Highlights of Sustainability

ISSN 2696-628X, A Peer-Reviewed Open Access Journal by Highlights of Science
https://www.hos.pub/journals/sustainability

Supply Chain Resilience Among Firms Operating in Lithuania: Adaptation to the COVID-19 Pandemic and the Russia–Ukraine War

by Cüneyt Çatuk

This article is part of the Collection
Sustainable Transportation, Logistics, and Supply Chains: Decarbonisation, Resilience, and Circular Transitions

Cite this Article

Çatuk, C. (2026). Supply Chain Resilience Among Firms Operating in Lithuania: Adaptation to the COVID-19 Pandemic and the Russia–Ukraine War. *Highlights of Sustainability*, 5(4), 681–700. https://doi.org/10.54175/hsustain5040041

Highlights of Science

Publisher of Peer-Reviewed Open Access Journals
https://www.hos.pub
Barcelona, Spain

Highlights of Sustainability

Article

Supply Chain Resilience Among Firms Operating in Lithuania: Adaptation to the COVID-19 Pandemic and the Russia–Ukraine War

Cüneyt Çatuk

Business Innovation and Entrepreneurship for Sustainable Development Research Group, Faculty of Business, Kauno Kolegija Higher Education Institution, Pramonės pr. 20, LT-50468 Kaunas, Lithuania; Email: cuneytcatuk@hotmail.com

Abstract This study examines how firms operating in Lithuania adapted their supply chains to two consecutive disruptions: the COVID-19 pandemic and the subsequent Russia–Ukraine war with its associated European Union sanctions. The study adopts a retrospective, qualitative cross-case interview design, drawing on semi-structured interviews conducted in 2026 with supply chain, logistics, procurement, and operations professionals in six firms spanning maritime logistics, e-grocery, customs brokerage, agri-trade, manufacturing, and construction. The data were analysed thematically and interpreted through the combined lens of dynamic capabilities and supply chain resilience. The findings show that the war, rather than the pandemic, was the more severe and lasting shock for most firms, particularly those historically tied to Russian and Belarusian transit corridors; for several, the pandemic proved neutral or even beneficial. Firms responded through supplier and route diversification, accelerated digitalisation, and geographic market expansion, and most emerged not by returning to their previous configuration but by rebuilding around a permanently altered environment. Across these cases, firm size appeared to operate as a double-edged capability, conferring agility on smaller firms while restricting their access to institutional support. The study's principal contribution is institutional. In the cases examined, logistics and service firms were unable to access war-relief and digitalisation funding, and in the case of digitalisation support the barrier is traceable to an eligibility rule that conditions funding on revenue from the applicant's own manufactured output, a condition service firms cannot meet by construction. This indicates that the accessibility and fit of support matter as much as its availability.

Keywords supply chain resilience; dynamic capabilities; compound disruption; retrospective case evidence; public support schemes; Russia–Ukraine war; Lithuania

Open Access

Received: 3 August 2026
Accepted: 27 October 2026
Published: 18 November 2026

Academic Editor
Zhongshuo Chen, Xi'an Jiaotong-Liverpool University, China and Ran Zhang, Dalian Jiaotong University, China

Copyright: © 2026 Çatuk. This article is distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use and distribution provided that the original work is properly cited.

1. Introduction

Over the past several years, supply chains across the world have been subjected to a sequence of severe and overlapping shocks. The COVID-19 pandemic, beginning in early 2020, disrupted production, transport, and demand simultaneously across nearly every sector of the global economy [1,2]. Before firms could fully absorb the consequences of that shock, a second and qualitatively different disruption emerged with Russia's full-scale invasion of Ukraine in February 2022 and the subsequent imposition of extensive European Union sanctions [3]. For firms operating in the Baltic region, and in Lithuania in particular, these two events were not experienced in isolation but as compounding pressures on supply networks that were already, in many cases, deeply intertwined with Russian and Belarusian trade and transit routes [4].

Lithuania occupies a distinctive position within the European economy. As a small, open economy located on the eastern frontier of the European Union, it has historically served as a transit corridor linking the European Union with Belarus, Russia, and the wider Commonwealth of Independent States [5]. Its only seaport, Klaipėda, and its extensive road and rail freight sector have long depended on eastbound and westbound flows that the war and sanctions abruptly interrupted. Consequently, the geopolitical disruption of 2022 struck the Lithuanian logistics and trade sector with a force that, for many firms, exceeded the operational difficulties of the pandemic [4].

Despite a rapidly expanding body of literature on supply chain resilience, relatively little qualitative, firm-level evidence has been gathered from firms operating in the Baltic states, and less

still that examines the two disruptions together as a connected sequence rather than as separate events. Much of the existing research concentrates on large multinational corporations, relies on survey-based quantitative methods, and treats disruptions in isolation [2,6]. Two studies provide the closest points of departure in the Lithuanian context. Župerkienė et al. (2021) [7] examined the resilience of small and medium-sized enterprises (SMEs) resilience during the pandemic in the Klaipėda region and found that firms relied heavily on short-term government support rather than developing proactive resilience capabilities, but their analysis ends before the war. Uygur & Peyravi (2025) [4] address the war period in Lithuania and Ukraine, looking at energy, agriculture, and manufacturing, and they establish the severity of the geopolitical shock and describe the subsequent pattern of resource diversification. At the same time, their analysis rests on secondary industry indicators and macroeconomic data, not on direct evidence from firms. The authors themselves identify this limitation, calling for research at the enterprise level capable of explaining how individual firms managed operational risk. This study answers that request directly. It covers both disruptions within a single set of firms, reconstructed retrospectively through interviews conducted in 2026, uses primary interview evidence from inside the firms, and extends the sectoral lens beyond production activities to include logistics, customs, and the transit-dependent service providers that were hit hardest by corridor closure.

The study is guided by five research questions (RQ):

RQ1. What types of supply chain disruptions did firms operating in Lithuania experience during the COVID-19 pandemic and the Russia–Ukraine war?
RQ2. What resilience and adaptation strategies did these firms adopt in response?
RQ3. How did firm size, sector, and pre-existing capabilities shape their resilience?
RQ4. To what extent do these firms perceive themselves as more resilient today than before the disruptions?
RQ5. What policy-level support do these firms identify as necessary for strengthening supply chain resilience?

By addressing these questions, the study makes three contributions. First, and most centrally, it identifies a mismatch between the design of public support instruments and the firms they are intended to reach. Digitalisation support in Lithuania has been conditioned on the applicant deriving the majority of its revenue from its own manufactured output, a criterion that service and logistics firms cannot satisfy irrespective of their exposure to disruption; war-relief measures were reported by respondents as similarly oriented towards producers. Firms most exposed to corridor closure were therefore among those least able to reach the instruments designed to assist recovery. This shifts attention from firm-level resilience strategies towards the institutional environment in which those strategies are attempted. Second, it examines the compounding effects of a pandemic followed by a major geopolitical disruption within a single analytical frame, showing that the two shocks placed demands on different resilience capacities and responding to calls for more integrative approaches [2]. Third, it provides qualitative firm-level evidence from a context that remains underrepresented in the resilience literature, extending the sectoral range beyond the manufacturing and energy firms that dominate existing Baltic studies.

2. Theoretical Background and Literature Review

2.1. Supply Chain Resilience

Supply chain resilience refers to the capacity of a supply chain to prepare for unexpected disruptions, to respond to them, and to recover while maintaining continuity of operations at a desired level of performance [6]. Early foundational work by Christopher & Peck (2004) [8] established resilience as a core objective of supply chain design, while Sheffi & Rice (2005) [9] characterised the disruption profile through which firms move, from initial impact to eventual recovery. Building on these foundations, the framework proposed by Ponomarov & Holcomb (2009) [6] conceptualises resilience through three interrelated capacities: absorptive capacity, the ability to absorb the initial impact of a disruption; adaptive capacity, the ability to adjust operations and strategies in response to changed conditions; and restorative capacity, the ability to recover and return to a desired or improved state. This three-part structure provides a useful analytical lens for interpreting the varied responses of the firms examined in this study.

Subsequent scholarship has broadened the concept along several dimensions. Hohenstein et al. (2015) [10], in a systematic review, identified flexibility, redundancy, visibility, collaboration,

and agility as core elements of resilient supply chains, while Scholten & Schilder (2015) [11] highlighted inter-organisational collaboration as a key mechanism in building resilience. Tukamuhabwa et al. (2015) [12], surveying ninety-one sources, similarly noted that even though many resilience strategies have been proposed, comparatively little research addresses how firms select among them; Ali et al. (2017) [13] then consolidated the area around five core capabilities: the abilities to anticipate, adapt, respond, recover, and learn. More recently, Ivanov (2022) [2] argued that the size and time span of pandemic-era disruptions require a shift away from a narrow, reactive conception of resilience, and towards a wider supply chain viability idea. This broader idea integrates agility, resilience, and sustainability, not just one dimension. That stance is directly useful for the present study, because it considers not a single isolated shock but the cumulative impact of a pandemic followed by a longer geopolitical crisis.

A further conceptual development is central to the argument advanced here. Wieland & Durach (2021) [14] distinguish two perspectives on resilience: an engineering perspective, which understands resilience as the capacity of a system to return to a prior equilibrium, and a social-ecological perspective, which understands it as the capacity to persist, adapt, or transform in the face of change. The distinction matters here because, as the findings below show, the most severely affected firms did not return to their pre-disruption configuration at all; they reconstituted their markets, routes, and service models around a permanently altered environment. An equilibrium conception of resilience cannot adequately describe that outcome.

2.2. Dynamic Capabilities

The Dynamic Capabilities Theory offers a complementary lens for understanding how firms adapt to rapidly changing environments [15]. In its later elaboration, Teece (2007) [16] disaggregated dynamic capabilities into three core clusters: sensing, the ability to identify and assess emerging threats and opportunities; seizing, the ability to mobilise resources to respond to them; and transforming, the ability to reconfigure the firm's resource base and organisational structure. Although the framework was originally developed in the context of large, technology-intensive firms and builds on the resource-based view of the firm [17], and although some scholars have questioned the precision of the construct [18], a growing body of research has applied it to firms of varying sizes. García-Valenzuela et al. (2023) [19], for example, found that among various dynamic capabilities, innovation capability was the strongest driver of SME resilience during the pandemic. Related work has specified the underlying mechanisms more precisely. Ambulkar et al. (2015) [20] found that a disruption orientation alone does not produce firm resilience: it must be coupled with either the ability to reconfigure resources or an established risk-management infrastructure, and the relative weight of these depends on whether the disruption is of high or low impact. Gölgeci & Ponomarov (2013) [21] showed that firm innovativeness enables more effective responses to supply chain disruptions, a result that anticipates the role of prior digitalisation among the firms examined here. In the SME context specifically, Ates & Bititci (2011) [22] demonstrated that change-management process capability is fundamental to resilience, and that the characteristic weakness of SMEs lies in long-term planning rather than in operational responsiveness.

The two frameworks operate at different levels and are used here accordingly: the Supply Chain Resilience Framework specifies outcome states, namely absorption, adaptation and restoration, while the Dynamic Capabilities Theory specifies the organisational processes that produce them. The analysis treats the second as explaining variation in the first. The specific pairing adopted here, in which sensing is read against absorption, seizing against adaptation, and transforming against restoration, is not stated in either source framework. Neither Teece (2007) [16] nor Ponomarov & Holcomb (2009) [6] maps one set of constructs onto the other. The pairing is proposed by the author as an analytical starting point on the grounds of conceptual proximity, and it is treated throughout as a proposition to be examined against the evidence rather than as an established relationship. It is also not exclusive: a single dynamic capability may contribute to more than one resilience capacity, and the digitalisation of the customs brokerage, discussed in Section 4.2.2, is read below as both a seizing and a transforming move. Section 5 examines where the proposed pairing holds and where it does not.

Figure 1 sets out the framework used here. Read from left to right, it treats the type of disruption as the point of entry, the dynamic capability processes as the mechanism, and the resilience capacities as the outcome. The three solid arrows represent the pairing proposed by the

author, as set out above: sensing is read against absorption, seizing against adaptation, and transforming against restoration. These arrows are analytical propositions, not relationships specified in the source frameworks, and they are not exclusive of one another. The remaining elements are drawn not from those frameworks but from the case evidence reported below, and are marked as such. The dashed outcome box records an outcome that the restorative category does not accommodate, and the two dashed boxes at the foot of the figure record the conditions under which the process–outcome relationship does not hold as specified. Both are developed in Section 5.

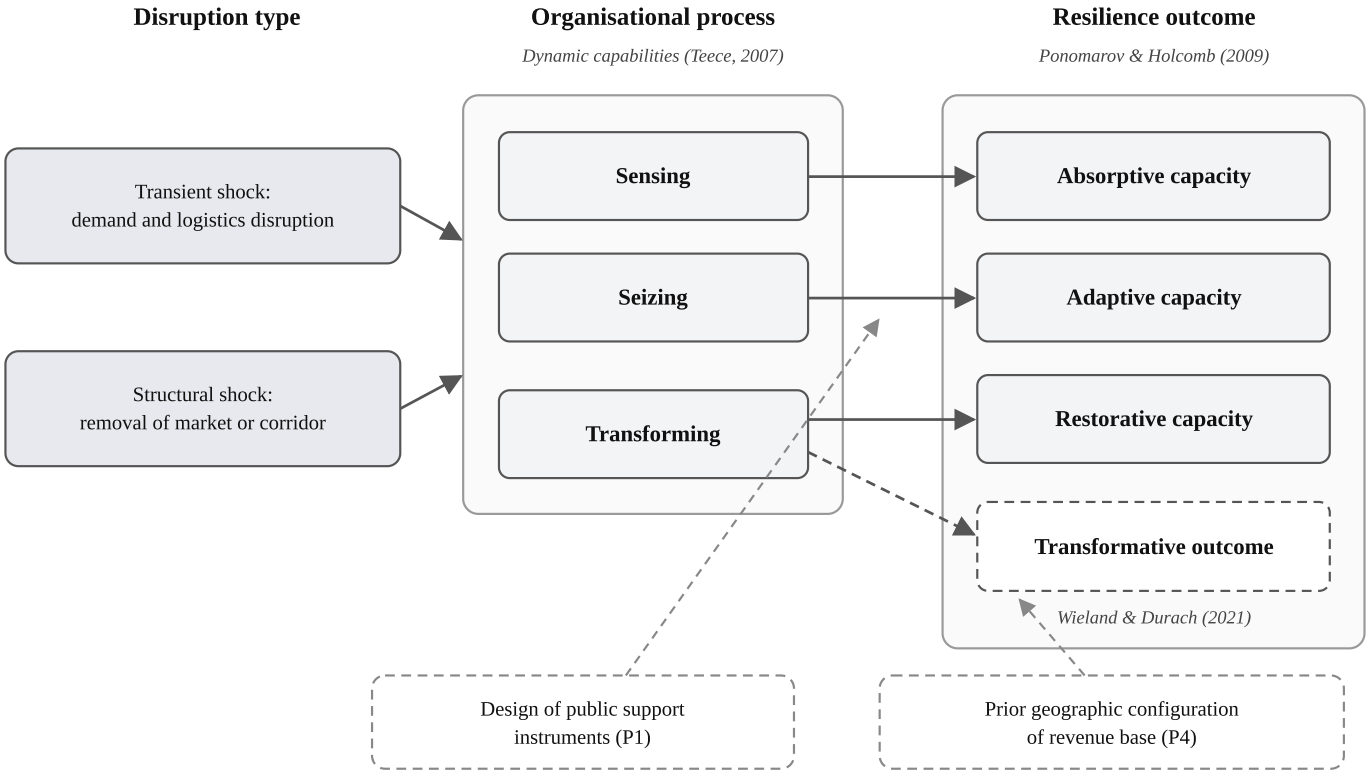

Figure 1. Proposed framework linking dynamic capability processes to supply chain resilience outcomes. *Note*. The solid arrows represent pairings proposed by the author, not relationships specified in the source frameworks.

2.3. The Baltic and Lithuanian Context

The Baltic states occupy a unique position at the intersection of European integration and historical dependence on eastern trade [5]. Prior to 2022, Russia and Belarus were significant trading and transit partners for Lithuania, and the country's logistics sector was heavily oriented towards east–west flows. The imposition of sanctions and the closure of Belarusian and Russian transit routes therefore affected Lithuanian firms with particular severity [4]. Existing studies of Lithuanian firms have tended to focus on the pandemic period alone [7,23]. Fewer studies, however, have examined how the same firms subsequently navigated the geopolitical disruption of the war, which is a central concern of this study. Lithuania's position in European production networks has historically been that of a receiving node. Slepniov et al. (2010) [24] document Danish manufacturers relocating production to Lithuania to reduce labour costs, as part of a wider redistribution of work across globally dispersed operations networks. Whether firms operating in Lithuania pursue geographic proximity in their own sourcing decisions is a separate question, and one this study addresses directly.

2.4. Alternative Transit Corridors and the Middle Corridor

A central consequence of the war for firms exposed to east–west trade has been the disruption of the older transit corridors that link Europe with Asia. Coming immediately after the pandemic, the war has been characterised in the literature as a mega-disruption, which is different from ordinary logistical interruptions in its scale, duration, and depth [3,25]. Before 2022, the North-

ern Corridor, running through Russia and Belarus, carried the majority of overland freight between Asia and Europe. The outbreak of the war brought this route to an abrupt halt. As a result, logistics firms and large manufacturers began rerouting cargo towards the Middle and Southern corridors. Those paths run through Kazakhstan, the Caspian Sea, the Caucasus, and Türkiye. The diversion, however, came at a substantial cost in transit time and operational complexity. This reflected the longer distances and the multimodal land–sea transfers involved, all of which add friction [25].

The functioning of the resulting Middle Corridor, formally the Trans-Caspian International Transport Route, has been assessed with cautious realism in the later literature. A World Bank (2023) [26] diagnostic found that, in its current state, the corridor is about three times slower than the Northern route, while also estimating that trade volumes could triple could triple by 2030 if the necessary investment and policy reforms were implemented. The OECD (2025) [27] likewise stressed that the main constraints are not only physical but also regulatory, with informal border fees, limited warehouse capacity, and multiple agency approval steps, even if it also reported that cargo movement through the corridor climbed by 62 per cent in 2024. Nurseiit (2026) [28] confirmed that shortfalls in Caspian Sea vessels, uneven pricing, and locomotive bottlenecks in Georgia persisted and continued to erode the corridor's speed advantage, even as geopolitical urgency pushed shippers towards it. Taken together, this body of work suggests that, several years after the disruption, the Middle Corridor is still a fragmented, multimodal, and only partially functional substitute rather than a complete replacement for the former northern routes. That outcome directly matches the firm-level realities described in the present study.

3. Methodology

3.1. Research Design

This study adopts a qualitative, cross-case interview design oriented towards theory-building from cases [29]. The approach is well suited to investigating complex, context-dependent phenomena where the boundaries between the phenomenon and its context are not clearly defined [30], and where the processes of interest cannot be specified in advance as closed response categories. Because the evidence base for each firm consists of a single in-depth informant account rather than multiple sources per firm, the design is described here as a cross-case interview study rather than as a case study in the fuller sense set out by Yin (2018) [30], which requires the triangulation of interview data with documentary and archival evidence. Cross-case comparison nonetheless remains central to the analysis, enabling the identification of patterns and divergences across firms of differing sectors and sizes while preserving the depth of each individual account [29]. The design is also retrospective. The disruptions under study occurred between 2020 and 2024, whereas the interviews were conducted in 2026; the firms were therefore not observed as the events unfolded, and the accounts analysed here are reconstructions offered after the outcomes were known. The study makes no longitudinal claims, and the implications of this design for recall and attribution are set out in Section 6.3.

3.2. Sampling and Participants

Participants were recruited through purposive sampling, supplemented by professional networking and referrals, with the aim of achieving maximum variation across sector and firm size. A total of eight interviews were conducted, of which two were excluded from the analysis according to a criterion defined prior to coding: an interview was excluded where the informant's organisational role did not provide direct visibility into the firm's strategic sourcing and business-continuity decisions during the study period. In these two cases, the informants held roles that did not afford reliable insight into the firm-level decisions that are the focus of this study. This criterion was applied uniformly to all interviews before thematic analysis began, leaving six firms whose accounts form the basis of the study. To protect confidentiality, all firm and participant identities have been anonymised and are referred to by codes throughout. Table 1 summarises the anonymised profile of each case.

The resulting sample spans maritime logistics, e-grocery retail, customs and transit services, agri-trade consultancy, multinational manufacturing, and construction, and ranges from micro firms to large multinational operations. This diversity is treated in the analysis as an analytical asset, enabling comparison of how firms of different sizes and sectors experienced and responded

Table 1. Profile of participating firms (anonymised).

Case	Sector	Approximate Size	Respondent Role
Firm A	International maritime logistics (shipping line agent)	Small	Business Development Manager
Firm B	E-grocery/last-mile retail delivery	Small	Shift Lead, warehouse & inventory
Firm C	Customs & transit brokerage	Large (multinational)	Senior executive
Firm D	Agri-trade & business development consultancy	Micro	Business Development Consultant
Firm E	FMCG manufacturing	Large (multinational)	Strategic Revenue/Demand Planning Manager, Baltics
Firm F	Construction services (previously pharmaceutical)	Small–medium	IT department/procurement

to the same external shocks [30]. The level of visibility each informant held varied, and the analysis treats that variation explicitly. In the micro and small firms, the distance between operational and strategic decision-making is short: the Firm D informant is a principal of the consultancy, and the Firm A business development manager held direct responsibility for client and routing decisions in a small agency. The Firm C informant is a senior executive of the brokerage and was directly involved in the market-entry and service-model decisions reported here. The Firm E informant, as Baltic demand and revenue planner, had direct visibility of sourcing allocation and availability, although corporate policy prevented discussion of raw-material sourcing in detail. Two informants held narrower vantage points. The Firm F informant works in procurement and information technology and was not employed by the firm during the pandemic period, so that case's account of 2020 to 2021 is indirect. The Firm B informant is a shift lead with operational visibility of warehouse, inventory and vendor performance, but not a member of the firm's strategic management; statements attributed to Firm B about company-level strategy are therefore reported as that informant's understanding of firm policy rather than as an account from the decision-making level. These differences are noted where the relevant evidence is presented and are revisited in Sections 5 and 6.3.

The analytical sufficiency of six cases rests not on a claim of thematic saturation, which a heterogeneous sample spanning six sectors could not credibly support, but on the concept of information power [31]. Sample size requirements are lower where the study aim is narrowly specified, the sample is highly specific to that aim, established theory guides the analysis, and the quality of dialogue is high. All four conditions obtain here: the aim concerns a defined pair of disruptions within a single national setting; informants were selected for direct exposure to those disruptions; two established frameworks structure the coding; and the visibility each informant held into the relevant decisions is set out case by case above. Six cases also fall within the range Eisenhardt (1989) [29] identifies as workable for theory-building from cases. The study was designed around small and medium-sized enterprises; two larger firms were included as contrast cases, allowing the size-related propositions to be examined against variation rather than within a single size band.

3.3. Data Collection and the Theoretical Grounding of the Interview Protocol

Data were collected through semi-structured interviews conducted in June 2026, using a common protocol of twenty-five open-ended questions. Interviews were conducted online via video conferencing and lasted approximately 45 minutes; in one case (Firm E) the participant elected to respond in writing to the same protocol, reflecting the preferences and availability of participants. Because that case yielded a written text rather than spoken responses, the statements attributed to Firm E are verbatim, whereas those from the remaining cases are near-verbatim reconstructions from field notes, as described below. Interviews were conducted in English, which was not the first language of most participants; although all were professionally fluent, this may have constrained nuance in some responses and is acknowledged in the Limitations section (Section 6.3). At the participants' request, interviews were not audio-recorded. The approved research protocol expressly provided for detailed note-taking as an alternative where participants preferred not to be recorded, and this option was taken in all six cases; participants were more willing to speak candidly about commercially and geopolitically sensitive matters when not being

recorded. Detailed contemporaneous notes were taken during each interview and expanded into full write-ups immediately afterwards, while recall was fresh. The informant statements presented in Section 4 are therefore reconstructed near-verbatim from these field notes rather than transcribed from audio; they are reported as faithful renderings of what participants said, not as audio-verified verbatim transcription. This is an established practice in field-note-based qualitative research, and its limitations for exact wording are acknowledged in the Limitations section (Section 6.3).

The written response from Firm E is not equivalent to the spoken interviews, and the difference is treated explicitly in the analysis. The same twenty-five-question protocol was used in both formats, so the thematic coverage is comparable. The mode of elicitation, however, is not. The written format allowed no probing or follow-up, so the responses are shorter and address only what the protocol asked; they were composed rather than spoken, and may have passed through a degree of internal review before being returned. Conversely, they are free of the transcription loss and recall error that affect note-based records of spoken interviews, which is why they are the only statements in this study reported as verbatim. In coding, the written case was therefore treated as a source of confirmatory rather than exploratory evidence: it was used to test patterns identified in the spoken interviews, and no theme rests on the written case alone.

The interview protocol was not constructed arbitrarily. Each of its six thematic sections was derived from the study's theoretical framework and mapped onto a specific research question, ensuring a transparent chain of reasoning from theory to question to data. Table 2 sets out this mapping, and the full protocol, with the construct and source behind each question, is reproduced in Appendix A.

Table 2. Mapping of interview protocol sections to research questions and theoretical constructs.

Protocol Section	RQ	Resilience Framework Dimension	Dynamic Capabilities Dimension
A. Company profile and background	-	Contextual foundation for cross-case comparison	-
B. Disruption experience	RQ1	Absorptive capacity	Sensing
C. Adaptation and resilience strategies	RQ2	Adaptive capacity	Seizing
D. Organisational capabilities	RQ3	Resource base [17]	Transforming
E. Perceived resilience outcomes	RQ4	Restorative capacity	-
F. Policy expectations	RQ5	Meso- and macro-level institutional environment	-

Note. Resilience framework dimensions follow Ponomarov & Holcomb (2009) [6]; dynamic capabilities dimensions follow Teece (2007) [16]. The alignment of the two columns is the author's analytical construction and is not specified in either source framework; it is examined against the evidence in Section 5.

3.4. Data Analysis

The interview data were analysed using thematic analysis, following the six-phase process proposed by Braun & Clarke (2006) [32]: familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final account. Coding was conducted manually rather than with qualitative data analysis software, given the size of the dataset. A hybrid coding approach was adopted, combining deductive codes derived from the two theoretical frameworks, namely sensing, seizing, and transforming [16], and absorptive, adaptive, and restorative capacities [6], with inductive codes emerging directly from the data. The full coding scheme is reported in Appendix B. Cross-case analysis was then used to identify patterns and divergences across sectors and firm sizes, following a replication logic in which each firm serves as a distinct analytical unit against which emerging patterns are tested [29,30].

3.5. Trustworthiness

Following Lincoln & Guba (1985) [33], trustworthiness was addressed across four criteria: credibility, transferability, dependability, and confirmability.

Credibility. Where firm-level accounts touched on conditions that could be verified externally, they were compared against published evidence. The customs brokerage's account of dysfunction in the Central Asian corridor (Section 4.2.3) was assessed against corridor diagnostics reporting consistent structural bottlenecks [26–28]. Other respondent estimates—notably one informant's assessment of sector-wide contraction in Lithuanian logistics—could not be corroborated in this way and are therefore reported as perceptions rather than as measured quantities.

Transferability. Thick description of each firm's sector, size, and disruption exposure is provided (see Table 1 and Section 4), enabling readers to assess the applicability of the findings to other settings. Purposive maximum-variation sampling supports analytical rather than statistical generalisation [29].

Dependability. An audit trail was maintained, comprising the common interview protocol, the field notes and their expanded write-ups, and the coding scheme applied during analysis. The deductive–inductive coding procedure is documented in Section 3.4.

Confirmability. As a single researcher conducted the interviews, coding, and interpretation, a reflexivity statement is provided. The researcher's prior professional background includes purchasing in the food industry and export–import operations, sectors that overlap with several of the firms studied. This experience aided access, rapport, and the interpretation of technical accounts, but it may also have shaped which issues were foregrounded during interviews and coding.

3.6. Ethical Considerations

The study received ethical approval from the Committee for the Assessment of Compliance of Applied Research with Research Ethics at Kauno Kolegija. All participants took part voluntarily and were assured of confidentiality. Participants additionally gave specific consent for the use of direct quotations, on the condition that personal and company identities were coded and anonymised. All firm names, personal names, and other identifying details have been anonymised in the field notes, the analysis, and this article, in accordance with the General Data Protection Regulation (Regulation (EU) 2016/679).

4. Findings

The analysis produced five principal themes, each corresponding broadly to one of the study's research questions: the differential impact of the two disruptions, strategies of adaptation, the role of firm size and capabilities, perceived resilience outcomes, and policy expectations. Each theme is presented below and illustrated with anonymised evidence drawn from the interviews, and Table 3 summarises the cross-case comparison of disruption impact, adaptation, and outcome.

A note on the status of the quoted material. No interview was audio-recorded. The statements presented in this section are near-verbatim reconstructions from contemporaneous field notes expanded immediately after each interview. They are reported as faithful renderings of what participants said, but they are not audio-verified transcription, and the exact wording cannot be guaranteed. Firm E did not take part in a spoken interview; that participant responded in writing to the same protocol, so statements attributed to Firm E are quoted verbatim from the participant's own written text. Quotations are labelled accordingly throughout.

4.1. The Differential Impact of the Two Disruptions (RQ1)

A consistent finding across the cases concerns the contrasting impact of the two disruptions. For most firms, the COVID-19 pandemic was not experienced as a supply chain catastrophe; in several cases it was neutral, and in others it was distinctly beneficial. In contrast, the Russia–Ukraine war and the associated sanctions produced the most severe and long-lasting damage, especially for firms whose operations were tied to eastern transit corridors. This pattern aligns with the observation by Uygur & Peyravi (2025) [4] that the geopolitical disruption placed exceptional strain on Lithuanian firms with eastern trade exposure.

For the maritime logistics firm (Firm A), the pandemic is described as one of the strongest periods the sector had ever experienced, as consumer spending moved towards goods while people stayed at home. The respondent said that cargo flows stayed almost the same both before and after the pandemic, while the war removed the firm's Belarusian business completely, which had

Table 3. Cross-case comparison of disruption impact, adaptation, and outcome.

Case	Pandemic Impact	War Impact	Primary Adaptation	Key Capability	Perceived Outcome
Firm A Maritime logistics	Positive—sector boom; cargo flows unchanged	Severe—loss of Belarusian flows, approx. half of pre-war volume	Sought clients outside Lithuania; relied on global principal	Self-managing staff; affiliation with global carrier	Not addressed
Firm B E-grocery	Strongly positive—daily orders tripled	Moderate negative—loss of Ukrainian vendors; cost inflation	Vendor diversification (UK, Middle East); safety stock	Platform digitalisation; warehouse sharing	More resilient
Firm C Customs brokerage	Positive—office closures reduced operating costs	Catastrophic—75% collapse in orders; loss of Belarus and Russia business	Market expansion (Italy, Switzerland, Romania); shift into rail	Multi-country information reach; digital service delivery	Cautiously optimistic
Firm D Agri-trade consultancy	Negligible on the logistics side	Severe at sector level; European suppliers became unreliable	Switched sourcing to China, accepting longer lines	Individual expertise; small-scale flexibility	Not addressed
Firm E FMCG manufacturing	Moderate—third-party raw material delays; shelf availability	Greater—self-imposed exit from Russian-made products overloaded remaining plants	Capacity reallocation; tighter short- and long-term forecasting	Cross-functional coordination of people, resources, solutions	More resilient
Firm F Construction services	Limited (informant not in post during this period)	Limited—Russian ties severed within 48 hours	Immediate supplier severance; redirection to other markets	Prior digitalisation; globally distributed operations	Resilient

Note. Impact classifications reflect respondents' own characterisations rather than an external measure. "Not addressed" indicates that the respondent did not comment on perceived resilience in comparable terms. The Firm F informant was not employed by the firm during the pandemic period, so that case's account of 2020–2021 is indirect.

accounted for about half of its pre-war volume, with the remainder now consisting of domestic Lithuanian traffic. The e-grocery firm (Firm B) reported that the pandemic drove extraordinary growth, with daily order volumes tripling as customer habits shifted firmly towards online grocery purchasing:

> *"During the COVID period the mindset of the customers changed... they were having only 100 orders per day, now they are getting 300."* (Firm B, reconstructed)

The customs and transit brokerage (Firm C) presented the sharpest contrast. During the pandemic, the firm reduced its operating costs by closing physical border offices and shifting to digital service delivery. The war, however, was catastrophic. The respondent described losing the firm's Belarusian and Russian business almost entirely, with an order volume collapse of approximately seventy-five per cent at the outbreak of the war and losses amounting to several million euros:

> *"At the end of March, we had a drop of 75 per cent of orders when the war started, and I lost my business in Belarus and Russia. The losses ran to several million euros, and they will not come back."* (Firm C, reconstructed)

The agri-trade consultant (Firm D) similarly reported that the pandemic had little effect on the logistics side of the business, whereas the sanctions were, in this respondent's assessment, devastating for the Lithuanian logistics sector as a whole—given that so much transport had been bound to Russia via Lithuania. The respondent estimated a contraction of roughly 60 per cent; as an outside observer's estimate offered from an adjacent sector rather than from within logistics, this figure is reported here as a perception rather than a measured quantity. The manufacturing firm (Firm E) reported that the war had the greater impact, as the firm chose to stop taking products manufactured in Russia, which overloaded capacity in its remaining factories and affected product availability on shelves. Only the construction services firm (Firm F), whose operations were globally distributed and already digitalised, reported comparatively little impact from either event.

Taken together, the pandemic emerges as an operational challenge that most firms absorbed, whereas the war was a market-destroying shock for those exposed to eastern trade. One respondent captured the contrast in a single formulation:

> *"Geopolitical, because it stopped goods movement. The pandemic stopped just people movement - it increased goods moving."* (Firm D, reconstructed)

4.2. Strategies of Adaptation (RQ2)

Firms responded through a recurring set of strategies, of which three were especially prominent: supplier and route diversification, accelerated digitalisation, and the reconfiguration of transport routes. These correspond closely to the adaptation strategies identified in the wider literature [2,11].

4.2.1. Supplier and Route Diversification

Diversification was the most widely shared response. The e-grocery firm, having lost several reliable vendors based in Ukraine, shifted its sourcing towards suppliers in the United Kingdom and the Middle East, and drew from the experience an explicit strategic lesson:

> *"This taught the company one thing: when you rely only on someone and something happens due to a geopolitical crisis, your business can drop down. So now the company has a strategy – don't rely on a single vendor or a single country; diversify."* (Firm B, reconstructed)

The manufacturing firm articulated the same principle from a demand-planning perspective, saying that firms should "divide, have local suppliers so if one fails you can turn to another" (Firm E, written response). The agri-trade consultant, after observing that European suppliers were unreliable in the disruption, reoriented sourcing towards China, while noting the accompanying challenges of language, time differences, and uneven product quality (Firm D). The customs brokerage responded by expanding into new national markets, including Italy, Switzerland, and Romania, and by moving beyond road transport into rail (Firm C).

The construction firm severed its Russian supplier ties within forty-eight hours: the first day was spent absorbing what had happened, the second brought an official internal instruction to cut everything connected to Russia (Firm F). A notable absence runs through these accounts. Although every firm was asked directly whether it had considered nearshoring or reshoring, none had adopted either. The maritime logistics and manufacturing firms reported no change in sourcing geography at all (Firms A and E). The customs brokerage's clients shifted first to air freight and subsequently towards the Central Asian corridor (Firm C). Diversification, in these cases, meant lengthening supply lines rather than shortening them—a pattern that sits uneasily with the policy emphasis on nearshoring and reshoring as European resilience strategies.

4.2.2. Digitalisation

Digitalisation featured consistently as an enabler of resilience, echoing the finding of García-Valenzuela et al. (2023) [19] that innovation capability is a primary driver of SME resilience. For the e-grocery firm it was described as decisive:

> *"Digitalisation is the only key... customers have the app, they can order anything, and our delivery drivers are only responsible to deliver."* (Firm B, reconstructed)

For the customs brokerage, the pandemic forced a rapid transition to digital service delivery: orders were received through email and messaging platforms, and these processes had to be aligned with customs authorities that had previously required the physical delivery of documents. The shift also permitted a substantial reduction in physical infrastructure, with border offices cut from over thirty to roughly a dozen and operating costs falling accordingly. This digital transition, initially a pandemic necessity, became a permanent feature of the firm's operations (Firm C). The maritime logistics firm found that its existing systems allowed a seamless shift to remote working during the pandemic (Firm A), and the construction firm attributed part of its resilience to already being digitalised and present in international markets (Firm F).

4.2.3. Route Reconfiguration and the Corridor Problem

For logistics and transit firms, the reconfiguration of transport routes was a central concern. With Russian and Belarusian transit closed, cargo that had previously moved through these corridors required alternative pathways. The customs brokerage described the emergence of the Central Asian, or so-called Middle, corridor as a potential alternative, but reported that it remained, at the time of interview, largely unworkable:

> *"The Asia corridor works so badly - it's really bad, there is no solution yet... more funding, more attention, more trials, but it is not really a solution."* (Firm C, reconstructed)

This finding is significant because it indicates that, several years into the geopolitical disruption, a durable structural solution to the loss of the eastern transit routes had not yet materialised, leaving a persistent vulnerability for firms dependent on east–west cargo flows. This firm-level observation aligns closely with the macro-level evidence describing the structural bottlenecks of the Middle Corridor, including its multimodal fragmentation, Caspian Sea vessel shortages, and regulatory friction [26–28]. The overlap between this respondent's day-to-day operational experience and the corridor-level findings of major institutional studies lends particular weight to the conclusion that the alternative routes remain, at present, only a partial substitute for the lost northern corridors.

4.3. Firm Size and Organisational Capabilities (RQ3)

Firm size emerged as a double-edged capability rather than a straightforward advantage or disadvantage. Smaller firms were repeatedly described as more agile and better able to change direction quickly, which matches the operational responsiveness Ates & Bititci (2011) [22] link to SMEs. The agri-trade consultant explicitly stated that "*for a small business it is very easy to adapt to changes*" (Firm D, reconstructed). The maritime logistics respondent made a similar point: "*for smaller companies it was easier*" (Firm A, reconstructed).

Larger firms, in turn, appeared to hold structural advantages in resources, brand strength, and their access to public backing, which fits the resource-based view of competitive advantage [17]. In the construction sector, one respondent said large firms possess brand awareness and financial reserves that allow them to recover when disruptions happen, while small and medium-sized enterprises, lacking such buffers, can be harmed far more severely (Firm F). The e-grocery respondent captured this ambivalence directly, noting that large firms usually have more resources, government funding, and visibility, while smaller firms face greater constraints on support, yet possess greater growth potential and more flexibility in day-to-day operational adjustments (Firm B).

The customs brokerage identified a structural disadvantage that size alone does not explain: despite employing over two hundred people, it was effectively excluded from public digitalisation funding by eligibility rules discussed in Section 4.5.

Beyond size, firms attributed their adaptive capacity to specific internal strengths, consistent with the dynamic capabilities perspective [15] and with the resource reconfiguration mechanism noted by Ambulkar et al. (2015) [20]. In practice, these included skilled and self-motivated employees, with the maritime logistics company saying they were able to maintain productivity without supervision during remote working (Firm A). A second point was the ability to function across many countries while gathering, interpreting, and then acting on information from different markets, which the customs brokerage cited as its principal advantage (Firm C). For the manufacturing firm, the emphasis was on the capability to combine "people, resources, and solutions" in one approach (Firm E, written response). The construction firm, in turn, focused on global distribution and prior digitalisation as the base of its resilience (Firm F), a configuration consistent with the link Gölgeci & Ponomarov (2013) [21] describe between firm innovativeness and disruption response effectiveness.

4.4. Perceived Resilience Outcomes (RQ4)

Most respondents perceived their firms as more resilient after the disruptions than before, attributing this improvement to a process of forced adaptation and learning. The e-grocery firm described a clear progression from vulnerability to preparedness:

> *"Earlier it was difficult when there was a war, but now, four years later, it is more resilient. The company is already ready for what comes next - if there is a problem with some countries, we will find our alternative."* (Firm B, reconstructed)

The same respondent noted that a subsequent episode of geopolitical tension elsewhere caused little disturbance, because the firm had internalised the expectation that disruptions may occur and the practice of preparing alternatives (Firm B). The customs brokerage expressed a more cautious optimism, anticipating that the business would recover and grow larger within two

to three years on the basis of lessons learned and continuing market diversification, while acknowledging that a fully functioning alternative to the lost eastern corridors did not yet exist (Firm C). The construction firm considered itself resilient largely by virtue of its global and digital character (Firm F). The manufacturing firm attributed its greater preparedness simply to accumulated experience: "*Definitely yes - learning by doing, and having some experience already in similar cases.*" (Firm E, written response). The maritime logistics and agri-trade respondents did not address this dimension in comparable terms, and no perceived-resilience judgement is attributed to them here.

The progression that several respondents described, from acute vulnerability towards a state of greater preparedness, is not adequately captured by an equilibrium conception of resilience. These firms did not return to their pre-disruption configuration; they reconstituted their markets, routes, and service models around a permanently altered environment. This corresponds to the adaptive and transformative capacities set out by Wieland & Durach (2021) [14] rather than to the restorative return implied by an engineering conception, and it suggests that the outcome dimension of the Ponomarov & Holcomb (2009) [6] framework requires extension where the disruption is structural rather than transient.

4.5. Policy Expectations and Barriers to Support (RQ5)

Respondents reported receiving little meaningful government support during the disruptions, echoing the reliance on limited short-term measures noted by Župerkienė et al. (2021) [7]. The wider evidence on pandemic-era support in the region is mixed. In Lithuania, a large share of the state support made available to firms, particularly for maintaining liquidity, went unused [23], while firm-level evidence from Slovakia indicates that support was broadly well targeted but modest relative to the size of the shock, with SMEs facing a higher insolvency risk than larger firms [34]. Several respondents noted that they had neither sought nor received assistance. One respondent's account suggested that the problem was not merely inaccessibility but invisibility:

> *"I'm not sure if there was such support from government... I'm not sure even where they should support us, because we were just working, and this is it."* (Firm A, reconstructed)

Where support was mentioned, it took the form of deferred tax payments or occasional funding to participate in trade fairs in new markets (Firm C).

The most pointed policy critique concerned the barriers logistics and supply chain firms face in reaching support mechanisms. The customs brokerage explained that war-related support schemes were, in practice, available to manufacturers and producers but not to logistics firms:

> *"Unfortunately, we are in the transport sector, so we are not able to use these things that support companies regarding the war. If we were a factory or producer we could use it, but as a logistics firm we get zero."* (Firm C, reconstructed)

The same respondent described a parallel barrier in accessing funding for artificial intelligence and digitalisation, which required establishing a separate information-technology company with its own director and accountants, at an annual cost that exceeded the value of the available grant. The respondent's central recommendation was therefore that policymakers should change their view of logistics and supply chain firms, recognising them as integrated, all-in-one businesses with internal information-technology and trade functions, and should remove the structural barriers that prevent them from accessing digitalisation support directly (Firm C).

This account is consistent with the published conditions of national digitalisation support for SMEs. The 2023 call "MVĮ skaitmeninimas" (No. 02-033-K) requires applicants to derive at least 51 per cent of annual sales revenue from products of their own manufacture in each of the preceding two financial years [35]. A customs brokerage or logistics operator cannot satisfy this condition, since it sells services rather than manufactured output. Whether or not this is the scheme the respondent had in mind, it shows that the barrier described is not a matter of firm-specific circumstance; it follows from how eligibility is defined. No equivalent published criterion could be located for the war-related relief measures the same respondent described, and that part of the account is reported here as the respondent's understanding of the schemes available rather than as a documented eligibility rule.

Other respondents offered complementary recommendations. The e-grocery firm called for a prepared emergency relief package for crisis periods, including tax rebates, financial support, and training programmes to help firms solve operational problems (Firm B). The manufacturing respondent argued, from a personal standpoint, that the free economy should not be over-

regulated through political decisions, but that governments should nonetheless support the security of irreplaceable supplies (Firm E). The construction firm emphasised the importance of maintaining strong relationships with all suppliers and suggested financial support in the form of low-interest lending (Firm F). The agri-trade consultant put the matter in the sharpest terms of any respondent, arguing that policymakers should recall who funds them: taxpayers are businesses, and measures that damage business ultimately remove the base on which public salaries rest (Firm D).

5. Discussion

Whereas much of the pandemic-era literature treats COVID-19 as the defining supply chain shock of the era [1,2], the firms in this study consistently identified the Russia–Ukraine war and its associated sanctions as the more severe and structurally damaging event, in line with Uygur & Peyravi (2025) [4]. For firms embedded in eastern transit corridors, the war did not merely disrupt operations; it removed entire markets. This finding underscores the importance, in the Baltic context, of analysing geopolitical disruption as a distinct category of supply chain risk, qualitatively different from the demand and logistics shocks of the pandemic.

Interpreted through the Dynamic Capabilities Theory [15], the cases produce a result that the framework does not readily accommodate. The company showing the broadest span of dynamic capabilities was also the worst affected. The customs brokerage, for instance, sensed the vulnerability of its border-dependent model early and seized alternatives rapidly, entering Italy, Switzerland and Romania and shifting from road to rail. At the same time, it moved from a physical service model towards digital delivery, and in the process it shut most of its offices. Still, it lost approximately three-quarters of its order volume, and it has not returned to its pre-war position. The construction services firm presents the opposite configuration. It showed no comparable capability development during the study window; its main move was to cut its Russian supplier connections within forty-eight hours. It emerged far less damaged.

In these two cases, what appears to separate the outcomes is exposure rather than capability. The brokerage's revenue was geographically concentrated in precisely the corridors that closed; the construction firm's was distributed across markets that remained open, and its digital infrastructure had been built years earlier for reasons unconnected to either disruption. This suggests a boundary on the explanatory reach of dynamic capabilities in conditions of structural geopolitical disruption: where a shock removes a market rather than degrading access to it, the configuration of prior exposure constrains what capability can achieve. In these cases, capabilities appear to have shaped how quickly firms began to rebuild, while whether rebuilding was necessary followed from prior exposure. This reading is formalised as *P4* below and requires testing against a larger sample.

The two disruptions put demands on different resilience capacities. The pandemic tested absorption, which most firms had in sufficient measure, whereas the war demanded adaptation and in the most affected cases reconstruction. This pattern, however, sits awkwardly within a framework whose outcome language is restorative. What the most severely affected firms describe is not restoration but substitution: the replacement of lost corridors, markets, and customer bases with new ones. Read against the distinction drawn by Wieland & Durach (2021) [14], these outcomes look transformative rather than restorative, and the case evidence points to a boundary condition in the Ponomarov & Holcomb (2009) [6] framework. Their restorative capacity dimension presumes that some prior state is still there to return to, an assumption that geopolitical closure of a transit corridor removes.

Across the cases, firm size appeared to operate on resilience through two channels running in opposite directions. Smaller firms demonstrated greater agility and speed of adaptation, consistent with the flexibility that is often linked to them in the literature [10,22]. However, they also faced higher structural vulnerability, and, critically, structural exclusion from support instruments built around the needs of larger manufacturers. The customs brokerage case, a firm that is not small in absolute terms yet still cannot access digitalisation financing without bearing disproportionate costs, points to the idea that the barrier is not just size. It is the mismatch between how the support schemes are designed and the operational realities of logistics and service providers. The two channels do not cancel out so much as apply at different moments: agility governs the speed of the initial response, while institutional access affects the ability to fund the reconstruction after that. A firm can be well served by the first channel and weakly served by the second, which is what the logistics cases describe.

A further pattern runs counter to prevailing European policy discourse. Although every firm was asked whether it had considered nearshoring or reshoring, none had. Where sourcing changed at all, it moved further away rather than closer: the agri-trade consultant turned to Chinese suppliers after European ones proved unreliable, accepting the resulting costs in language, time-zone difference and quality assurance; the e-grocery firm replaced Ukrainian vendors with suppliers in the United Kingdom and the Middle East; and the brokerage's clients redirected cargo first to air freight and then towards the Central Asian corridor. Resilience, as these firms practised it, meant multiplying options rather than shortening distances. This sits uneasily with a policy literature that has treated proximity as a resilience strategy in its own right, and it suggests that where the binding constraint is supplier reliability rather than transit distance, geographic proximity offers no particular advantage.

The difficulty logistics and supply chain firms face in reaching both war-related relief and digitalisation funding is a barrier that has received limited attention in the resilience literature, which tends to emphasise firm-level strategies over the design of the institutional environment [11]. The exclusion, moreover, operated through more than one mechanism. For the brokerage it was formal: eligibility rules written around manufacturing structures, and a digitalisation scheme requiring the establishment of a separate information-technology entity at a cost exceeding the grant itself. For the maritime logistics firm it was something closer to invisibility—the respondent could not identify what public support might have been relevant to the firm's situation at all. A scheme that a firm cannot find is, in practical terms, indistinguishable from one for which it is ineligible. The evidence here suggests that the availability of support is not sufficient; its accessibility, and its fit with the structure of the firms it is intended to help, are equally important.

These readings rest on single-informant accounts, and their evidential weight is uneven across the cases. Where the informant sat at or near the decision-making level, as in the brokerage and the consultancy, the account can be read as a report of the decisions themselves. Where the informant held an operational vantage point, or was not in post during part of the period covered, the account is better read as an informed description of what the firm did than as an account of why it was decided. The patterns set out above draw their strength from convergence across cases rather than from the authority of any single account, and the propositions below are framed accordingly. A further constraint applies to the comparative claims made above. With six cases spanning six sectors, sector, firm size, geographic spread of revenue and organisational capability co-vary, and their effects cannot be separated within this design. The patterns reported here should therefore be read as candidate explanations rather than as isolated effects, which is the status the propositions below assign to them. The cross-case evidence supports four propositions, offered for testing in larger and comparative samples:

P1. Where public support instruments are designed around the organisational structures of manufacturing firms, service firms facing equivalent disruption exposure experience a gap between seizing and adaptation: they identify viable adaptive responses but cannot resource them.

P2. Firm size affects resilience through two opposing channels—adaptive speed, which declines with size, and institutional access, which increases with it—so that neither small nor large firms hold a uniform advantage under compound disruption.

P3. Transient shocks that suppress demand or delay supply are met principally by absorptive capacity, whereas structural shocks that remove a market require transformative capacity; resilience frameworks whose outcome language is restorative under-specify the latter condition.

P4. Under structural geopolitical disruption, the prior geographic configuration of a firm's revenue base constrains outcomes more strongly than its endowment of dynamic capabilities.

6. Conclusion, Policy Recommendations, and Limitations

6.1. Conclusion

This study examined how six firms operating in Lithuania, spanning a diverse range of sectors and sizes, adapted their supply chains to the compounding disruptions of the COVID-19 pandemic and the Russia–Ukraine war. The findings reveal that, in contrast to the weight placed on the pandemic in much of the resilience literature, the geopolitical disruption of the war was for most firms the more severe and lasting shock, particularly for those historically dependent on Russian and Belarusian transit. Firms adapted principally through supplier and route diversification,

accelerated digitalisation, and geographic expansion, and most emerged not by returning to their prior configuration but by rebuilding around a permanently altered environment. Firm size appeared to operate through two opposing channels, conferring adaptive speed on smaller firms while restricting their institutional access—a division that left logistics and service firms exposed on both counts, since the digitalisation scheme designed to assist recovery conditions eligibility on manufacturing output that service firms do not produce. Theoretically, the cases suggest two boundary conditions. Resilience frameworks whose outcome language is restorative under-specify what occurs when a disruption removes a market rather than degrading access to it; and dynamic capabilities, while appearing to explain the speed with which firms began to rebuild, did not in these cases determine whether rebuilding was necessary, which followed instead from the prior geographic configuration of each firm's revenue base. Both readings are advanced as propositions for testing rather than as established findings.

6.2. Policy Recommendations

On the basis of these findings, several policy recommendations can be advanced, framed at the level the evidence supports. In the short term, governments should establish prepared emergency relief packages for crisis periods, including tax relief and targeted financial support, that are accessible to firms across sectors rather than confined to manufacturers. Accessibility, however, presupposes awareness. One respondent could not identify what public support might have been relevant to the firm at all, which suggests that eligibility reform alone is insufficient without active, sector-specific communication of what is available and to whom. In the medium term, digitalisation and artificial-intelligence funding schemes should be redesigned so that logistics and supply chain firms can access them directly, without the disproportionate requirement of establishing separate information-technology entities. In the longer term, the corridor problem requires attention that firm-level action cannot supply. The evidence here is limited to a single firm's operational experience of the Central Asian route, but that experience converges with corridor-level diagnostics reporting persistent multimodal and regulatory bottlenecks [26,27]. For firms whose viability depends on east–west transit, no substitute for the lost northern corridors is currently available at commercially workable cost—a gap that lies beyond the reach of any individual firm's resilience strategy.

6.3. Limitations and Future Research

This study is subject to several limitations. It is based on six cases, and although these were selected for maximum variation, the findings are analytically rather than statistically generalisable [29,30]. The study makes no claim to thematic saturation, which a sample spanning six sectors could not credibly support. What it offers is a contextualised, in-depth but empirically localised cross-section of firms operating in Lithuania during a specific pair of disruptions; the findings should not be read as representative of Lithuanian supply chains as a whole, still less of the wider Baltic region. Three further limitations warrant emphasis. First, each case rests on a single informant, and the visibility those informants held into firm-level strategic decisions was uneven. In two cases it was partial: the Firm B informant holds an operational rather than a strategic role, and the Firm F informant was not employed by the firm during the pandemic period, so that case's account of 2020 to 2021 is indirect. In a third, corporate policy prevented the Firm E informant from discussing raw-material sourcing in detail. Accounts of sourcing and continuity strategy should be read with these limits in mind, and no finding in this study rests on a single uncorroborated account. Second, the interviews were not audio-recorded, so the statements reported in Section 4 are near-verbatim reconstructions from contemporaneous field notes rather than verified transcription, and exact wording cannot be guaranteed. Third, informants were asked in 2026 to recall events beginning in 2020, a window of up to six years that introduces recognised risks of retrospective and attributional bias, whereby outcomes known at the time of interview may colour recollection of the decisions that preceded them. The study also captures firms' perceptions at a single point in time, several years into a still-evolving geopolitical situation. The interviews were conducted in English, which was not the first language of most participants; although all were professionally fluent, this may have constrained nuance in some responses. Member checking was not undertaken, and respondent estimates concerning conditions beyond the firm's own operations—notably one assessment of sector-wide contraction in Lithuanian lo-

gistics—could not be independently corroborated and are reported as perceptions. Future research could extend this work through a larger sample, through comparison with firms in neighbouring states such as Poland or Latvia, and through longitudinal designs that track how firms' resilience continues to develop as the search for durable alternative corridors proceeds. The four propositions advanced in Section 5 offer specific points of entry for such work.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data Availability

The data supporting the findings of this study consist of anonymised field notes from interviews conducted under assurances of confidentiality and are not publicly available, in accordance with the conditions of the ethical approval. Further information is available from the author on reasonable request.

Use of Generative AI and AI-Assisted Technologies

During the preparation of this article, the author used Claude (Anthropic) for language editing and proofreading. The author reviewed and edited all suggestions and takes full responsibility for the content of the article.

Ethics Statement

Research ethics approval was granted by the Committee for the Assessment of Compliance of Applied Research with Research Ethics of Kauno Kolegija Higher Education Institution on 20 May 2026 (Minutes No. 25; registered under No. AMTE-26 on 27 May 2026) for the study "Supply Chain Resilience in the Baltic Context: How Lithuanian SMEs Adapted to COVID-19 and Geopolitical Disruptions", with an approved research period of June–December 2026.

Conflicts of Interest

The author has no conflict of interest to declare.

References

1. Fonseca, L. M., & Azevedo, A. L. (2020). COVID-19: outcomes for global supply chains. Management & Marketing, *15*(s1), 424–438. https://doi.org/10.2478/mmcks-2020-0025
2. Ivanov, D. (2022). Viable supply chain model: integrating agility, resilience and sustainability perspectives - lessons from and thinking beyond the COVID-19 pandemic. *Annals of Operations Research*, *319*(1), 1411–1431. https://doi.org/10.1007/s10479-020-03640-6
3. Kim, S., Choudhury, N. A., Heikkinen, P., & Son, B.-G. (2025). Supply base complexity in times of crisis: moderating the negative impact of the Russia-Ukraine war. *International Journal of Operations & Production Management*, *45*(13), 204–232. https://doi.org/10.1108/IJOPM-12-2024-1046
4. Uygur, M. R., & Peyravi, B. (2025). Business resilience and strategic responses in Ukraine and Lithuania during the Russia-Ukraine conflict: insights from the energy, agriculture, and manufacturing sectors. *Business: Theory and Practice*, *26*(1), 62–77. https://doi.org/10.3846/btp.2025.22164
5. OECD. (2026). *Strengthening FDI and SME linkages in the Baltic states*. OECD Publishing. https://doi.org/10.1787/26532e46-en
6. Ponomarov, S. Y., & Holcomb, M. C. (2009). Understanding the concept of supply chain resilience. *The International Journal of Logistics Management*, *20*(1), 124–143. https://doi.org/10.1108/09574090910954873
7. Župerkienė, E., Šimanskienė, L., Labanauskaitė, D., Melnikova, J., & Davidavičienė, V. (2021). The COVID-19 pandemic and resilience of SMEs in Lithuania. *Entrepreneurship and Sustainability Issues*, *8*(3), 53–65. https://doi.org/10.9770/jesi.2021.8.3(4)
8. Christopher, M., & Peck, H. (2004). Building the resilient supply chain. *The International Journal of Logistics Management*, *15*(2), 1–14. https://doi.org/10.1108/09574090410700275
9. Sheffi, Y., & Rice, J. B. (2005). A supply chain view of the resilient enterprise. *MIT Sloan Management Review*, *47*(1), 41–48.
10. Hohenstein, N.-O., Feisel, E., Hartmann, E., & Giunipero, L. (2015). Research on the phenomenon of supply chain resilience: a systematic review and paths for further investigation. *International Journal of Physical Distribution & Logistics Management*, *45*(1/2), 90–117. https://doi.org/10.1108/IJPDLM-05-2013-0128
11. Scholten, K., & Schilder, S. (2015). The role of collaboration in supply chain resilience. *Supply Chain Management: An International Journal*, *20*(4), 471–484. https://doi.org/10.1108/SCM-11-2014-0386

12. Tukamuhabwa, B. R., Stevenson, M., Busby, J., & Zorzini, M. (2015). Supply chain resilience: definition, review and theoretical foundations for further study. *International Journal of Production Research*, *53*(18), 5592–5623. https://doi.org/10.1080/00207543.2015.1037934
13. Ali, A., Mahfouz, A., & Arisha, A. (2017). Analysing supply chain resilience: integrating the constructs in a concept mapping framework via a systematic literature review. *Supply Chain Management: An International Journal*, *22*(1), 16–39. https://doi.org/10.1108/SCM-06-2016-0197
14. Wieland, A., & Durach, C. F. (2021). Two perspectives on supply chain resilience. *Journal of Business Logistics*, *42*(3), 315–322. https://doi.org/10.1111/jbl.12271
15. Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z
16. Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350. https://doi.org/10.1002/smj.640
17. Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108
18. Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, *21*(10–11), 1105–1121. https://doi.org/10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E
19. García-Valenzuela, V. M., Jacobo-Hernandez, C. A., & Flores-López, J. G. (2023). Dynamic capabilities and their effect on organizational resilience in small and medium-sized commercial enterprises. *Management & Marketing*, *18*(4), 496–514. https://doi.org/10.2478/mmcks-2023-0027
20. Ambulkar, S., Blackhurst, J., & Grawe, S. (2015). Firm's resilience to supply chain disruptions: scale development and empirical examination. *Journal of Operations Management*, *33–34*, 111–122. https://doi.org/10.1016/j.jom.2014.11.002
21. Gölgeci, I., & Ponomarov, S. Y. (2013). Does firm innovativeness enable effective responses to supply chain disruptions? An empirical study. *Supply Chain Management: An International Journal*, *18*(6), 604–617. https://doi.org/10.1108/SCM-10-2012-0331
22. Ates, A., & Bititci, U. (2011). Change process: a key enabler for building resilient SMEs. *International Journal of Production Research*, *49*(18), 5601–5618. https://doi.org/10.1080/00207543.2011.563825
23. Ulvidienė, E., Prūsaitienė, D., Valentukevičienė, S., Zakarienė, J., & Martišienė, R. (2022). Impact of COVID-19 pandemic on Lithuanian small and medium-sized businesses. *Ecoforum*, *11*(3).
24. Slepniov, D., Waehrens, B. V., & Jørgensen, C. (2010). Global operations networks in motion: managing configurations and capabilities. *Operations Management Research*, *3*(3–4), 107–116. https://doi.org/10.1007/s12063-010-0032-4
25. Sarwar, D., & Rye, S. (2025). The impact of the Russia-Ukraine war on global supply chains: a systematic literature review. *Frontiers in Sustainable Food Systems*, *9*, 1648918. https://doi.org/10.3389/fsufs.2025.1648918
26. World Bank. (2023). *Middle Trade and Transport Corridor: policies and investments to triple freight volumes and halve travel time by 2030*. World Bank. https://hdl.handle.net/10986/40626 (accessed 10 April 2026).
27. OECD. (2025). *Enhancing the competitiveness of the Trans-Caspian transport corridor in Central Asia*. OECD Publishing. https://doi.org/10.1787/f261e7fa-en
28. Nurseiit, N. (2026). Attractiveness and prospects of the Middle Corridor for cargo transportation between Europe and Asia. *Journal of Eurasian Studies*, *17*(1), 167–182. https://doi.org/10.1177/18793665251388115
29. Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550. https://doi.org/10.2307/258557
30. Yin, R. K. (2018). *Case study research and applications: design and methods* (6th ed.). Sage Publications.
31. Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies: guided by information power. *Qualitative Health Research*, *26*(13), 1753–1760. https://doi.org/10.1177/1049732315617444
32. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa
33. Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.
34. Lalinsky, T., & Pál, R. (2021). *Efficiency and effectiveness of the COVID-19 government support: evidence from firm-level data* (EIB Working Papers 2021/06). Luxembourg: European Investment Bank. https://doi.org/10.2867/888346
35. Ministry of the Economy and Innovation of the Republic of Lithuania. (2023). *Kvietimas „MVĮ skaitmeninimas" Nr. 02-033-K* [Call for proposals "SME digitalisation", No. 02-033-K] (in Lithuanian). Vilnius: Innovation Agency Lithuania. https://www.esinvesticijos.lt/kvietimai/mvi-skaitmeninimas (accessed 10 March 2026).

Appendix A. Interview Protocol and Its Theoretical Grounding

The protocol comprised twenty-five open-ended questions across six thematic sections and was applied in identical wording across all six cases. The questions are reproduced below exactly as posed. The third and fourth columns record the construct each question was designed to elicit and the source from which that construct was drawn. Questions marked "Contextual" were included to establish case background or to close the interview and were not derived from a specific theoretical source; recording this distinction avoids implying a theoretical basis where none was intended.

No.	Question as Posed	Construct Elicited	Source
A1	Could you briefly describe your company - what sector you operate in, how many employees you have, and what your main products or services are?	Case context; basis for cross-case comparison	Eisenhardt (1989) [29]; Yin (2018) [30]
A2	What is your role in the company, and how long have you been involved in supply chain-related decisions?	Informant visibility of firm-level decisions; basis of the exclusion criterion (Section 3.2)	Contextual
A3	Before 2020, what did your company's supply chain structure look like? Who were your main suppliers, and from which countries?	Pre-disruption configuration; baseline for assessing change and geographic exposure	Contextual
B1	How did the COVID-19 pandemic affect your company's supply chain operations? Could you describe the most significant disruptions you experienced?	Absorptive capacity; sensing	Ponomarov & Holcomb (2009) [6]; Teece (2007) [16]
B2	How did the Russia-Ukraine war and the subsequent EU sanctions impact your supply chain? Were there specific disruptions related to raw materials, energy costs, logistics routes, or supplier availability?	Absorptive capacity under geopolitical disruption	Ponomarov & Holcomb (2009) [6]; Kim et al. (2025) [3]; Sarwar & Rye (2025) [25]
B3	Which of these disruptions - pandemic-related or geopolitical - had a greater impact on your business, and why?	Compound disruption; comparative severity	Ivanov (2022) [2]
B4	Were there any disruptions that you did not anticipate at all?	Limits of sensing capability	Teece (2007) [16]
C1	What were the first actions your company took when these disruptions occurred?	Seizing	Teece (2007) [16]
C2	Did you change or diversify your supplier base as a result of these disruptions? If so, how - did you shift to new countries, new regions, or local suppliers?	Adaptive capacity; flexibility and redundancy	Ponomarov & Holcomb (2009) [6]; Hohenstein et al. (2015) [10]
C3	Did you make any changes to your inventory management policies - for example, increasing safety stock levels or changing ordering frequencies?	Redundancy as a resilience element	Christopher & Peck (2004) [8]; Hohenstein et al. (2015) [10]
C4	Did you consider or implement nearshoring or reshoring strategies - bringing production or sourcing closer to Lithuania or the EU?	Geographic reconfiguration of sourcing	Slepniov et al. (2010) [24]
C5	Did digitalization play a role in your response? For example, did you adopt new technologies for supply chain monitoring, communication with suppliers, or demand forecasting?	Innovation capability as a driver of resilience	García-Valenzuela et al. (2023) [19]; Gölgeci & Ponomarov (2013) [21]
C6	Did you restructure your logistics operations - for example, changing transport routes, carriers, or warehousing arrangements?	Route reconfiguration; corridor substitution	World Bank (2023) [26]; OECD (2025) [27]
C7	Were there any strategies you considered but decided not to implement? If so, why?	Constraints on resource reconfiguration	Ambulkar et al. (2015) [20]
D1	What internal strengths or capabilities helped your company adapt to these disruptions? For example, skilled employees, financial reserves, flexible processes, or strong supplier relationships?	Resource base; transforming	Barney (1991) [17]; Teece (2007) [16]
D2	What were the main obstacles or weaknesses that made adaptation more difficult?	Barriers to resource reconfiguration	Ambulkar et al. (2015) [20]
D3	Did the size of your company - being an SME - make it easier or harder to respond to these disruptions compared to larger companies?	SME resilience; firm size as a capability	Ates & Bititci (2011) [22]; Hohenstein et al. (2015) [10]

D4	Did you collaborate with other companies, industry associations, or institutions during this period? If so, how did this help?	Inter-organisational collaboration	Scholten & Schilder (2015) [11]
E1	Compared to 2019, do you consider your company's supply chain to be more resilient today? Why or why not?	Restorative capacity; engineering versus social-ecological conceptions of resilience	Ponomarov & Holcomb (2009) [6]; Wieland & Durach (2021) [14]
E2	If a similar disruption were to occur tomorrow, how confident are you that your company would be able to handle it?	Viability and forward preparedness	Ivanov (2022) [2]
E3	Are there any specific areas where you still feel vulnerable?	Residual vulnerability	Tukamuhabwa et al. (2015) [12]
F1	During these disruptions, did you receive any support from the Lithuanian government, local authorities, or any public institution? If so, what kind of support, and how effective was it?	Public support during crisis; institutional environment	Župerkienė et al. (2021) [7]; Lalinsky & Pál (2021) [34]
F2	What kind of policy support do you think would be most helpful for SMEs to build more resilient supply chains? For example, financial incentives, infrastructure investment, training programmes, information-sharing platforms, or regulatory changes?	Design of the institutional environment	Ulvidienė et al. (2022) [23]; Lalinsky & Pál (2021) [34]
F3	Do you think educational institutions like Kauno Kolegija could play a role in supporting SMEs with supply chain resilience? If so, how?	No theoretical grounding; excluded from analysis (see note below)	-
F4	If you could make one recommendation to policymakers regarding supply chain resilience for Lithuanian SMEs, what would it be?	Summative; open-ended	Contextual

Note 1. The protocol was drafted for a study of small and medium-sized enterprises, and the wording of D3, F2 and F4 reflects that framing. Two participating firms fall outside the SME category and were included as contrast cases under the maximum-variation sampling strategy; responses to size-related questions from those firms are interpreted in Section 4.3 with this in mind.

Note 2. Question F3 named the researcher's own institution. Because responses to a question framed in this way cannot be treated as independent evidence, they were excluded from the analysis, and no recommendation concerning educational institutions is advanced in Section 6.2.

Appendix B. Coding Scheme

Codes were applied to the expanded field-note write-ups following the hybrid deductive–inductive procedure described in Section 3.4. Deductive codes were derived from the two theoretical frameworks; inductive codes emerged from the data and are marked as such. The scheme was applied uniformly across all six cases.

Code	Label	Definition and Scope
1	Firm profile and context	Sector, size, ownership, pre-2020 supply chain structure, geographic exposure of revenue base.
2	Disruption experience	Parent code for reported effects of both shocks.
2.1	Pandemic impact	Operational, demand-side and cost effects attributed to COVID-19, including neutral and positive effects.
2.2	War and sanctions impact	Effects attributed to the Russia-Ukraine war and EU sanctions, including market loss and corridor closure.
2.3	Comparative severity	Respondent judgements as to which disruption was the more damaging, and stated reasons.
2.4	Unanticipated disruption	Effects respondents reported not having foreseen (inductive).
3	Adaptation strategies	Parent code for actions taken in response.
3.1	Supplier diversification	Adding, replacing or spreading suppliers across vendors or countries.
3.2	Sourcing geography	Direction of change in supplier distance. Deductive sub-code: nearshoring/reshoring. Inductive sub-code: far-shoring - lengthening of supply lines.
3.3	Route reconfiguration	Changes to transport corridors, modes or carriers, including the Central Asian corridor and air freight.
3.4	Digitalisation	Adoption or intensification of digital tools for service delivery, monitoring, communication or forecasting.
3.5	Market expansion	Entry into new national markets or customer segments.
3.6	Inventory adjustment	Changes to safety stock, ordering frequency or warehousing.
3.7	Strategies considered but rejected	Options weighed and declined, with stated reasons.
4	Organisational capabilities	Parent code; deductive codes 4.1–4.3 derived from Teece (2007).
4.1	Sensing	Recognition and assessment of emerging threats and vulnerabilities.
4.2	Seizing	Mobilisation of resources to act on recognised threats or opportunities.
4.3	Transforming	Reconfiguration of the resource base, service model or organisational structure.
4.4	Human resources	Staff skill, autonomy and self-management as enabling or constraining factors (inductive).
4.5	Prior digital infrastructure	Digital capability established before the disruptions, distinguished from digitalisation adopted in response (inductive).
4.6	Obstacles to adaptation	Internal weaknesses reported as impeding response.
4.7	Firm size effects	Respondent judgements on how size shaped speed of response and access to resources.
5	Resilience outcomes	Parent code; deductive codes 5.1–5.3 derived from Ponomarov & Holcomb (2009) [6].
5.1	Absorptive capacity	Ability to absorb initial impact without substantial reconfiguration.
5.2	Adaptive capacity	Adjustment of operations and strategy to altered conditions.
5.3	Restorative capacity	Recovery toward a prior or improved state.
5.4	Transformative outcome	Reconstitution of markets, routes or service models where no prior state remained available for return (inductive).
5.5	Residual vulnerability	Areas in which respondents still considered the firm exposed.
6	Institutional environment	Parent code for support, eligibility and policy.
6.1	Support received	Public assistance actually obtained, and its assessed effectiveness.
6.2	Eligibility exclusion	Formal barriers preventing access to support, including sector classification and required corporate structure (inductive).
6.3	Support invisibility	Inability to identify what support might be relevant, distinct from ineligibility (inductive).
6.4	Policy expectations	Respondent recommendations addressed to government or public institutions.
6.5	Collaboration with institutions	Engagement with associations, other firms or public bodies during the disruptions.

Note. Codes 4.1–4.3 follow the dynamic capabilities framework (Teece, 2007 [16]); codes 5.1–5.3 follow the supply chain resilience framework (Ponomarov & Holcomb, 2009 [6]). Codes 2.4, 3.2 (far-shoring), 4.4, 4.5, 5.4, 6.2 and 6.3 are inductive.