antifragility*, suggesting that supply chains can evolve to benefit from volatility rather than merely withstand it.

Managing uncertainty: From control to adaptation

Across these studies, a fundamental shift in management logic becomes evident. The classical assumption of control – where risk can be measured, mitigated, and eliminated – gives way to an adaptive paradigm in which uncertainty is inherent and continuous. As Ivanov [2020, p. 2910] notes, supply chains must operate under the expectation of “permanent turbulence.” In such an environment, resilience becomes less about returning to equilibrium and more about maintaining functionality through evolution.

This echoes the insight of Marzantowicz [2017, p. 68], who argues that unpredictability is an intrinsic feature of supply chain systems and must be addressed through *coordinated adaptability* rather than static planning. In practice, this means designing supply networks that learn and self-adjust, supported by digital visibility, distributed decision-making, and collaborative governance. The aim is not to eliminate uncertainty but to coexist with it productively – a principle that foreshadows the systemic resilience model developed later in this paper.

Theoretical Frameworks of Resilience

The concept of resilience has evolved across disciplines – from engineering and ecology to organisation theory and supply chain management – reflecting shifts in how scholars understand systems' capacity to endure and transform under stress. The diversity of definitions has produced a rich but fragmented field. To develop a coherent theoretical foundation, resilience must be examined through three complementary lenses: engineering, ecological, and capability based perspectives.

From engineering to ecological resilience

Early approaches to resilience derived from engineering disciplines, where the term described the ability of a material or system to return to equilibrium after disturbance. Hollnagel [2011, pp. xxvii–xxix] formalised this view within *resilience engineering*, defining four essential capabilities: the ability to anticipate, monitor, respond, and learn. These functions, originally applied to safety critical systems such as aviation or energy, have since been extended to organisational contexts. Engineering resilience

thus emphasises *stability and recovery* – the speed and efficiency with which a system regains its predisruption state.

Ecological perspectives, in contrast, recognise that systems may not always return to equilibrium. Folke et al. [2010, p. 3] define resilience as the capacity of a system to *persist, adapt, and transform* in the face of change. This broader view reflects the dynamics of complex adaptive systems, where diversity, feedback, and self-organisation determine long-term survival. In such systems, transformation – rather than restoration – may be the key to persistence. Taleb [2012, pp. 3–6] extends this logic with the concept of *antifragility*, arguing that some systems can actually benefit from disorder. Antifragility thus represents a higher-order form of resilience – one that thrives on volatility instead of merely resisting it.

Lengnick-Hall and Beck [2005, pp. 731–735] integrate these ideas into organisational studies, proposing that resilient organisations maintain an *adaptive fit* with their environments through learning and strategic flexibility. Their model suggests that resilience arises from iterative interactions between the organisation and its external context, leading to “new equilibriums” rather than returns to prior states. This evolutionary understanding of resilience aligns with the contemporary reality of global supply chains operating in conditions of continuous turbulence.

Resilience as a dynamic and strategic capability

The capability-based view of resilience emerged as scholars sought to link adaptive behaviour with organisational performance. Duchek [2020, pp. 220–225] conceptualises resilience as a dynamic capability composed of three interdependent stages: anticipation, coping, and adaptation. Anticipation involves recognising potential threats; coping refers to immediate responses during crisis; and adaptation captures long-term learning and transformation. This framework builds on the dynamic capabilities theory, where organisational survival depends on the ability to integrate, build, and reconfigure internal and external competences.

Ponomarov and Holcomb [2009, pp. 130–134] apply this reasoning to supply chain contexts, arguing that resilience enables organisations to restore performance levels and re-establish equilibrium following disruptions. They emphasise the importance of relational mechanisms – trust, collaboration, and information sharing – as the social infrastructure that supports resilience. Similarly, Pettit, Fiksel, and Croxton [2010, pp. 5–7] identify *flexibility, velocity, visibility, and redundancy* as operational drivers of resilience, but they stress that these elements must be balanced to avoid inefficiency. Their framework positions resilience as the *equilibrium between efficiency and redundancy*, requiring managerial judgement rather than optimisation.

Wieland [2021, pp. 44–50] advances this argument by presenting resilience as a design principle for supply chains rather than a reactive mechanism. He proposes that resilience-oriented design must integrate modularity, distributed control, and network diversity. This perspective mirrors the logic of *design thinking* in management – resilience is not something organisations acquire aftershocks, but something they embed structurally through architecture and culture. As Wieland and Durach [2021, pp. 317–320] observe, resilience operates along two dimensions: the *engineering view* (focused on recovery) and the *ecological view* (focused on transformation). The interplay between these perspectives enables both short-term continuity and long-term renewal.

Systemic and network-oriented frameworks

Contemporary resilience research increasingly adopts a systemic orientation, viewing supply chains as *complex socio-technical networks*. Bhamra, Dani, and Burnard [2011, pp. 5378–5381] identify this as a necessary evolution: resilience cannot be understood without considering interdependence among actors, technologies, and institutions. From this vantage point, resilience is not an attribute of individual firms but a *relational property* of the network. The health of the system depends on flows of information, resources, and trust that allow coordinated adaptation.

Marzantowicz [2017, pp. 67–69] contributes to this discussion by highlighting uncertainty as a *structural condition* of supply chain systems. He argues that unpredictability should not be treated as an external disturbance but as a defining element of the system itself. Effective management, therefore, requires “coordinated adaptability” – collective responses that emerge through collaboration rather than centralised control. This view resonates with Pettit et al.’s [2010, p. 7] notion of *balanced resilience*, where both flexibility and coordination are necessary for sustained performance.

The systemic approach culminates in Hollnagel’s [2011, p. xxxiv] concept of *resilience potential*, which captures an organisation’s overall capacity to anticipate, monitor, respond, and learn across interdependent processes. In global supply chains, this potential manifests through information visibility, diversified sourcing, and relational governance. Folke et al. [2010, p. 4] emphasise that the same diversity and modularity that promote adaptability also prevent cascading failures. Thus, resilience at the network level depends on both structural variety and cognitive diversity – the ability of actors to perceive and interpret disruptions in multiple ways.

Integrative synthesis

Synthesising these perspectives reveals that resilience is a *multi-level construct* bridging the physical, organisational, and systemic domains. Engineering resilience focuses

on *recovery*; ecological resilience on *transformation*; and capability-based resilience on *learning and adaptation*. Within supply chains, these dimensions intersect: firms must recover from shocks (engineering), adapt to persistent changes (ecological), and develop learning capabilities that support ongoing renewal (strategic).

Consequently, resilience is best understood not as a fixed state but as a continuous process of sense-making and adaptation. As Lengnick-Hall and Beck [2005, p. 732] observe, resilient organisations “do not merely survive disruptions; they are altered by them in ways that increase their future viability.” This insight encapsulates the transition from static robustness to dynamic resilience – an understanding essential for operating in the era of permanent polycrisis.

A Conceptual Model of Resilience as a Strategic Capability of Supply Chains

Global supply chains now operate in a context where uncertainty is not episodic but structural. The concept of *resilience* must therefore move beyond recovery-oriented models to a strategic, capability-based understanding. This section develops a conceptual model that interprets resilience as a dynamic strategic capability composed of four interrelated dimensions: *anticipation*, *absorption*, *adaptation*, and *transformation*. The model integrates insights from organisational theory, systems thinking, and supply chain management to explain how firms can survive and evolve under conditions of permanent polycrisis.

The model synthesises insights from organisational theory, systems thinking, and supply chain management to explain how resilience emerges as a dynamic, learning-oriented capability. It conceptualises resilience through four interdependent dimensions – anticipation, absorption, adaptation, and transformation – which together enable supply chains to sustain functionality and evolve under conditions of structural uncertainty.

Conceptual foundations of strategic resilience

The theoretical foundation for treating resilience as a strategic capability can be traced to the dynamic capabilities framework in strategic management. Lengnick-Hall, Beck, and Lengnick-Hall [2011, pp. 244–246] conceptualise resilience as a strategic resource that allows organisations to renew themselves through disruption. They argue that resilience arises from the interaction of *cognitive*, *behavioural*, and *contextual* capacities that together create “a readiness to respond to and learn from adversity.” This understanding shifts the focus from risk management to strategic renewal.

Ponomarov and Holcomb [2009, pp. 134–136] extend this reasoning to supply chain contexts, defining resilience as a firm’s ability to “prepare for unexpected disruptions, respond to them, and recover by maintaining control over structure and function.” Their model aligns resilience with the resource-based view (RBV), positioning it as a higher-order capability that integrates operational and relational competences. Duchek [2020, pp. 220–225] further refines this into a three-phase model – *anticipation*, *coping*, and *adaptation* – where learning connects the stages into a continuous process of renewal.

From a strategic perspective, therefore, resilience represents a firm’s ability to sense, seize, and reconfigure resources in response to environmental turbulence [Teece, 2007]. This dynamic conception underpins the model developed here, in which resilience is an active capability, not a passive characteristic.

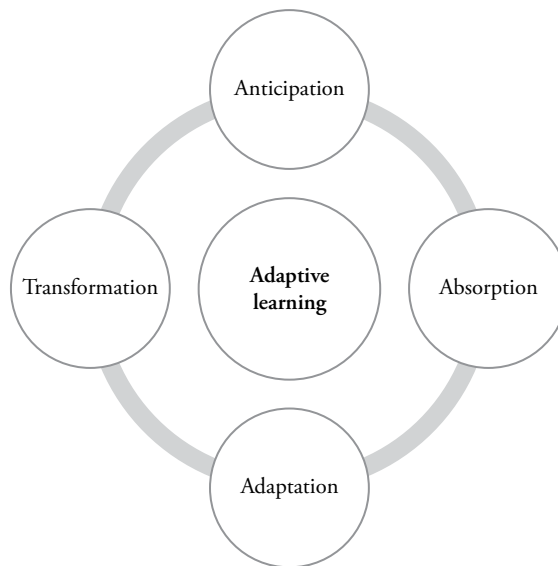
The four dimensions of resilience capability

Building on the capability-based view, resilience in supply chains can be described through four interdependent dimensions: anticipation, absorption, adaptation, and transformation. Each dimension represents a stage in the organisational response to disruption and a component of strategic capability.

1. Anticipation refers to the ability to foresee potential disruptions and emerging risks. Pettit, Fiksel, and Croxton [2010, pp. 6–8] emphasise *visibility* and *situational awareness* as prerequisites for anticipation. Duchek [2020, p. 221] similarly identifies anticipation as the stage of “recognising potential threats and opportunities” before they manifest. In supply chain terms, this involves the use of predictive analytics, scenario planning, and strategic foresight [OECD, 2024, pp. 3–5].
2. Absorption represents the capacity to withstand and contain the impact of disruptions without catastrophic failure. Ponomarov and Holcomb [2009, p. 135] describe this as the ability to maintain control over key functions under stress. Pettit et al. [2010, p. 7] link absorption to redundancy and buffer capacity – features that allow systems to sustain operations while absorbing shocks. In global supply networks, this dimension is often supported by diversified sourcing and flexible logistics architectures [Ivanov, 2020, pp. 2909–2911].
3. Adaptation involves the rapid reconfiguration of resources and processes to restore or maintain functionality. Wieland [2021, pp. 46–49] conceptualises adaptation as a *design principle*, arguing that resilient supply chains incorporate modularity and decentralised control to enable flexible responses. Lengnick-Hall et al. [2011, p. 245] note that adaptive capability is deeply rooted in learning processes and social capital – networks of collaboration that facilitate coordinated change.

4. Transformation is the ability to use disruption as a catalyst for strategic renewal. Bhamra, Dani, and Burnard [2011, pp. 5380–5383] identify transformation as the highest form of resilience, in which organisations integrate lessons from crises into new structures or business models. Taleb [2012, pp. 5–8] describes this property as *antifragility* – benefiting from volatility through iterative experimentation. In supply chains, transformation manifests as shifts toward digitalisation, circular economy models, or localised sourcing strategies that enhance longterm viability. These four dimensions are not sequential but mutually reinforcing. Anticipation improves absorption by enhancing preparedness; absorption stabilises systems to enable adaptation; adaptation produces knowledge that informs transformation; and transformation, in turn, strengthens anticipatory capacity. Together, they constitute a self-reinforcing loop – a dynamic process of *learning through disruption*.

Figure 1. A conceptual model of supply chain resilience as a strategic capability in the era of permanent polycrisis



Source: own elaboration.

The figure illustrates resilience as a dynamic meta-capability composed of four interdependent dimensions – anticipation, absorption, adaptation, and transformation – linked through continuous learning and operating across firm, network, and systemic levels.

The integrative conceptual model

Drawing on these theoretical insights, the proposed model positions resilience as a *strategic meta-capability* that integrates operational, relational, and cognitive capacities across the four interdependent dimensions of anticipation, absorption, adaptation, and transformation. At its core lies adaptive learning, which connects each dimension through feedback loops. As Hynes, Lees, and Müller [2023, pp. 5–7] observe, resilience in complex systems depends on *information feedbacks* that enable self-regulation and coordinated adaptation. Marzantowicz [2017, pp. 67–69] likewise emphasises “coordinated adaptability” as a systemic property of supply chains functioning under uncertainty. The interaction among anticipation, absorption, adaptation, and transformation thus forms a *resilient learning cycle* that sustains system viability in turbulent environments.

From a systemic perspective, resilience also operates across multiple levels:

- Micro-level (firm): adaptive operations, resource flexibility, and leadership cognition [Lengnick-Hall et al., 2011].
- Meso-level (supply network): relational coordination, shared visibility, and distributed control [Wieland, Durach, 2021, pp. 317–320].
- Macro-level (global system): institutional frameworks supporting strategic foresight and sustainability [OECD, 2024, pp. 4–5].

This multi-level interaction reflects Ivanov’s [2020, pp. 2911–2912] concept of *viable supply chains* systems capable of maintaining identity while dynamically adapting their structure. The integrative model therefore situates resilience as both a strategic capability of firms and a systemic property of networks.

Managerial and systemic implications

Interpreting resilience as a strategic capability carries several implications for both management practice and policy design. First, firms must treat resilience not as an operational cost but as an *investment in adaptive capacity*. As Pettit et al. [2010, p. 10] note, resilience enhances not only recovery speed but also competitiveness by fostering innovation.

Second, building resilience requires a shift from efficiency optimisation to *strategic flexibility*. Wieland [2021, p. 53] argues that “efficiency and resilience are not opposing goals but complementary dimensions of design.” Similarly, Lengnick-Hall et al. [2011, p. 246] show that firms capable of leveraging human and relational capital recover faster and evolve more sustainably.

Third, resilience must be embedded in *systemic governance*. OECD [2024, p. 5] advocates for institutional mechanisms that promote cross-sector foresight and information sharing, while Hynes et al. [2023, p. 7] stress the need for “adaptive coordina-

tion” across interconnected networks. This systemic view aligns with the concept of *strategic foresight* – the capacity to anticipate, adapt, and transform collectively within volatile environments.

Finally, from a normative standpoint, resilience represents a paradigm of *learning through crisis*. As Taleb [2012, p. 6] argues, systems that evolve through volatility not only survive but become stronger. In the context of the global polycrisis, resilience thus emerges as the cornerstone of sustainable competitiveness and institutional endurance.

Conclusion and Theoretical Implications

The unprecedented convergence of global crises has revealed the structural fragility of the world’s economic and logistical systems. This paper has argued that in an era of permanent polycrisis, survival depends not on eliminating uncertainty but on developing capabilities that convert uncertainty into adaptive advantage. By integrating insights from organisational theory, complexity science, and supply-chain management, resilience emerges as a *strategic meta-capability* – a dynamic process that enables anticipation, absorption, adaptation, and transformation across multiple levels of analysis.

Summary of theoretical contributions

First, the paper re-conceptualised resilience from a reactive to a *strategic* construct. Drawing on Lengnick-Hall, Beck, and Lengnick-Hall [2011] and Duchek [2020], resilience was positioned within the dynamic capabilities framework as a source of renewal rather than recovery. This reframing highlights the importance of *learning and reconfiguration* as continuous processes that sustain competitive advantage under persistent turbulence.

Second, the paper linked the phenomenon of the *polycrisis* [Tooze, 2022; OECD, 2024] with the micro-level mechanisms of organisational adaptation [Pettit et al., 2010; Ivanov, 2020]. By doing so, it contributed a theoretical bridge between macrosystemic instability and firm-level strategy, demonstrating that global supply networks are both victims and vectors of systemic risk. The conceptual model proposed here integrates these scales, showing how resilience propagates through interconnected feedback loops of learning and coordination [Hynes et al., 2023].

Third, the framework articulated four interdependent dimensions – *anticipation, absorption, adaptation, and transformation* – as the core architecture of resilient capability. This synthesis refines previous typologies by explaining how these functions reinforce one another through feedback and learning. In this way, resilience becomes a *recursive capability*: each disruption not only tests the system but also contributes to its future preparedness.

Finally, the paper expanded the understanding of resilience from organisational to *systemic* domains. Following Folke et al. [2010] and Wieland [2021], resilience is interpreted as an emergent property of complex adaptive networks rather than a trait of individual firms. This systemic perspective underscores the need for collective coordination, information transparency, and governance mechanisms that sustain the resilience of entire supply ecosystems.

Implications for research

The theoretical synthesis presented here opens several avenues for future inquiry.

1. Operationalisation of strategic resilience. Further empirical studies are required to measure how anticipation, absorption, adaptation, and transformation interact dynamically within supply chains [Duchek, 2020]. Longitudinal and simulation-based research could examine the temporal sequencing of these capabilities.
2. Network-level analysis. Building on Hynes et al. [2023] and Marzantowicz [2017], future work should investigate how interorganisational governance structures and digital platforms facilitate coordinated adaptability across networks.
3. Integration with foresight and sustainability. The OECD [2024] highlights the role of strategic foresight as a policy tool for resilience. Empirical testing of foresight – resilience linkages could yield new insights into sustainable competitiveness.
4. Cross-cultural and regional perspectives. Comparative studies of resilience practices across economies may illuminate how institutional diversity influences adaptive capacity in global value chains.

Implications for managerial practice

From a managerial standpoint, resilience must be treated as an investment in *capability development* rather than as a contingency plan. Firms should:

- cultivate anticipatory intelligence through data-driven forecasting and scenario planning [Pettit et al., 2010];
- enhance absorptive capacity via redundancy and flexible sourcing [Ivanov, 2020];
- institutionalise adaptive learning mechanisms – after-action reviews, cross-functional teams, and digital knowledge sharing [Lengnick-Hall et al., 2011];
- and embrace transformational strategies that convert disruption into innovation [Taleb, 2012; Bhamra et al., 2011].

For policymakers and industry bodies, the findings imply the necessity of governance systems that foster *collective resilience* – shared standards, information exchange, and foresight collaborations [OECD, 2024]. Resilience thus becomes both a managerial competency and a socio-institutional function.

Closing reflection

In the words of Bauman [2012, p. 53], we live in “times of interregnum” – an age suspended between collapsing certainties and unformed futures. In such conditions, resilience is neither luxury nor metaphor; it is the very grammar of survival. By understanding it as a strategic, systemic capability, organisations and societies may not only endure the polycrisis but evolve through it. As Taleb [2012, p. 6] suggests, the goal is not to become unbreakable, but to become *stronger because of the shocks we survive*.

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