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Building Supply Chain Resilience During Global Geopolitical Disruptions in the Manufacturing Sector

A Comparative analysis between Bangladesh and Finland

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ABSTRACT:

The global manufacturing supply chains have been exposed to more vulnerabilities to geopolitical disruptors such as the trade conflicts, pandemics, and political instabilities. These shocks have revealed certain major vulnerabilities in traditional supply chain models with a focus on efficiency rather than resilience. This has led to the emergence of the supply chain resilience as a vital ability in ensuring a continuity in operations and performance. The research problem is to investigate how manufacturing supply chains resilience to geopolitical disruptions, with the ability to respond to such disruptions, and the impact this capacity has on operational performance. A comparative approach is taken, whereby Bangladesh is considered a developing economy and Finland is a developed economy with well developed industrial systems. The research design used is a quantitative and comparative secondary research design. The data is gathered using credible sources including the World Bank, UNCTADstat as well as company reports and industry publications. Major indicators, such as trade performance, manufacturing output, and supply chain diversification are examined.

The SAS Enterprise Guide and SAS Studio is used to process the data, and descriptive statistics, trend analysis, and comparative analysis methods are used to analyze the difference between the two countries. The results will be deemed to show that the resilience capabilities of supply chain in the form of diversification, digitalization, and risk management practices positively affect the performance of operations. Finland can be more resilient since there is better infrastructure and a greater technological adoption rate, whereas Bangladesh can be vulnerable regarding a lack of digital integration and reliance on the global supply networks. Nonetheless, other adaptive strategies that Bangladesh can exhibit include flexible sourcing and cost efficiency. The research is both theoretical and practical because it offers information on the ways in which resilience strategies vary in terms of economic backgrounds. It emphasizes the significance of digital transformation and strategic flexibility in boosting supply chain resilience. The comparative study between Bangladesh and Finland covers a significant research gap and helps to create more resiliency in manufacturing supply chains.

KEYWORDS: Supply Chain resilience, Geopolitical Risk, Trade Fragmentation, Logistics capability, Resilience strategy, Operational Continuity

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Abbreviations

OPI : Operational Performance Index

LPI : Logistics Performance Index

GDP : Gross Domestic Product

Iot : Internet Of Things

RMG : Ready-Made Garments

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1. Introduction

Global manufacturing supply chains have become progressively endangered to geopo-litical disruptions as a result of trade fragmentation, economic sanctions, regional wars, and political instability. The COVID-19 pandemic, the conflict between Russia and Ukraine and increasing tensions in trade have shown that there are structural vulnerabilities in global production networks. These shocks have resulted in shortages in supply, high transportation costs, stoppages in production and long lead times. As a result, the manufacturing companies are no longer focusing on the efficiency-based supply chains but are moving towards the resilience-based designs. Supply chain resilience is a core strategic capability for manufacturers.

The concept of supply chain resilience refers to the ability of a system to predict, absorb, adjust to, and recover from a disruption without affecting continuity. Despite the wide scholarly and managerial interest in resilience, little comparative evidence on the development of manufacturing sectors in different economic environments in response to geopolitical shocks has been offered. Research shows that global supply chains are extremely prone to systemic risks, especially in geopolitical unpredictability and crisis (Ivanov, 2024; Y. Li et al., 2025a). Moreover, the reorganization of global value networks has increased vulnerability to cross-border risks, and resilience is becoming an essential ability of companies that operate in a dynamic environment (Y. Li et al., 2025a).

To dealing with these issues, organizations are turning into resilience strategies as a way of securing continuity in times of disruption. These measures can be taken for instance, digital transformation, diversification of suppliers, and enhanced risk management processes. According to the recent research, digital technologies contribute to the resilience of supply chains through visibility enhancement, better coordination, and response(Tian & Cui, 2025).

Besides, companies are moving towards adaptable and flexible supply chain systems to handle uncertainty during the post-pandemic period (Setyadi et al., 2025a).

The capacity of implementing these strategies, however, is not equal in all countries as they are different in terms of their economic development, infrastructure, and institutions. The current research compares Bangladesh and Finland in order to examine the response of the manufacturing supply chain to geopolitical disruption. Bangladesh is an export-oriented, emerging manufacturing economy prone to an increased dependency on international trade, whereas Finland is an advanced industrialized economy with well-developed institutional support and digital infrastructure. The comparison between the two contexts will help to identify the differences in the structure, the ability to withstand, and the best practices, which can be transferred to different circumstances.

1.1 Background and Motivation

The choice of the two countries as Bangladesh and Finland in this comparative study is primarily because they have two different roles in the world's manufacturing system. Bangladesh is an important emerging economy, as well as a central point for labour-intensive manufacturing that is particularly vulnerable to external shocks to the supply chain (Ahmed et al., 2024). Finland, on the other hand, provides a special example as a technologically well-developed industrial country with advanced logistics systems and digital resilience (Kähkönen et al., 2023). This research analyzes both environments, one a developing manufacturing power and the other a technology-driven advanced economy, to develop an overall picture of the reactions of different economic structures to geopolitical shocks. The comparative lens is used to identify strategies for resilience that are applicable in different industrial contexts.

Table 1. Comparison between Bangladesh and Finland Economic and industrial profile**.**

Dimension	**Bangladesh (Emerging economy)**	**Finland (Advanced economy)**
Economic status	Emerging, export-oriented economy with significant dependence on international buyers.	High-income, advanced industrial economy with diversified industrial structure.
Manufacturing profile	Labor-intensive, cost-competitive industries (e.g. RMG, Textile)	More capital- and technology-intensive industries, including machinery, electronics, and forest products.
Export dependence	Highly relies on a limited set of export products and key destination markets.	Exports spread across several sectors and a broader set of Markets.
Logistics and infrastructure	Developing a logistics system;	Advanced Logistics system
Market Role	Primary Supplier for USA and EU	High-end industrial producer
Exposure to geopolitical disruptions	Highly sensitive to external shocks due to export dependence and infrastructure	Exposed through trade and energy links, but supported by stronger institutions and risk-management capabilities.

The rising rate of international upheavals has had a profound impact on the operations of manufacturing supply chains. Geopolitical conflicts, trade restrictions and global pandemics are some of the events that have underscored the fragility of supply networks. Such disturbances not only affect material flows but also introduce unpredictability into production planning and logistics. Studies indicate that supply chains that are less flexible and those that rely more on global sourcing are more vulnerable to the risk of disruption(Ivanov, 2024). The structural problems associated with manufacturing industries in developing countries such as Bangladesh include low technological competence and excessive reliance on exports. However, developed nations such as Finland enjoy infrastructure and digital integration that contribute to their ability to deal with disruptions. This opposition is a good incentive for a comparative study.

Table 2 Summary of recent examples of geopolitical disruption and their main impacts on manufacturing supply chains.

Event	Type of disruption	Main supply chain effect	Relevance to manufacturing
COVID-19 pandemic	Global health crisis	Border closures, lockdowns, and restrictions on movement which disrupted transport and logistics networks.	Factory shutdowns, labor shortages, cancellations of order, and difficulty in production operation.
Russia–Ukraine war	Regional conflict	Price of Energy spikes, sanctions, and blocked transport corridors which increased costs and rerouted flows.	Higher production and logistics costs in Europe, delays in deliveries, and shortage of raw materials.

Trade tensions and tariffs	Trade policy and regulation	New tariffs, export bans, and regulatory uncertainty created volatility in trade conditions.	Sudden changes in input prices and access to markets are forcing manufacturers to adjust sourcing and pricing.

1.2 Purpose and Objective of the Study

This research is mainly aimed at examining how manufacturing companies of Bangladesh and Finland develop and utilize supply chain resilience to respond to geopolitical shocks. The research will determine the most important risks related to geopolitical instability and look at the impacts of such risks on the operational performance. To achieve this, the study concentrates on the identification of resilience practices including diversification, digitalization and risk management practices. According to the recent literature, the digital transformation is important to increase resilience and improve operational outcomes (J. Li et al., 2026). Additionally, the research will compare resilience capability between Bangladesh and Finland and draw differences in approaches and results. The research also seeks to add to the conceptual learning and practice.

The overall aim of the study is to explore and compare the mechanisms of supply resilience in the manufacturing sector of Bangladesh and Finland against global geopolitical disruptions. By analyzing an advanced economy like Finland alongside an emerging one like Bangladesh. To achieve this, the study identifies main geopolitical disruptions between 2018 and 2024. This timeframe has been chosen to understand global phases of pre-pandemic period (2018-2019) ,caused supply chain disruptions duo to COVID-19 and the ongoing post war geopolitical shifs due to Russia-Ukraine war(2023-2024). This timeline depicts a picture of ‘before-and-after’ analysis of how manufacturing resilience respond to consecutive global shocks.

Therefore, the study explores the effect of geopolitical shocks on the manufacturing performance of Bangladesh and Finland by using macro-level indicators such as manufacturing output, GDP growth, export value, and import value. Also, to examine strategic implications for designing resilient manufacturing supply chains under different economic and institutional settings. The objectives link the theoretical discussion of resilience and geopolitical risk with an empirical analysis where diversification, logistics performance and manufacturing outcomes are analyzed together in the case of Bangladesh and Finland. Ultimately, the findings will give a practical recommendations for manufacturing firms to increase the robustness against future uncertainties.

1.3 Research Problem and Research Questions

Although resilience is widely discussed in both research and practice, we still know relatively little about how resilience appears in different national manufacturing contexts when geopolitical disruptions occur (Islam et al., 2023). Emerging economies such as Bangladesh often face resource constraints, high export dependence, and weaker logistics infrastructure. Developed economies like Finland typically benefit from better infrastructure and technology, but they can still be vulnerable if their trade or sourcing is concentrated on a few partners. A comparative, indicator-based perspective can therefore provide valuable insights. The research problem addressed in this thesis is :

How can manufacturing supply chains maintain operational performance under geopolitical disruptions, and how do resilience capabilities differ between the manufacturing sectors of Bangladesh and Finland?

The main purpose of this research is to critique how the manufacturing supply chains develop resilience under geopolitical disruptions in the world and how this resilience ability helps in maintaining operational continuity and performance. By compiling the two

examples of Finland and Bangladesh, the study aims to develop a systematic knowledge of processes through which firms are prepared, reacting, and recovering to geopolitical shocks such as trade tensions, sanctions, regional upheaval, and limited supply(Maheshwari & Jaggi, 2025). In doing so, the study will seek to explain both situational and generalizable resilience measures. The technique of comparative analysis will be used to evaluate the impact of various economic settings on resilience strategies and performance outcomes.

To fulfill this goal, the investigation will focus on the definition of the topical geopolitical disruption threats which threatening manufacturing supply chains and on the discussion of the resilience practices implemented by businesses in both research environments. It also examines how these strategies impact operational performance under disruption conditions (Tian & Cui, 2025). In some areas special attention will be given for example: structural exposure of trade dependency and supplier concentration, strategic response of diversification, regional sourcing and inventory buffering and digital supply-chain visibility and operational performance of production continuity, recovery speed, and lead-time stability.

In this study, a brief working hypothesis is also used to guide empirical research. The hypothesis assumes that the strong capabilities of supply-chain resilience are positively related to increased operational continuity and performance in geopolitical disruptions. In other words, companies that have adopted diversified sourcing, digital visibility, and buffering are expected to suffer fewer operational disruptions and recover faster compared to other companies that adopt limited resilience strategies. The hypothesis is tested with the help of comparative indicators such as diversification index and export value to check how higher diversification significantly reduce the negative impact of geopolitical shocks on export values.

Based on these objectives, the main research question is: **How do manufacturing supply chains in Bangladesh and Finland build resilience during global geopolitical disruptions?**

Supporting Research Questions:

1 . How do diversification and logistics capability impact operational performance during disruptions, as mentioned by indicators such as manufacturing output, export values, and GDP growth?

2. How do resilience strategies, shown in diversification and logistics performance indicators, differ between the manufacturing sectors of Bangladesh and Finland?

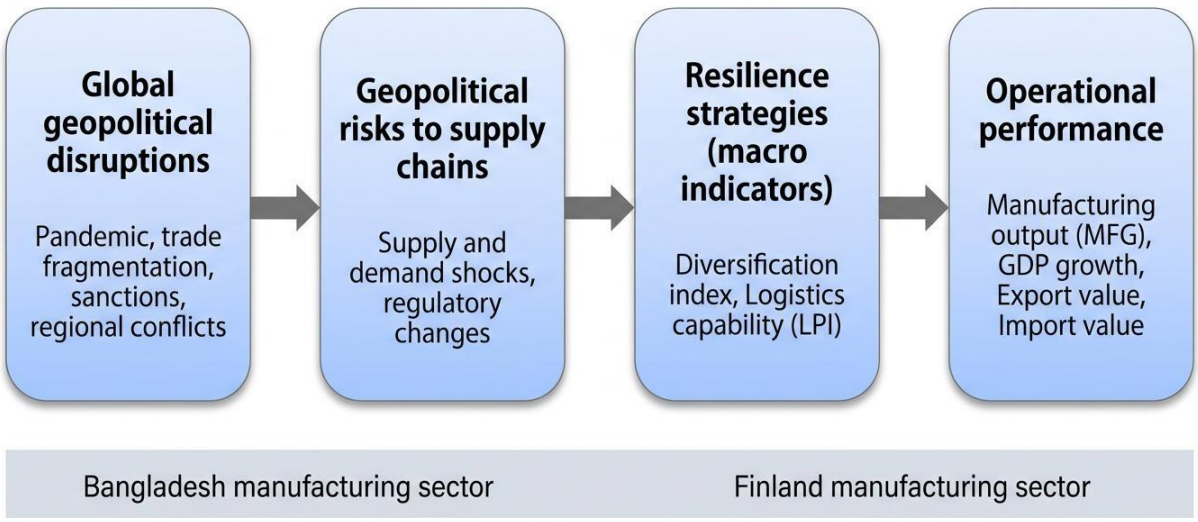


Figure 1. A conceptual map of research problem. Shows how geopolitical disruptions, resilience strategies, and operational performance are linked in the context of Bangladesh and Finland.

1.4 Key Concepts and Theoretical Framework Overview

The study focuses on the concepts of supply chain resilience, geopolitical disruptions, diversification, logistics capability and operational performance that are interrelated. Supply chain resilience is the ability of supply chains to plan for, react to and recover from unexpected events and adapt to changes while keeping operations going(Ivanov & Dolgui, 2020). Geopolitical disruption, including fragmentation in trade flows, instability caused by the pandemic and international conflict, has been increasing for manufacturing industries in recent years, having important consequences for global production and logistics systems (Bednarski et al., 2023a). In this context, the importance of manufacturing organisations in uncertain environments in the world means that resilience has become an important strategic ability. The operational performance used in this study is the continuity and stability of manufacturing-related activities measured by export performance, manufacturing output and GDP growth.

The study thus looks at the roles of capabilities that are connected to resilience in relation to operational continuity in times of geopolitical uncertainty. This study's theoretical basis mainly relies on the theories of supply chain resilience and diversification theory. The theory of the supply chain resilience states that there are four principles that enable organizations to stay alive and operate during disruption: adaptability, flexibility, recovery mechanism, and coordinated recovery mechanism (Ivanov, 2021). Diversification theory also postulates that diversification of sourcing structures, supplier networks, and market dependence are ways of mitigating supply chain vulnerability by diversifying where and on whose network to build supply connections(Queiroz et al., 2022).

Furthermore, logistics capability is an important resilience-enabling concept as efficient transportation systems, customs performance, and logistics coordination contribute to the quick recovery and flexibility of operation in the event of a disaster (Belhadi et al., 2021). The conceptual model of this research thus links the concept of geopolitical disturbances and the concept of resilience abilities and operational performance results. Specifically the study assumes that the more diversified a firm is and the better its logistics capability is, the more resilient it will be and the more stable it will perform during a period of disruption. The framework is used comparatively for Bangladesh and Finland to understand variations in resilience patterns between labour intensive manufacturing and high-tech manufacturing systems. It is essential in developing a research study to understand the significance and relevance.

1.5 Significance and Relevance of the Study

This study is extremely relevent in the present international context where the disruptions in the supply chain become more frequent and severe. Academically, the study is beneficial in assisting the expanding body of research on the topic of supply chain resilience because it offers a cross-country comparison of the topic. It fills the gap in knowledge about how geopolitical disturbances impact the manufacturing business and how the resilience strategies differ between the countries. Practically, the findings can be used by managers to create better strategies to improve resiliency in the supply chain. The paper is also informative about the significance of digitalization and risk management in enhancing operational performance (Setyadi et al., 2025a). Also, the findings can be utilized by policymakers to develop superior structures to aid industrial resilience.

Academically, this study is important because it would be added to the existing knowledge on supply chain resilience and geopolitical disruption management in manufacturing. While there is ample literature on the effects of the COVID-19 pandemic and global disruptions on supply chains, there are only a few studies that comparatively analyzed the resilience

patterns of developing and developed manufacturing economies based on operational performance indicators (OPIs) (Ivanov, 2024; Y. Li et al., 2025a). This research is the first to take a comparative approach to the study of resilience in both the industrial and comparative frameworks by comparing low-tech manufacturing systems (such as those in Bangladesh) and high-tech manufacturing systems (such as those in Finland).

The study also makes a theoretical contribution by connecting the concepts of diversification, logistics capability, and operational performance within a single resilience framework (Wagner & Bode, 2008). In addition, the study integrates the theory of resilience with measurable metrics like export performance, manufacturing output, GDP growth, and logistics capability. In this sense, the results offer a conceptual and empirical understanding of the mechanisms of adjustment of manufacturing systems in the face of geopolitical uncertainty and instability in the supply chains. The study is also of great importance for industrial management and practical aspects.

In addition, Unpredictable geopolitical tensions, fragmented trade and disrupted supply chains are the reality of the world in which manufacturing companies are increasingly living and working. The results of this research explicitly give practical suggestions to the manufacturing companies on how to improve their resilience by diversifying their businesses, upgrading their logistics abilities and planning their operations in an adaptive way. The study emphasises the need for technological upgrading, logistics improvement, and diversifying their supply networks in labour intensive industries for Bangladesh. The results highlight the need for operational flexibility and a logistics joint capability in high-tech manufacturing in Finland.

Overall, The comparative analysis also has implications for industrial managers, policy makers and supply chain decision makers who want to re-configure supply chains in times of global uncertainty. Many previous studies look either at a single country or a single crisis. By contrast, this study uses comparable macro-level data to explore how

resilience and performance interact over several years and across two different contexts. As a result, the study not only provides insights into the practical knowledge which can aid strategic decisions, resilience planning and longer-term operational sustainability in manufacturing industries, but also provides a comprehensive overview of this. In short, it provides a balanced and globally relevant view by considering both Bangladesh and Finland.

1.6 Structure of the Thesis

Figure 2. Visual overview of the thesis structure

The outline of this thesis is intended to provide a logical and systematic structure for the research. It is organised into five main chapters and under each chapters there are sub-chapters. Introduction is the first chapter of this thesis that covers the background of the study, research problem, objectives of the study, and key concepts of the study.. The second chapter is Theoretical Framework and Literature review that draws in detail a literature review, with the focus on the supply chain resilience and geopolitical disruptions. The third

chapter is Research Methodology that explains the research methodology such as research design, data collection and analysis methods. The fourth chapter is Results and Analysis where the empirical findings are given, and a comparative analysis is made between Bangladesh and Finland. Lastly, the fifth and the last chapter c is the conclusion and discussion chapter, which summarizes the main findings of the study and gives the appropriate recommendations.

2 Theoretical Framework and Literature Review

The growing complexity of global supply chains has rendered them very susceptible to external interference, especially where there is uncertainty with geopolitical uncertainty and global crises. In recent years, the concept of supply chain resilience has become one of the most significant research topics in the fields of operations and industrial management. The COVID-19 epidemic, trade wars, and regional conflicts have revealed vulnerabilities in the global manufacturing systems, and it is necessary to be more adaptive and resilient in supply chain strategies. According to recent research, the old efficiency-based supply chains are not adequate in dealing with uncertainty and risk anymore (Ivanov & Dolgui, 2020; Queiroz et al., 2022). Therefore, the purpose of this chapter is to investigate the theoretical background and the literature available on the topic of supply chain resilience in terms of geopolitical disruptions.

Moreover, the increasing digitization of technologies and global value chains has also altered the manner in which supply chains operate and react to disruptions. The recent studies point to the role of digital transformation, risk management practices, and strategic capabilities in improving supply chain resilience (Ivanov & Dolgui, 2021).Nonetheless, even though the amount of research undertaken is on the rise, comparative studies that look at resilience in various economic settings remain wanting. The chapter thus summarizes some of the important theories and empirical studies on the supply chain resilience, geopolitical risk, and operational performance. It also puts out gaps in the current literature to warrant this research. The discussion offers a solid theoretical basis of the resilience strategies in manufacturing industries, especially in Bangladesh and Finland.

2.1 Introduction to the Theoretical Framework

The theoretical framework of the present study is based on the modern outlooks on supply chain resilience, risk management, and digital transformation in manufacturing systems. The latest studies shows that supply chain resilience is a proactive as well as a strategic operation that allows businesses to predict and address disruption, not merely a reactive one (Kessler & Arlinghaus, 2022). In recent work, dynamic capability perspectives are expanded to describe the way organizations reorganize resources and come up with adaptive strategies in turbulent settings(Dubey et al., 2021). Moreover, supply chain viability is becoming a contemporary follow-up of the concept of resilience, which is concerned with the long-term sustainability and functionality in the face of constant disruptions (Ivanov & Dolgui, 2020). All these views offer a solid theoretical foundation in explaining how manufacturing supply chains react to geopolitical threats.

Along with that, the recent literature points to the increasing importance of digital technologies as a driver of supply chain resilience. Digital transformation allows companies to become more visible, coordinated, and responsive in the supply networks that are essential to cope with uncertainty (Belhadi et al., 2021; Tian & Cui, 2025). By incorporating the latest technologies, including big data analytics and artificial intelligence, the companies will be able to anticipate disruptions and streamline the decision-making process. Furthermore, the concept of resilience is also becoming a multidimensional construct that encompasses flexibility, adaptability, and robustness (Kessler & Arlinghaus, 2022). The theoretical progress is an indication of a transition between the conventional risk management methods and more integrated and technological-oriented models.

2.2 Key Theories and Concepts

The focal point of this study is supply chain resilience which has been defined as the capacity of a supply chain to prepare, respond and recover disruptions and still ensure continuity in operations. The concept has been extended recently with the focus on adaptability, flexibility, and real-time responsiveness as the main dimensions of resilience (Chowdhury et al., 2019; Ivanov, 2021). The resilience is directly related to the capacity to cope with uncertainty and sustain performance in the context of altered conditions in modern manufacturing systems. The other concept is supply chain viability, which is concerned with long-term sustainability and survivability of supply chains operating in highly uncertain conditions (Ivanov & Dolgui, 2020). It is more than a short-term recovery and focuses on constant adaptation and change.

Another central concept is the geopolitical risk that is the uncertainty caused by political instability, trade wars, and economic tensions in the world that cause disruptions in supply chains (Caldara & Iacoviello, 2022). These risks may have a serious effect on sourcing, production planning, and logistics operations. In this case, operational performance can be described as the efficiency and effectiveness of the manufacturing processes, such as production continuity, cost control, and reliability of delivery. The recent empirical research shows that operational performance is directly and positively affected by resilience capabilities, especially in the context of disruption (Belhadi et al., 2021; Dubey et al., 2021). Also, the digital transformation is becoming one of the enabling factors of resilience, as it improves the exchange of information, coordination, and decision-making (J. Li et al., 2026). These concepts are the basis of this study.

Table 3 Summarises theories and concepts and how they are used in the thesis

Theory / concept	Short definition or main idea	Role in this thesis
Supply chain resilience	Ability to prepare for, absorb, adapt to, and recover from disruptions while maintaining acceptable performance.	Central lens in the study, used to interpret how diversification and logistics capability support performance.
Supply chain viability	Long-term adaptability of supply networks under ongoing or frequent disruptions.	Increase resilience for a longer periods of geopolitical instability in the manufacturing sector.
Geopolitical risk	Uncertainty caused by political decisions, conflicts, sanctions, and wars affects trade and investment.	Explains why manufacturing supply chains in Bangladesh and Finland face disruptions.
Diversification strategy	Expanding sourcing and markets across multiple partners or regions to reduce dependence and risk.	Core resilience capability, measured by a diversification index in the empirical analysis.
Logistics capability (LPI)	Capability and reliability of logistics and transport systems with infrastructure and services.	Another key resilience capability, measured by the Logistics Performance Index which linked to performance outcomes.
Operational performance	Productivity and efficiency of supply chain and production outcomes (e.g., output, growth etc)	Measures efficiently outputs for example, MFG, GDP growth, export value, and

Theory / concept	Short definition or main idea	Role in this thesis
		import value in the dataset.
Digitalization / digital transformation	Implementation of digital tools and systems (analytics, platforms, tracking) in supply chains.	Important helper of Resilience that explains how rapidly coordination can be improved in both countries.
Supply Chain Risk Management (SCRM)	Structured system for identifying, assessing, and reducing supply chain risks.	Outlines how geopolitical risks are conceptualized and how resilience strategies manage them.
Dynamic Capabilities Theory	It's an ability to sense, seize, and reconfigure resources in changing environments.	Provide the idea that resilience is a high-level capability that developed over time in response to disruptions.

2.3 Review and Relevant Literature

Recent years have seen the literature on supply chain resilience grow considerably, especially after the disruptions experienced internationally in recent years that include the COVID-19 pandemic and the geopolitical conflicts. Redundancy, flexibility, and supplier diversification were considered by early researchers as the main components of resilience (Ivanov & Dolgui, 2020; Queiroz et al., 2022). The following sections review key literature in seven areas that are directly related to this study: global geopolitical disruptions and manufacturing supply chains, resilience strategies, diversification and logistics capability, digitalization and operational continuity, the manufacturing sectors of Bangladesh and Finland, and the resulting research gap.

2.3.1 Global Geopolitical Disruptions and Manufacturing Supply Chains

Through an increasing number of studies, the adverse effects of geopolitical shocks on manufacturing supply chains are becoming clear (Bednarski et al., 2023b; Caldara & Iacoviello, 2022). Regional conflict closures and delays can restrict or block important transport corridors, and global events such as an epidemic like COVID-19 can create fluctuations in demand and disrupt production and transportation at the same time (Ivanov, 2021). Manufacturing supply chains are particularly vulnerable as they often cross multiple countries and are dependent on resourceful and time-sensitive supply chain movements. If the geopolitical situation deteriorates, companies can experience extended and unpredictable lead times as well as a lack of critical input and demand in key export markets. These impacts can affect manufacturing productivity, negatively influence export performance and make production planning more challenging (OECD, 2025; Queiroz et al., 2022).

2.3.2 Supply Chain Resilience Strategies

Resilience literature outlines various methods that companies can take to deal with disruption. This involves working with backup suppliers or additional capacity, designing flexible processes and contracts, developing visibility and information sharing, and fostering collaboration with key partners (Ivanov, 2021; Kessler & Arlinghaus, 2022). Risk management, collaboration, supplier management, digital technology and sustainability are emphasized as important themes, when reviewing papers that are focused on manufacturing (Belhadi et al., 2021; Y. Li et al., 2025a). Resilient manufacturing companies are less likely to have breakdowns, maintain stable customer service levels, and rebound quickly from shocks (Dubey et al., 2021). Researchers also highlight clear trade-offs: the use of resilience strategies, such as the maintenance of redundancy or of high safety stocks, can

result in higher operating costs, while the managers have to balance between resilience and efficiency (Ivanov, 2024).

2.3.3 Diversification and Logistics Capability

Research on supplier diversification reveals that diversifying sources into more supplier partners and across more regions can lessen the impact of single supplier failures or geopolitical developments (Queiroz et al., 2022; Setyadi et al., 2025a). One of the other key factors is logistics capability. From a logistics point of view, it has been argued that logistics services and infrastructure are vital in ensuring that a supply chain is resilient when supporting swift rerouting, flexibility in transport options and improved inventory management (Belhadi et al., 2021). A greater LP index correlates with easy disruption recovery and better service levels. Financial, infrastructural and institutional constraints make it difficult for emerging economies to develop diversified suppliers and quality logistics networks. Generally, developed economies have greater resources, but also more complex and globally extended supply networks that can lead to vulnerabilities (OECD, 2025).

2.3.4 Digitalization and Operational Continuity

Research indicates that technologies like IoT, data analytics, cloud platforms, and blockchain have the potential to greatly enhance information flow and visibility through the supply chain (Al Amin et al., 2025; Dubey et al., 2021; Tian & Cui, 2025). Empirical research has demonstrated the advantages of digitalisation for improving the resilience and performance of decision making processes in detecting disruption faster, coordinating responses more effectively, and optimising the use of resources. For instance, some research indicates better visibility as a result of digitalization, and that the digitalization-visibility-performance linkage is mediated by resilience (J. Li et al., 2026). Other studies highlight the importance of digital transformation as a strategic capability for enhancing resilience in contexts where disruptions are common (Tian & Cui, 2025). However, such benefits need substantial

investment and are contingent on institutional and organisational preparedness and support (Al Amin et al., 2025)

2.3.5 Bangladesh Manufacturing Sector

The manufacturing sector of Bangladesh has been gaining importance particularly in export related manufacturing sectors like RMG. There are some structural weaknesses identified such as overreliance on limited export products and markets, reliance on the imported raw materials, and inadequate logistics and infrastructure (Julie et al., 2024; Syed & Mahmud, 2022). Recent events, including COVID-19, have demonstrated that there were gaps in coordination and information systems as well as formal risk-management practices (Islam et al., 2023). Meanwhile, there are documented new resilient practices in the literature. This encompasses a variety of factors such as diversifying buyers and suppliers, investing in technology, quality systems, and establishing stronger ties with customers and logistics partners (Al Amin et al., 2025). Policy reports also suggest upgrading infrastructure, strengthening customs and port processes and fostering digital innovation as ways to fill gaps in the supply chain and enable more resilient exports of manufacturing products (OECD, 2025).

2.3.6 Finland Manufacturing Sector

The characteristics of the developed economies like Finland are typically identified as the good infrastructure, well-established governance, and level of digitalization. Manufacturers in Finland are typically part of intricate global value chains and employ sophisticated tools in planning, tracking and risk management processes (Dubey et al., 2021; Tian & Cui, 2025). These can help increase resilience through better coordination and faster responses to changing circumstances. But studies indicate that also developed economies continue to be vulnerable to geopolitical shocks. For instance, energy prices, input costs and trade flows in Europe have been impacted by the Russia–Ukraine war, including Finland (Bednarski et al.,

2023b) It's an experience that confirms the fact that high levels of reliance on energy supplies, trade partners, and technologies can leave even advanced supply chains exposed. For emerging economies diversification, logistics capability and digitalization are also relevant aspects in Finland (OECD, 2025).

2.3.7 Research Gap

The available literature provides several insights into strategies of resilience and diversification, logistics capacity and digitalization, but there are still some gaps. Few studies systematically compare national contexts of resilience and focus on a single crisis or single country or sector (Ivanov, 2024; Y. Li et al., 2025a). Empirical studies are conducted mostly at the firm level through surveys or case studies, but less work is done to compare the resilience and performance of firms across countries at the macro level. There are few quantitative comparative studies that examine the interactions between the resilience capabilities and operational performance in emerging and developed manufacturing economies. The detailed comparison of manufacturing supply chain resilience between countries, including Bangladesh and Finland, based on similar indicators e.g. manufacturing output, trade values, logistics performance, diversification, etc. is very limited.

2.4 Summary and Implications for the Research

In this chapter, the literature reviewed shows that there is growing significance in supply chain resilience in dealing with global disruptions, especially in the manufacturing industry. Recent reports show that resilience is a multifaceted ability that contain flexibility, adaptability, and digital integration. Supply chain resilience, dynamic capabilities, and supply chain viability can serve as a powerful theoretical framework to comprehend the response of companies to geopolitical risk(Ivanov, 2021; Kessler & Arlinghaus, 2022). Empirical studies also show that digital transformation and supplier diversification, as resilience strategies, are also important in keeping operational performance steady during disruptions (Belhadi

et al., 2024; Tian & Cui, 2025). These results demonstrate the need to combine strategic and technological methods in the supply chain management.

This study has demonstrated that supply chain resilience has emerged as a central issue in operations and industrial management(Bednarski et al., 2023b; Ivanov, 2021). Resilience is consistently associated with the ability to diversify, have good logistics capability and digitalise, and these capabilities are correlated with improved stress operational performance in the literature (Belhadi et al., 2021; Dubey et al., 2021). Meanwhile, there are a number of areas of weakness that need to be addressed. The empirical evidence on the presence of the capacity to be resilient in macro level indicators in different countries and their relationship to manufacturing performance is still limited. Comparative analyses among developing and developed manufacturing economies and between various contexts, such as between Bangladesh and Finland, are relatively less frequent (Y. Li et al., 2025a). Additionally, there is a demand for further research combining diversification, logistics performance, digitalization and performance in one analytics model.

In order to fill these gaps, the author has developed and applied a comparative, indicator-based framework for analysing manufacturing supply chain's resilience within Bangladesh and Finland. Based on secondary data sources relating to manufacturing output, GDP growth, export and import values, logistics performance and diversification, it aims to explore the link between resilience capabilities and operational performance in the context of geopolitical disruptions. The study thus brings together the macro level operational indicators and the comparative resilience analysis to enrich the resilience theory and literature of industrial management. The research design, research data and analysis techniques adopted for this empirical study are explained in the next chapter.

3 Research Methodology

The chapter on the research methodology describes a systematic exploration of supply chain resilience within the manufacturing industry, specifically concerning geopolitical disruptions. In this chapter, the research problem is converted to a systematic procedure of research, such as research design, data collection, and data analysis procedures. Over the past few years, there has been a growing interest in the role of methodological rigor in supply chain studies to give valid and evidence-based results on intricate global issues (Ivanov, 2021; Kes-sler & Arlinghaus, 2022). To make the research valid, reliable, and consistent with the study objectives, it is necessary to choose an appropriate methodology.(Hahn Fox & Jennings, 2014)

This chapter explains how the study is carried out in practice. It describes the research task, the overall design and approach, the data and indicators used, and the analysis methods. It also discusses reliability, validity, and ethical considerations and summarizes the research process step by step. The study follows a quantitative, comparative approach using secondary data from Bangladesh and Finland. The dataset combines macro-level indicators related to manufacturing performance, logistics capability, and trade diversification for selected years between 2018 and 2024. These indicators are used to build resilience and performance profiles for the two countries and to explore the relationships between resilience-related variables and operational outcomes.

Moreover, this chapter justifies the application of secondary data and statistical analysis tools in the study of supply chain resilience. The growing access to international databases and sector reports has allowed research to perform mass comparative analysis using valid and standardized data (OECD, 2025; World Bank, 2023) This study would be best suited to secondary data because it will enable cross country comparison of Bangladesh and Finland without the constraint of primary data collection. Moreover, the advanced analytical tools

(SAS Enterprise Guide and SAS Studio) are used to facilitate strict statistical analysis and increase the accuracy of results. The other important methodological considerations covered in this chapter include reliability, validity, and ethical issues. In general, the methodology gives the research a clear and systematic structure in which the research was conducted.

3.1 Description of the Research or Development Task

The research task is to analyze and compare how the manufacturing sectors of Bangladesh and Finland build and express supply chain resilience under global geopolitical disruptions. The focus is on understanding how vulnerability and resilience are reflected in macro-level indicators rather than on individual firms. More specifically, the study aims to capture how geopolitical disruptions are associated with changes in manufacturing performance indicators such as manufacturing output, GDP growth, export value, and import value. To analyze how resilience-related indicators, specifically diversification and logistics capability, act over time and across disruptions. To compare the resilience and performance profiles of Bangladesh and Finland and discuss what these differences imply for manufacturing supply chains in each context. In this way, the research task directly supports the main research question. The research assignment is thus analytical and comparative.

3.2 Research Design and Approach

The study uses a quantitative, comparative research design based on secondary macro-level data. This design is appropriate because the research questions deal with measurable relationships between resilience-related indicators and operational performance at the level of national manufacturing sectors. The research follows a largely positivist philosophy, which emphasizes objective measurement and statistical analysis. It adopts a deductive approach: concepts from supply chain resilience, diversification strategy, logistics capability, and

digitalization are used to form expectations about how certain indicators should behave under disruption, and these expectations are then examined empirically using the data. The unit of analysis is the manufacturing sector of each country in each year.

Supply chain research extensively employs quantitative research methods to estimate how variables relate and the performance results)(Dubey et al., 2021) . In brief, all observation in the dataset illustrate the national manufacturing sector of Bangladesh and Finland in selected year, narrated by indicators such as manufacturing output, GDP growth, trade values, LPI score, and diversification index. The study depend exclusively on secondary data obtained from publicly available in international and national sources. Use of secondary data is suitable because the focus is on national-level indicators and cross-country comparison rather than on firm-level decisions.

Comparison between Bangladesh and Finland across selected years under geopolitical disruptions.

Figure 3 Summary Of the Research Design

3.3 Data Collection Methods

The study relies exclusively on secondary data obtained from established international and national sources. This data is publicly available for use. Using secondary data is appropriate because the focus is on national-level indicators and cross-country comparison rather than on firm-level decisions. Such a combination of macro and firm level data gives a deep insight in supply chain resilience. The study is also robust because of the use of multiple data sources. The important sources of data are the World Bank which has indicators of logistic performance and trade efficiency.

3.3.1 Data Sources

The main data sources are:

- **World Bank** – for GDP growth rates and the Logistics Performance Index (LPI) scores, Export value, Import Value, manufacturing output
- **UNCTADstat**– for Diversification Index.
- **Other policy and statistical reports** – for cross-checking figures and understanding context where needed.

3.3.2 Indicators

The dataset includes the following variables for each country and year:

- **MFG (Manufacturing output):** This measures total output of the manufacturing sector.
- **GDP growth (GDP):** The annual percentage growth rate of gross domestic product.
- **Export value:** Total value of the goods sold worldwide.
- **Import value:** Total value of the goods purchased from foreign country.

- **LPI score:** Logistics Performance Index, representing customs, infrastructure, logistics capability, international shipments,tracking and timeliness.It measures in a scale of (1-5)

Diversification index: It measures trade diversification, where higher values mean more diversified trade structures.

3.3.3 Time period and Country

Data are combined from **Bangladesh and Finland** for the years **2018, 2019, 2020, 2022, 2023, and 2024**. This period captures conditions before, during, and after major disruptions such as the COVID-19 pandemic in 2019 , The Russia-Ukraine war in 2023 and recent geopolitical tensions. The year 2021 is excluded because of data availability and consistency issues for some indicators, and 2025 data are not yet fully available at the time of analysis. Regarding the LPI score data is available only 2018 and 2023 within the selected year. Its because World bank published data periodically. The gap between 2018 and 2023 is due to the COVID-19 survey of 2020 suspended. (World Bank, 2023).

Table 4 Indicators and data sources used in the study

Indicator	Description	Unit / scale	Primary data source
MFG – Manufacturing output	Output of the manufacturing sector for each country and year (value of goods produced by manufacturing).	US dollars (US$)	World Bank
GDP growth (GDP)	Annual percentage growth rate of gross domestic product, reflecting overall economic growth.	Percent (%)	World Bank – World Development Indicators

Export value	Total value of merchandise exports of goods for each country and year, reported on a gross value basis.	US dollars (US$)	World bank
Import value	Total value of merchandise imports of goods for each country and year.	US dollars (US$)	World bank
LPI score	Logistics Performance Index overall score, reflecting logistics performance (1 = low, 5 = high).	Index from 1 to 5	World Bank – Logistics Performance Index
Diversification index	Index capturing the degree of trade diversification; higher values	Index between 0 and 1	UNCTADstat

Table 5 Summary of theoretical constructs into empirical indicators

Construct	Indicator(s) used	Measurement / notes	Related research questions
Geopolitical disruption impact	GDP growth, Export value, Import value	Changes in GDP growth and trade values across disruption years (2018–2024) reflect macro-level Impact.	RQ1
Resilience – diversification	Diversification index	Trade diversification index between 0 and 1; higher values = more diversified partners/markets.	RQ2, RQ3
Resilience – logistics capability	LPI score	World Bank LPI score (1–5) capturing logistics performance (infrastructure, services, tracking, timeliness).	RQ2, RQ3
Operational performance	MFG (manufacturing output)	Manufacturing output level for each country and year.	RQ1, RQ2, RQ3
Operational performance	GDP growth	Annual percentage change in GDP; macro-level performance.	RQ1, RQ2
Operational performance	Export value, Import value	Gross merchandise export and import values per year.	RQ1, RQ2, RQ3
Country and time context	Country (Bangladesh / Finland), Year	Categorical variables identifying country and year (2018, 2019, 2020, 2022, 2023, 2024)	All RQs (comparative dimension)

	Country	Year	LPI	MFG	GDP	Export	Import	Diversification
1	Bangladesh	2018	2.58	66900000000	7.319413	12.67479	19.83984	0.893
2	Finland	2018	3.97	40500000000	1.192978	39.14922	39.99439	0.517
3	Bangladesh	2019	.	74500000000	7.881915	13.09476	18.4833	0.891
4	Finland	2019	.	39300000000	1.349738	40.6183	39.94583	0.516
5	Bangladesh	2020	.	77000000000	3.448018	10.44279	15.82866	0.88
6	Finland	2020	.	39200000000	-2.49104	36.21434	35.97025	0.521
7	Bangladesh	2022	.	10000000000	7.099829	12.88223	20.89774	0.874
8	Finland	2022	.	44200000000	0.763042	46.28478	48.27775	0.511
9	Bangladesh	2023	2.6	97700000000	5.775112	13.15716	17.82581	0.882
10	Finland	2023	4.2	42700000000	-0.93909	42.79306	42.77033	0.511
11	Bangladesh	2024	.	98500000000	4.223259	10.46119	16.31689	0.884
12	Finland	2024	.	42500000000	0.416172	41.90779	41.55231	0.509

Figure 4 Overview of the manufacturing resilience dataset for Bangladesh and Finland (2018-2024)

3.4 Data Analysis Methods

The collected secondary data were analysed using SAS Enterprise Guide and SAS Studio. The analysis was conducted to compare some operational indicators of resilience between Bangladesh and Finland for specific periods of disruptions. The data was first cleaned in Microsoft Excel and then entered into SAS for statistical and graphical analysis. The chosen indicators were export values, manufacturing output, growth in GDP, Logistics Performance Index (LPI), and diversification index of the supply chain. The variables were selected for being important dimensions for the operational performance and supply chain resilience for manufacturing sectors in the context of a geopolitical disruption. To answer the research questions, a descriptive analysis, trend analysis, comparative analysis and regression analysis method were used.

Descriptive analysis was first used to describe indicators. This analysis enabled the overall performance trend of Bangladesh and Finland in terms of manufacturing activity, trade performance and logistics capability. This includes summary measures such as minimum, maximum, and mean values, as well as simple tables and graphs showing the levels of manufacturing output, GDP growth, export and import values, LPI scores, and diversification indices for each year and country. This step helps to

answer the first research question by showing how geopolitical disruptions appear in the performance indicators and gives a basic picture of resilience-related indicators in each country.

A comparative analysis was also conducted to shed light on the differences between two different manufacturing environments, Bangladesh and Finland. Line graphs and bar charts created in SAS were then used for trend analysis of the operational performance before, during and after the disruption periods, specifically the COVID-19 pandemic and the ensuing geopolitical uncertainty. Visual analysis of export performance trends, manufacturing output trends, GDP growth trends, logistics performance comparisons, and diversification comparisons were done to detect fluctuations, recovery patterns, and differences in resiliences between the two countries. The analysis directly contributed to answering the first and second research questions.

Lastly, a simple regression analysis was done to explore the relationship between export performance and diversification of the supply chain. Diversification index values were used as the explanatory variable in the regression model and the value of exports was used as the dependent variable. This analysis aimed to investigate if there is a link between diversification capability and operational continuity and manufacturing resilience during disruption periods. The regression results from SAS include parameter estimates, significance values and model fit indicators including the R-square value. The regression results were then combined with the graphical trend analysis, in order to gain a wider perspective of the ability of resilience within the manufacturing supply chains. This analysis was used to answer the third research question around the relationship between resilience related operational strategies and manufacturing performance in the context of geopolitical uncertainty (Dubey et al., 2021; Queiroz et al., 2022).

3.5 Reliability, Validity and Ethical Considerations

Reliability and validity are crucial factors in academic research that contribute to the credibility, consistency, and transparency of the study's findings, while ensuring they are reliable and valid. It is particularly crucial in quantitative comparative research to assess the validity and comparability of the secondary data produced by several data sources in different countries. The validity of the comparative analysis and the use of publicly available data in the research process, thus, is discussed in this study with a critical understanding of the reliability of the indicators used. Solving these problems enhances the overall credibility and soundness of the study (Saunders et al., 2023a).

3.5.1 Reliability and Validity

The secondary data were gathered from sources which were international and publicly available such as World Bank and UNCTADstat which helped to increase the reliability of this study. These organisations are widely accepted and apply accepted statistical procedures, which ensures the reliability and consistency of the data. Furthermore, the study analysed the resilience in multiple dimensions, such as export value, manufacturing output, GDP growth, logistics performance and diversification index instead of looking at a single indicator. Analysis was further strengthened by the use of comparative trend and regression analysis using SAS Enterprise Guide and SAS Studio. where it is suggested that the use of multiple secondary indicators can strengthen the quality of the resilience analysis (Ivanov, 2021; Queiroz et al., 2022).

Several validity restrictions of the secondary data material should be noted, however. Selected indicators are sourced from various international databases and the process of calculating and reporting these indicators may differ between organisations and countries. Hence, some country-level indicators can not be directly compared between Bangladesh and Finland because of differences in industrial structure, statistical reporting system, scale of economy and data collection methods. For instance, logistics performance and diversification indicators could mean different things in the developing

and developed economies.The regression analysis may also not be statistically generalizable due to the relatively small data set and the number of years observed. Despite this, the study tries to increase the validity by triangulating the various indicators and interpreting them together with existing literature on resilience and theoretical frameworks (Bednarski et al., 2023b; Y. Li et al., 2025b).

3.5.2 Ethical Considerations

The research in the study has been conducted according to ethical principles. The data sources used in the study consisted of secondary sources, publicly available and officially published data, and no confidential organizational or personal data were accessed. Thus, informed consent practice procedures were not used in the research and no interviews nor surveys were conducted with persons. All original data sources used in the study and the scholarly literature used in the study were properly acknowledged using the appropriate academic referencing and APA 7 citation practices. Furthermore, the results were analyzed objectively, without any intentional manipulation of data. The importance of transparency and responsible data use is even more critical in comparative resilience research (Saunders et al., 2023a). For this reason, ethical aspects were taken into account throughout the research process to ensure academic integrity and research credibility.

3.6 Description of the Development or Research Process

The research process is systematic and structured, where the research problem and objectives are identified at the start of the research process. The initial phase is a thorough literature review in order to define the theoretical framework of the research. The second phase is the gathering of the data based on the chosen international and national databases. At the third stage, the obtained data are compiled and processed with the help of SAS Enterprise Guide and SAS Studio, where statistical and comparative methods are used. The fourth phase entails the interpretation of the findings and connecting them to the theoretical framework and research questions. Lastly, the

findings are presented and discussed, and the conclusion and recommendations are given. This gradual approach brings a logical and understandable consistency to the research. The systematic method improves the quality and reliability of the study.

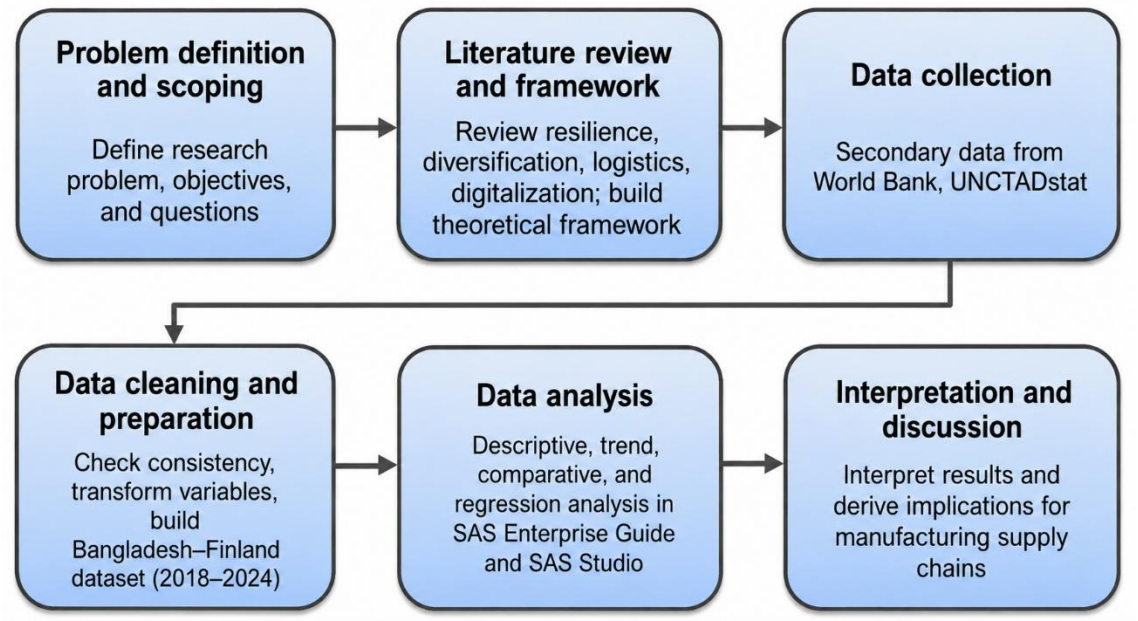


Figure 5 Summary of research process

4 Results and Analysis

This chapter represents the empirical results of the Bangladesh–Finland comparative analysis using related indicators of supply chain resilience and operational performance. The analysis highlights how manufacturing performance changed during disruption periods, particularly around COVID-19 and later the Russia-Ukraine war. This directs to geopolitical uncertainty. This approach is appropriate because recent supply chain research emphasizes the need to examine resilience through measurable performance, recovery, and adaptation indicators (Ivanov, 2021). The chapter therefore, uses some relevant trend graphs, comparison charts between Bangladesh and Finland, and regression analysis to connect the empirical findings with the research questions.

4.1 Presentation of Findings

In this section the empirical findings sourced from the secondary dataset and SAS Enterprise Guide software and SAS studio web browser interface has been used to data analysis. The results of this analysis made a comparison between Bangladesh and Finland in terms of supply chain resilience and operational performance. Previous studies suggest that resilient supply chains are often associated with diversification capability, logistics efficiency, and adaptive operational strategies during disruption periods (Chowdhury et al., 2019; Ivanov, 2021). The analysis focuses on export performance, manufacturing output, GDP growth, logistics performance, diversification index, and the regression relationship between supply chain diversification and export performance. The findings are presented in trend graphs, comparative bar charts, and regression output to examine how both countries performed throughout the disruption periods.

4.1.1 Descriptive analysis

The comparative descriptive statistics of Bangladesh and Finland are given in a comparative descriptive Table for the years 2018-2024. The results indicate that the Logistics Performance Index (LPI) score of the average country (4.09) in Finland is

substantially higher than LPI score of the average country (2.59) in Bangladesh, which shows that the logistics capability and efficiency of logistics infrastructure in Bangladesh is lower than that in Finland. This meant that on average, exports and imports in Finland were also considerably higher, giving it greater coordination with international trade. In the case of Bangladesh on the contrary, the rate of GDP growth and manufacturing output were found to be very high which shows the fast development of the manufacturing in the country during the time under study. The diversification index was however, much higher in Bangladesh (0.88) than in Finland (0.51) which reflects a broader diversification of the manufacturing supply chain in Bangladesh.

Source: Author's calculation using SAS Studio based on data from World Bank and UNCTADstat

Comparative Descriptive Statistics: Bangladesh and Finland

The MEANS Procedure

Country	N Obs	Variable	Label	Mean	Std Dev	Minimum	Maximum	N
Bangladesh	6	LPI_score	LPI_score	2.59	0.01	2.58	2.60	2
		Manufacturing_output	Manufacturing_output	70766666667	32418739437	10000000000	98500000000	6
		GDP_growth	GDP_growth	5.96	1.80	3.45	7.88	6
		Export_value	Export_value	12.12	1.30	10.44	13.16	6
		Import_value	Import_value	18.20	1.97	15.83	20.90	6
		Diversification_index	Diversification_index	0.88	0.01	0.87	0.89	6
Finland	6	LPI_score	LPI_score	4.09	0.16	3.97	4.20	2
		Manufacturing_output	Manufacturing_output	41400000000	2039607805.4	39200000000	44200000000	6
		GDP_growth	GDP_growth	0.05	1.49	-2.49	1.35	6
		Export_value	Export_value	41.16	3.41	36.21	46.28	6
		Import_value	Import_value	41.42	4.07	35.97	48.28	6
		Diversification_index	Diversification_index	0.51	0.00	0.51	0.52	6

Figure 6 Comparative descriptive statistics of Bangladesh and Finland

4.1.2 Export Performance: Bangladesh and Finland (2018–2024)

The export trend for Bangladesh and Finland is presented in figure 7 for the period 2018-2024. However, the export values are much higher in Finland in all periods, although there are variations in the periods of disruption. Both countries experienced a drop in export performance in 2020, symbolising the global effect of the COVID-19 pandemic on manufacturing supply chains and international trade activities. In 2022, Finland's recovery was relatively strong, with the highest value in exports followed by a small decrease. On the other hand, Bangladesh also recovered in 2022 but at a comparatively lower and less stable rate. The observation suggests that geopolitical disruptions and global uncertainty affected export continuity in both countries but with stronger industrial and logistics structures may recover more effectively from global disruptions.

Source: Author's calculation using SAS Studio based on data from World Bank

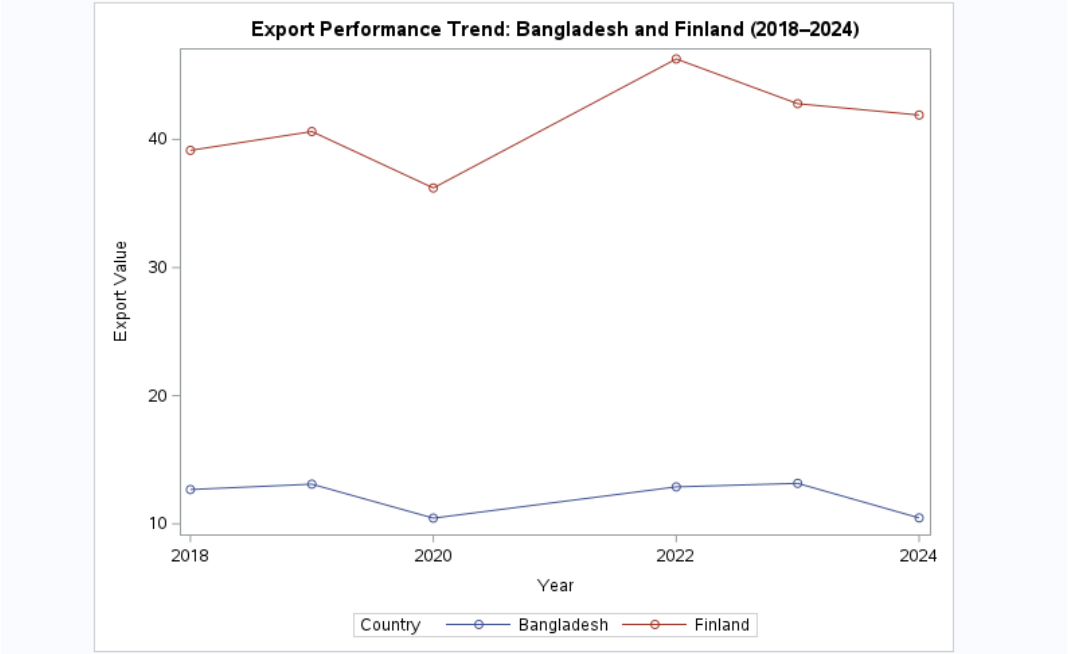


Figure 7 Export performance trend of Bangladesh and Finland

4.1.3 Manufacturing Output Trend: Bangladesh and Finland (2018–2024)

Figure 8 illustrates the manufacturing output trends in Bangladesh and Finland during the selected periods. Bangladesh experienced significantly high fluctuations in manufacturing output, specifically a major decline in 2022 and after that a rapid recovery in 2023 and 2024. This indicates the weakness of labor-intensive manufacturing systems to external disruptions and supply chain instability. The situation was different in Finland, however, as manufacturing output was maintained at a fairly steady pace in the country, with moderate fluctuations throughout the period. The stability in Finland may indicate stronger industrial resilience, technological harmonization, and operational continuity techniques. The comparative findings indicate that high-tech manufacturing environments can adapt more to geopolitical disruptions than labor-intensive systems.

Source: Author's caculation using SAS Studio based on data from the World Bank

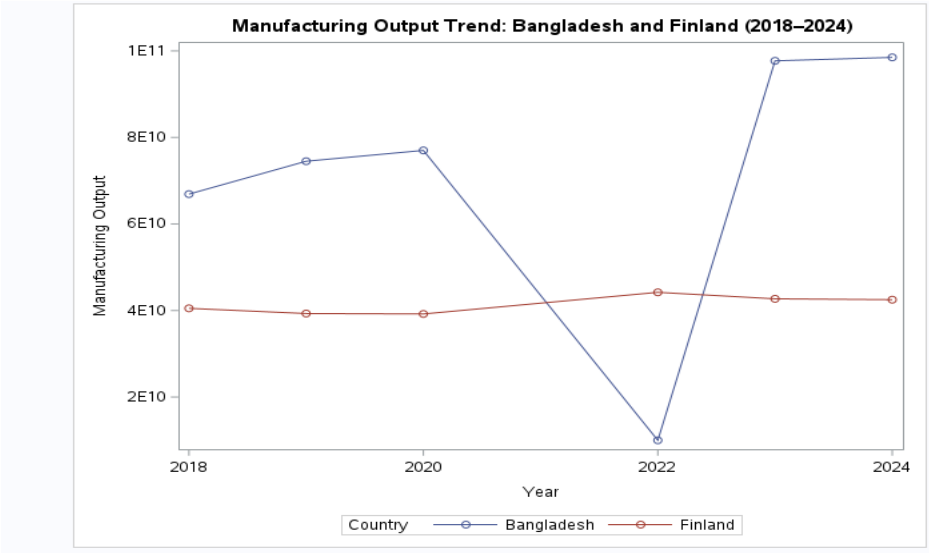


Figure 8 Manufacturing output trend of Bangladesh and Finland

4.1.4 GDP Growth Trend: Bangladesh and Finland (2018–2024)

Figure 9 presents the GDP growth trends of Bangladesh and Finland from 2018 to 2024. Bangladesh has a positive GDP growth during the period, but there was a significant decline in 2020 because of the global pandemic and supply chain disruptions. After the disruption period, Bangladesh gained a partial recovery in 2022, then declined again by 2024. Finland also experienced a negative GDP growth in 2020 for global pandemic and again in 2023, which shows stronger economic vulnerability to global disruptions and market instability. Despite fluctuations, Finland has moderate recovery after major disruption periods. Due to different economic responses to geopolitical uncertainty and supply chain shocks two countries experienced differently. The figure also suggests that operational resilience and economic recovery systems differ with industrial structure and global trade dependence.

Source: Author's calculation using SAS Studio based on data from World Bank.

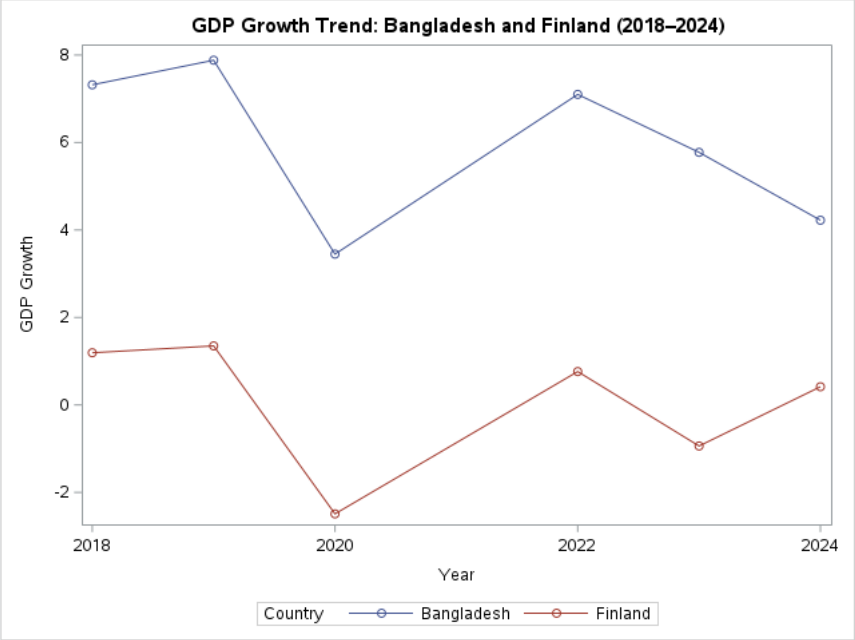


Figure 9 GDP growth trend of Bangladesh and Finland

4.1.5 Logistics Performance index Comparison

Figure 10 measures the Logistics Performance Index (LPI) scores of Bangladesh and Finland of 2018 and 2023. Finland has significantly higher LPI scores in comparison with Bangladesh, which shows a stable logistics infrastructure, transportation efficiency, customs performance, and supply chain balance capability. On the contrary, Bangladesh showed only slight improvement between 2018 and 2023. The outcome suggests that logistics capability plays a vital role in maintaining supply chain continuity during the periods of disruption and uncertainty. Stronger logistics performance may help to achieve faster recovery, better supplier coordination, and improved operational flexibility during geopolitical crisis. Therefore, the comparison pointed the importance of logistics efficiency as a resilience-supporting factor within manufacturing supply chains.

Source: Author's calculation using SAS Studio based on data from World Bank.

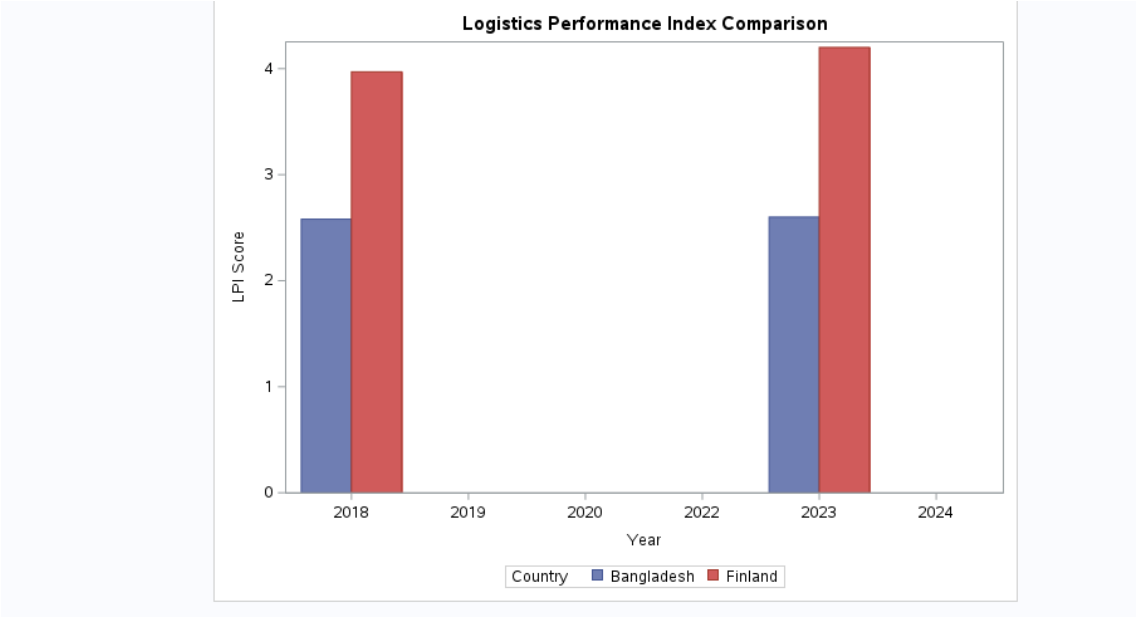


Figure 10 Logistics performance index of Bangladesh and Finland

4.1.5 Supply Chain Diversification Comparison

Figure 11 demonstrates the supply chain diversification patterns of Bangladesh and Finland from 2018 to 2024. Bangladesh has the higher diversification index values, while Finland experienced comparatively lower but relatively stable diversification values. The diversification type did not change over the period , although slight changes can be seen in following 2020. The finding indicate that Bangladesh has comprehensive sourcing and export diversification systems in labor-intensive manufacturing sector. On the other hand, Finland may rely more on specialized industrial networks and high-tech supply systems. Therefore, it indicates that diversification strategies may differ based on industrial structure and manufacturing orientation.

Source: Author's calculation using SAS Studio based on data from UNCTADstat

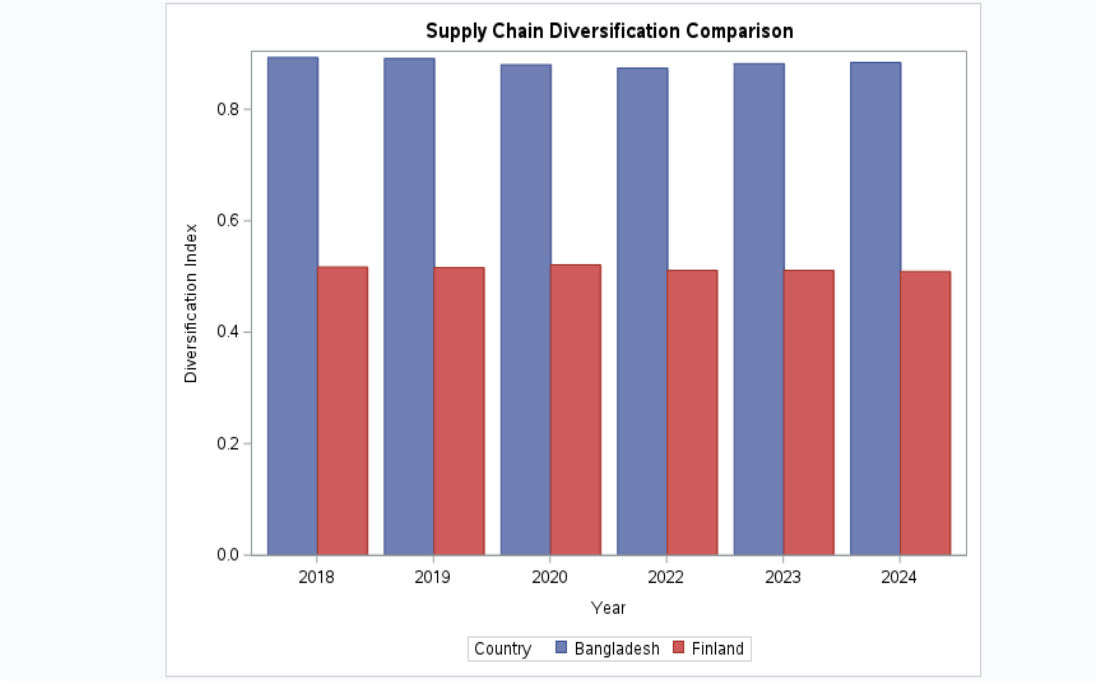
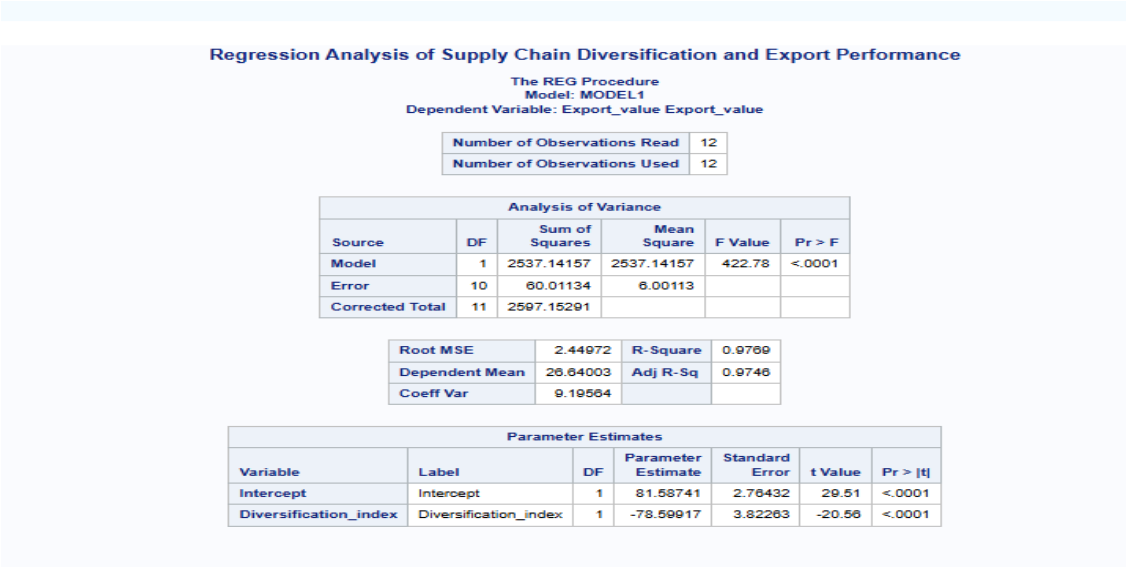


Figure 11 Supply chain diversification comparison between Bangladesh and Finland

4.1.6 Regression Analysis of Diversification and Export Performance

The table represents the regression analysis describing the relationship between supply chain diversification and export performance. The high value of R-square (0.9769) indicates that diversification accounts for a large percentage of the variation in export performance in the data set. The coefficient of diversifi-cation was negative, suggesting that there is an opposite relationship between the value of diversification index and export performance among the sample selected. A p-value less than 0.0001 is also obtained in the case of a statistical significance in the model. However, the findings should be interpreted carefully due to the limited sample size and comparative nature of the dataset. The analysis therefore supports the broader argument that resilience-oriented supply chain structures influence operational continuity in manufacturing sectors.

Source: Author's calculation using SAS Studio based on secondary data collected from World Bank and UNCTADstat



Regression Analysis of Supply Chain Diversification and Export Performance

The REG Procedure
Model: MODEL1
Dependent Variable: Export_value Export_value

Number of Observations Read	12
Number of Observations Used	12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	2537.14157	2537.14157	422.78	<.0001
Error	10	60.01134	6.00113		
Corrected Total	11	2597.15291			

Root MSE	2.44972	R-Square	0.9769
Dependent Mean	26.64003	Adj R-Sq	0.9746
Coeff Var	9.19564		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	81.58741	2.76432	29.51	<.0001
Diversification_index	Diversification_index	1	-78.59917	3.82263	-20.56	<.0001

Figure 12 Regression Analysis of Supply chain Diversification and Export performance

4.2 Interpretations of Results

The results reveal that global geopolitical shocks had a substantial impact on manufacturing supply chains and business operations in Bangladesh and Finland. The COVID-19 pandemic has had a devastating effect on the global economy, export results, GDP growth and manufacturing stability, as evidenced by the dramatic decrease in performance during 2020. The findings are corresponding with other research that states that modern manufacturing systems are still very sensitive to disruptions due to growing global reliance and complexity of supply chains (Ivanov & Dolgui, 2020; Van Hoek, 2020). Despite the disruption that occurred in both countries, the type and severity varied based on their industrial base and economies.

Bangladesh's GDP showed greater resilience to growth fluctuations despite short-term declines in manufacturing and exports, and short-term declines were more apparent in Finland. The results indicate that geopolitical shocks have differential effects on high-tech manufacturing and labour-intensive manufacturing systems. The comparative analysis also highlights the significant differences in the capability to be resilient between Bangladesh and Finland. However, Finland had more stable manufacturing performance and better logistics performance continuously than Bangladesh. This could be a sign of better institutional coordination, technological integration and flexibility in Finland's manufacturing sector.

Bangladesh, on the other hand, experienced more volatile manufacturing performance and less continuity in exports, underscoring the vulnerability of export-oriented labor-intensive sectors from any external shock and disruption in the supply chains. But the diversification index values were comparatively high in the case of Bangladesh, indicating diversified sourcing structure and diversified export dependency in the manufacturing sector in the country. The previous studies highlight the importance of logistics capability, digital integration and diversification in enhancing disaster resilience and recovery during global disruptions (Belhadi et al., 2024; Queiroz et al., 2022). Thus, the results

suggest that there are significant differences in the resilience strategies between developed and developing manufacturing settings.

After the disruption period, there were relatively small fluctuations in export performance and manufacturing in Finland, but larger fluctuations with partial recovery in Bangladesh. The results indicate that resilient supply chains need both diversification and effective logistics, strategic coordination, and flexibility in operations. The regression analysis also confirms that there is a strong correlation between diversification and export performance, but it varies depending on the specialization of industrial structure and economic diversification. The findings thus help to substantiate the idea that manufacturing firms need to reshape their supply chains strategically, enhance their logistics capability and build adaptive resilience mechanisms to ensure the continuity of their operations in times of geopolitical crises. These results align with recent resilience research that has focussed on three key resilience strengths: agility, flexibility, and reshaping supply networks (Davis-Sramek & Richey, 2022; Ivanov, 2021).

4.3 Comparison with Theoretical Framework

The results of this research confirm key tenets of supply chain resilience theory, namely that adaptability, flexibility, and the ability to recover from external shocks and stress is crucial. The export data, manufacturing data, and GDP data fluctuations that were observed during the disruption period provide an illustration of the impact these geopolitical crises and global uncertainties have on manufacturing operations and the continuity of international trade. Finnish manufacturing activity has been more resilient, and the country has solid logistics performance, which correlates with Ivanov and Dolgui's (2020) concept of a resilient supply chain, a supply chain that would have to be able to survive, adapt and be operationally resilient in the face of crises. The results corroborate Ivanov's (2021) assertion that during periods of disruption, resilient manufacturing systems rely on adaptive strategies, flexibility in supply chains, and coordinated recovery processes.

The results also show a very strong connection with the diversification theory part of the literature in supply chain management. The diversification comparison showed that Bangladesh had comparatively higher value of diversification index as compared with Finland during the period under consideration. This implies that labour intensive manufacturing industry sectors might depend more on diversified sourcing and export configuration to minimize exposure to external shocks. The regression analysis also showed that diversification had a statistically significant relationship with export performance, which was aligned with the findings of previous studies that highlight diversification's role as a resilience-building factor amidst geopolitical instability and fragmentation in supply chains (Y. Li et al., 2025a; Queiroz et al., 2022)Hence, it is concluded that diversification policies need to be integrated within the wider resilience of the manufacturing sectors to ensure continuity of operations in the long-term.

In addition to the theoretical arguments raised in the context of supply chain resilience and operational flexibility, the logistics capability findings also support this theory.The logistics capability findings reinforce the theory as presented in the context of the supply chain resilience and operational flexibility. Finland also recorded higher Logistics Performance Index (LPI) scores than Bangladesh in all the consecutive years, indicating that Finland has better infrastructure, transportation systems, customs efficiency and its capability of coordinating supply chains. In the resilience theory, logistics capability is considered as one of the important resilience enablers; in the event of a disruption, logistics systems help the recovery process to be faster, the response to be more responsive and the operational flexibility to be more enhanced (Belhadi et al., 2021).

The results are thus in line with the theoretical point of view that resilient supply chains must not only be based on a diversified sourcing structure, but also on a well-functioning logistics network and technological integration. Moreover, the differences between Bangladesh and Finland in comparison are supportive of the recent literature that resilience strategies differ in terms of industrial structure, technological advancement and institutions capability of manufacturing systems (Dubey et al., 2021; OECD, 2025).

The results are overall consistent with the continued validity of the theory of supply chain resilience in understanding how manufacturing adapts and continues in the face of global geopolitical shocks.

4.4 Practical Implications of the Results

This study brings out some strategic implications for manufacturing organisations in Bangladesh. The differences in export performance and manufacturing activity suggest that labour-intensive manufacturing industries are still extremely sensitive to geopolitical events or disturbances in the global supply chain. Hence, Bangladeshi manufacturing companies need to enhance the diversification of their supply chains through more suppliers, less dependence on a few supplier areas, and more flexibility in operations. The results also indicate that investments in digital supply chain systems, logistics infrastructure, and technological coordination can have a significant positive effect on the resilience capability during a crisis. Previous studies also advise about the digital transformation and supply chain viability are important in improving operational flow in the developing manufacturing economies (Al Amin et al., 2025; Islam et al., 2023).

The results also have significant implications for the future strategy of the high-tech manufacturing sector in Finland. The results show that export performance and GDP growth were still impacted during periods of disruption, though Finland had comparatively stable manufacturing output, as well as a stronger logistics capability. Hence, the importance of further enhancing manufacturing resilience by means of digital integration, predictive analysis and flexible coordination of suppliers within Finnish manufacturing companies. The results also suggest that operational resilience in production of high-tech products relies not only on productivity but also on adaptability and flexibility in the supply chain when crises hit the world. The earlier studies also highlight the need for proactive risk management, digital transformation and integrated logistics capability to ensure operational continuity in the event of disruptions for resilient manufacturing systems (Dubey et al., 2021; Tian & Cui, 2025). Thus, the companies in Finland must continue to invest in resilient logistics systems and co-

industrial partnership in order to continue to be competitive and stable in case of future geopolitical shocks.

The study also has significant policy implications for the governments and industrial policy makers of Bangladesh and Finland. The results indicate that national logistics capacity, infrastructure efficiency, and institutional coordination are important factors in improving the resilience of manufacturing in geopolitical shocks. Hence, the policy-maker should focus on investments in transport systems, customs modernization, digital infrastructure and trade facilitation policies to enhance transport chain continuity and the competitiveness of industries. Policy support in Bangladesh should also emphasize industrially diversifying the economy, skill development and technological upgrading in labor-intensive sectors. Policymakers in Finland can focus on integrating high-end logistics innovations, digital governance of the supply chain and strategic cooperation between industry sectors to maintain resilience in high-tech production systems.

The coordinated Government policy, infrastructure development, and the industrial planning that is more resilient to global uncertainty are also necessary in enhancing the national supply chain resilience, as stated by previous research (OECD, 2025; Setyadi et al., 2025a). As such, the planning of resilience should be an integral part of future industrial and trade policy frameworks. The outcome also has real-life implications for industrial management and for organizational decisions. Any manufacturing manager should understand that geopolitical disturbances have the potential to impact operations, supplier alignment, and export results to a serious degree in relatively sophisticated industrial locations. Comparative results shows that resilient firms required to apply a mix of diversification, logistics capacity, digitalization and supplier collaboration.

Managers need to therefore approach crisis scenario risk assessment proactively with adequate contingency sourcing plans and increase visibility along the supply chains to reduce disruption during such events. The observations also indicate that resilience is

not just used for the short term, but rather a longer-term strategic ability implemented as part of the organizational planning and management process. Resilient supply chain management also relies on flexibility in the organization, information sharing, and strategic collaboration between partners in the supply chain, as emphasized by previous studies (Ivanov, 2024; Kessler & Arlinghaus, 2022). As a result, the need for managers of industries to increasingly adopt operational strategies to enhance resilience in global manufacturing settings is getting stronger.

4.5 Contribution to the Field

The present study is an addition to the existing literature through making comparison of the supply chain resilience between a developing manufacturing economy like Bangladesh and a developed high tech manufacturing economy like Finland. The literature on resilience largely has been based on single-country analysis or industry-specific disruptions, and few studies have comparatively analyzed resilience patterns between labor-intensive and high-tech manufacturing systems during geopolitical events on a global scale (Ali et al., 2025; Bednarski et al., 2023b)). This study compares the various industrial structures using operational criteria, including export performance, manufacturing output, GDP growth, capability of logistics, and diversification, to gain a more comprehensive picture of how they react to global uncertainty.

The results show that there are significant differences between the resilience strategies and recovery capacities depending on logistics performance, technological capacity, and structures of dependency in the industry. The study intends to extend the comparative supply chain resilience literature by linking the impacts of disruptions to operational continuity across two distinct manufacturing environments. The Bangladesh–Finland comparison also provides an empirical understanding of resilience adaptation in developing and developed industrial economies. The research is also relevant to the emerging area of supply chain resilience studies. The results of the study corroborate recent theoretical work outlining the need to consider resilience as not only a recovery

capability, but also as the ability to adapt, survive and be strategically flexible during periods of disruption (Ivanov, 2021; Ivanov & Dolgui, 2020).

The analysis demonstrates that diversification and logistics competence are highly correlated to operational continuity in the geopolitical uncertainty. Beyond this, the comparative results indicate that diversification may not ensure resilience unless combined with a robust logistics and technological coordination, and with flexible and adaptive operational structures. This adds to the growing literature on resilience by focusing on the multi-dimensional nature of resilience in manufacturing supply chains. The empirical evidence in the regression analysis also supports the relationship between diversification and export performance in the context of disruptions. The study thus reinforces the resilience theory in place and bridges the strategic adaptation mechanisms and operational indicators during global crises.

The results also enrich the domain of industrial management by offering a new line of sight to take a look at the need for resilient-based operational strategies in manufacturing systems. In today's industrial management, flexible, adaptable and risk management capacity are becoming more and more demanded with the requirement of efficiency.In the current global situation, flexibility, adaptability and risk management capacity are becoming increasingly required with the requirement of efficiency in the industrial management. The study shows that the manufacturing resilience is not only dependent on cost efficiency, but also on harmonising logistics systems and on diversifying the manufacturing portfolios and on collaborative operational planning.

The comparative analysis also offers actionable management insights into the effects of industrial structure on resilience capability and performance of recovery in disruptions. In line with this, the previous studies also point out that digital integration, collaborative coordination and operational flexibility are becoming a necessity in the modern industrial management systems (Dubey et al., 2021; Tian & Cui, 2025). Therefore, this research contributes to the field of industrial management knowledge, because it

emphasizes the strategic value of resilience planning, adaptive operations, and remodeling supply networks in the current manufacturing landscape.

5 Conclusion and Discussion

The chapter gives the overall results of the study and discusses the significant findings in the context of the research objectives and the theory presented. The chapter provides a brief overview of the impact of geopolitical influences on manufacturing supply chains and the role of resilience measures like diversification and logistics capability for operational continuity in Bangladesh and Finland. It also includes the questions of research, study quality and limitations, and suggestions for further studies and industrial practices. Finally, the chapter covers personal learning outcomes that have been acquired in the process of writing of this thesis. The discussion is connected with the recent supply chain resiliency literature(Mbonigaba Celestin* & S. Sujatha**, 2024) and the empirical results obtained by using SAS Enterprise Guide and SAS Studio Analyses.

5.1 Summary of the Research and Key results

This study analyzed the ways in which manufacturing supply chains can be made resilient during global geopolitical shocks by comparing two countries Bangladesh and Finland in the time period of 2018-2024. The research was specifically aimed at the key indicators of resilience: manufacturing output, export performance, GDP growth, logistics capability and diversification of the supply chain. Secondary data were gathered from the reliable sources of international databases like World Bank, UNCTADstat, Eurostat and Bangladesh Bureau of Statistics. Using SAS Enterprise Guide and SAS Studio, descriptive and comparative analyses, trend and regression analyses were performed to examine patterns in resilience and operational effectiveness in both countries.

The results indicate that geopolitical events like the COVID-19 pandemic, trade fragmentation and the war between Russia and Ukraine had a substantial impact on manufacturing activities and international trade performance in both countries. The trend analysis showed that there were noticeable changes in export values and GDP growth as well as manufacturing output in periods of disruptions, particularly in 2020. The economy in Finland contracted in the pandemic period and in Bangladesh the

manufacturing and trade performance weakened significantly. The results are consistent with some previous research which suggested that geopolitical uncertainties produce significant issues in the functioning and logistics of manufacturing value chains .(Bals et al., 2016a; Min et al., 2019)

The comparative analysis presented a good structural distinguish between Bangladesh and Finland. Finland's logistics performance was much better, and its international trade values were high, due to its advanced logistics infrastructure and global value chain; the performance was excellent. Bangladesh, on the other hand, showed relatively higher growth rate in GDP and manufacturing sectors in most years of the study period, thus reflecting the potential of the labour-intensive manufacturing industries of Bangladesh. It also revealed that Bangladesh has a higher diversification index, indicating extensive efforts to diversify suppliers and markets as a strategy to enhance resilience. These results suggest that the resilience strategies depend upon the economic structure, industrial capacity and institutional setting.(Roscoe et al., 2020)

Results from the regression analysis revealed that there was a statistically significant relationship between the variables of supply chain diversification and export performance. The findings indicated that diversification was an important factor influencing export performance over the time period under consideration, in that it reduced the reliance on limited suppliers, regions or markets during geopolitical crises. This is in line with the resilience theory which suggests that diversifying supply chains increases flexibility, adaptability, and resilience in the face of crisis (Choudhury & Rahman, 2017; Christopher, 2011)). The outcome also highlights recent research that emphasizes the direct connection between resilience capabilities and operational continuity and manufacturing stability in global uncertainty (Guntuka et al., 2024; Setyadi et al., 2025b).

5.2 Reflection on Research Questions and New Insights

The primary focus of the research was what makes manufacturing supply chains resilient in the context of global geopolitical shocks in Bangladesh and Finland. The results show that the application of resilience-related capabilities was different in both countries depending on their industrial structure and economic situation. During some of the years in the study period, Finland's logistics capability and the performance of its infrastructure were stronger, as were Bangladesh's diversification practices and manufacturing growth. Even though there were ups and downs in exports, manufacturing and GDP growth due to disruptions, the countries exhibited recovery patterns after major crisis periods. These results indicate that resilience is achieved by a combination of logistics efficiency, diversification, adaptability and operational flexibility in the face of uncertainties in the global environment (Ivanov, 2024; OECD, 2025).

The first supporting research question focused on understanding the impact of diversification and logistics capability on operational performance during disruption. The analysis indicated that there is close relationship between logistics capability and manufacturing stability and export performance. Better transport and infrastructure systems, resulting in a relatively stable trade, was evident in Finland's higher Logistics Performance Index (LPI). However, Bangladesh showed high levels of diversification, which helped to minimise over-dependence on few markets and suppliers. The regression analysis also demonstrated that diversification was statistically significantly related to export performance, thus reinforcing the significance of diversified supply networks in terms of resilience and continuity in operation (Chowdhury et al., 2019; Ivanov & Dolgui, 2025).

The second supporting research question explored the differences between the factors of resilience among the manufacturing sectors of Bangladesh and Finland. The results showed that there were significant differences in the concept of resilience between the two countries. The advanced logistics systems, the quality of infrastructure and technological capability were more correlated with Finland's resilience, whereas

diversification and flexibility in manufacturing adaptation were more correlated with those of Bangladesh. These differences are due to the difference between a high tech developed economy and a labor intensive emerging manufacturing economy. The paper thus indicates that resilience strategies are situational and depend on industrial composition, institutional capacity, and the level of economic development (Belhadi et al., 2024; Liu et al., 2024).

This study also provided a number of new insights into manufacturing resiliency during geopolitical events. An important lesson learned is that resilience should not only be considered at the company level, but also at the national level of the supply chain and at the national level of industrial policy. The comparison between Bangladesh and Finland shows that there are indications that there are different strategic pathways to become resilient, depending on the resources and the characteristics of the industries. The other lesson is that diversification is still crucial for emerging economies and logistics becomes an important capability in advanced manufacturing systems where a high level of integration with the rest of the world is needed. The results presented here add to a comparative resilience research by using a macro level indicator and manufacturing performance analysis in two different economic contexts.

5.3 Evaluation of the Work and Ethical Considerations

The primary research objective of this study was achieved when the manufacturing supply chain resilience during the global geopolitical disruptions in Bangladesh and Finland were explored. Comparative macro-level indicators were used to assess the operational performance, diversification capability, and logistics resiliency in two different manufacturing settings. Descriptive, comparative, trend and regression analyses were integrated to get a structured pattern of resiliency during periods of disruption. Similarly, previous resilience studies highlight the importance of using multiple operational indicators to achieve a better quality of comparative analysis of supply chains (Ivanov & Dolgui, 2025; Queiroz et al., 2022). Thus, the method chosen to solve the problem in this research was deemed suitable to answer the research questions.

The use of secondary data has also increased the reliability of the study as the data were obtained from internationally reputed and widely published sources like World Bank, UNCTADstat, Bangladesh Bureau of Statistics etc. These organisations use standard statistical and reporting systems that enhance consistency and credibility of information. Furthermore, the benefits of using SAS Enterprise Guide and SAS Studio led to the increase in transparency and decreased risk of manual calculation errors in the analysis process. The methodological literature in the past also emphasizes the benefits of using statistical software in quantitative research for increased analytical reliability and consistency in research (Saunders et al., 2023b). To ensure a systematic and transparent analytical process throughout the study, the study was developed in a logical sequence.Therefore, the research is carried out in a logical sequence to ensure a systematic and transparent analytical process of the study.

However, there are Several methodological limitations noted. Secondary data offer comparative information at a broad level but do not necessarily compare the data at the country level because there may be differences in the way data is collected across countries (Bangladesh and Finland) and the range of indicators does not necessarily match. Continuous year-by-year comparison was reduced by not having certain indicators available each year, such as the Logistics Performance Index (LPI). In addition, the study relied on broad indicators rather than operational data from firms, preventing direct observation of firm-level resilience practices. The regression results are also not very generalizable because the data set is relatively small and the time period relatively short. These are also widespread issues in comparative resilience studies based on secondary international data (Bednarski et al., 2023b; Liu et al., 2024)

Research was conducted in an ethical manner. No confidential organisational information or personal information was collected and all data used in the study was gathered from publicly accessible and officially published data. As such, the study was not conducted with direct human involvement, interviews, or surveys involving informed

consent procedures. All sources of original information have been cited and plagiarism avoided in accordance with APA 7. The results were also reported objectively, without intentional manipulation and/or selective reports for predetermined conclusions. This is especially important when using a number of international datasets and resilience indicators to compare different supply chains (Saunders et al., 2023a).

Ethical responsibility in the use of digital and AI tools in the preparation of theses was also taken into account in the research. AI tools are used solely for language, structure and writing assistance, with the analysis, interpretation and final academic decisions made by the author. Additionally, information from authentic datasets was supplied to and used in all statistical outputs in the study without being fabricated or falsified, and all statistical outputs were created using SAS Enterprise Guide and SAS Studio. Hence, the study sought to ensure transparency, sourcing accuracy and methodological consistency in all aspects of the research. The practices are consistent with academic rigor and trustworthiness of the study (Dubey et al., 2021; Saunders et al., 2023a).

5.4 Limitations of the Study

There are a number of limitations of this study that should be considered in interpreting the results. First, the research was completely based on secondary data extracted from international databases including the World Bank, OECD, Eurostat and UNCTADstat. These are reliable and are well utilised for academic research purposes; however, disparities in reporting methodologies, calculation methods and update frequency may create some issues in full comparability between Bangladesh and Finland. Secondary international data sources also highlight that inconsistencies between countries and indicators are possible (Saunders et al., 2023a). The results should be viewed within the scope of available macro level data, therefore.

Another constraint is the solely relying on macroeconomic indicators instead of firm-level operating data. In the study, indicators like export value, GDP growth, manufacturing output, logistics performance and diversification index were used to

assess national-level patterns of resilience. These indicators, however, do not necessarily consider the internal organizational resilience strategies, managerial decision-making processes, or operational adjustments produced by each manufacturing company in response to disruption. Previous resilience studies highlight that in-depth analysis of case studies at the firm-level, and the analysis of firm-level surveys, can enable a deeper understanding of operational resilience practices (Dubey et al., 2021; Queiroz et al., 2022). As a result, certain factors of supply chain's resilience could not be explored in detail in this study.

The main limitations of the study were the limited number of samples available and the selected time frame of 2018 to 2024. However, a number of indicators were not available on an annual basis, limiting the ability to make continuous trends across all years. Furthermore, the regression analysis was performed on a small sample of observations, thus limiting the generalizability of the results statistically. The results of the regression analysis showed that there was a significant relationship between diversification and export performance, but the results must be treated with some caution as it might be different with larger dataset and longer time periods. Comparative resilience studies between macro-level operational indicators share similar limitations.(Bednarski et al., 2023b)

Lastly, the study did not include other countries as comparative cases, thereby reducing the scope of its applicability to other manufacturing economies. Bangladesh is a labor-intensive emerging manufacturing economy and Finland is technologically advanced developed economy. While this comparison brings to light differences in resilience in industrial contexts, the results may not be fully applicable to other countries with differing political, economic or industrial conditions. Future cross country studies could offer deeper insights into how stable manufacturing sectors are during times of geopolitical disruption. (Y. Li et al., 2025a; OECD, 2025)

5.5 Suggestions for Future Research

This research could be extended in the future to analyze geopolitical shock response actions from a firm perspective using firm level data. The main data sources used in this study were macro level indicators, including export value, GDP growth and logistics performance, which offer broad comparative insights but are not able to capture the practices within organisations, and managerial decision making processes. Surveys, interviews or case studies might therefore provide greater insights into operational resilience practices in manufacturing companies in the future. In recent years, literature on the concept of resilience also highlights the need for an integrated approach of macro-economic and organizational viewpoints in research on supply chain resilience (Tian & Cui, 2025; Setyadi et al., 2025).

Larger sets of countries and manufacturing sectors could also be studied in the future to gain a better understanding of resilience strategies across different industrial contexts. The study was confined to Bangladesh and Finland, which are a developing economy with labour-intensive industries, and a developed economy with high technology industries, respectively. However, there are often differences in the resilience capacities between regions, sectors and political contexts. Further analysis with other European, Asian or emerging economies could offer a wider perspective on the impact geopolitical shocks have on manufacturing systems across the globe. Even as geopolitical tensions have grown and the world has become more fragmented in trade, the extent to which resilience analysis can be done across countries is still limited (Li et al, 2025; OECD, 2025).

A key research field for the future is how digitalization and advanced technologies contribute to enhancing manufacturing resilience. While this study focused on logistics capability and diversification, future research may be conducted to closer examine the impact of technologies like artificial intelligence, blockchain, Internet of Things (IoT), and predictive analytics on resilience performance in the face of disruptions. Digital transformation is gaining popularity as a strategic resilience capability for visibility, flexibility, and operational coordination of supply chains (Al Amin et al., 2025; Liu et al.,

2024) . Thus, there is a great need for future empirical studies that integrate digitalization indicators and operational performance analysis in the resilience literature.

Future studies could also consider the impact of geopolitical disruptions for periods other than post-disruption recovery. The timeframe of this research was mainly between 2018 and 2024, which encompasses the COVID-19 pandemic and recent geopolitical turmoil. But, structural long-term shifts in global manufacturing networks and supply chain governance could result from disruptions caused by trade fragmentation, energy crises, and regional conflicts. Longer-term studies (longitudinal studies) will then yield better insight into the evolution of resilience strategies over time in the various sectors of the manufacturing industry.Longer time length studies (longitudinal studies) will then give better insight into the evolution of resilience strategies over time in the various sectors of the manufacturing industry. The research will add to the field of literature on sustainable and adaptive supply chain resilience in the era of ongoing uncertainty in the world (Ivanov, 2024)

5.6 Personal Learning and Development

The research aspect of this thesis greatly enhanced the author's understanding of supply chain resilience, geopolitical disruptions and manufacturing operations in a global industrial environment. Comparing the two countries, Bangladesh and Finland, gave the author greater understanding of the various ways manufacturing systems cope with disruption based on their logistics capability, level of diversification and industrial structure. Additionally, the research process enhanced critical thinking and analysis abilities through the need to interpret operational indicators, as well as performance trends in relation to resilience. In recent years, the importance of the research-based approach in developing analytical skills and problem-solving abilities in industrial management education has also been highlighted (Min et al., 2019).

Logical thinking and applying research and technical skills were also developed through the thesis. The author personally collected secondary data from international sources

like World Bank, OECD, Eurostat and UNCTADstat. Also, the author developed quantitative analysis and data visualization skills using the software tools, SAS Enterprise Guide and SAS Studio. The work with the data, creating graphs, making regression analysis and analyzing the statistics outputs reinforced the author in the use of analytical tools in the process of conducting industrial and business research. The importance of quantitative and digital analytical skills has been put forward as one of the key skills required for success in the field of supply chain and operations management (Bals et al., 2016b).

The research process also enhanced academic writing and autonomous learning ability. The literature review involved the author critically analyzing academic journals, theories, and recent literature related to resilience of manufacturing supply chains and geopolitical disruptions. The process also helped the author in organizing the research arguments systematically and using the referencing of APA 7 standards properly. Moreover, the long term independent research project helped to develop better time management skills, problem-solving skills and academic work during the process of completing the thesis. The previous studies on education indicate that independent thesis writing is an important element in the formation of self-directed learning and professional research skills in higher education settings (Huber & Harvey, 2016).

Lastly, this thesis raised the author's consciousness on the applicability of resilience in contemporary manufacturing and supply chain management. The research gives insights into the effect of global disruption on operational flow, trade performance and industrial stability in various economic settings. The author gained a deeper knowledge about the significance of logistics capability, diversification and adaptive supply networks in uncertain global environments. The student is expected to achieve a learning experience that will benefit the author for further academic and career development in industrial management, logistics and supply chain-related areas. The thesis process thus not only helped to develop academic knowledge but also helped for long-term professional development and career.

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Appendices

Appendix 1: Data sources

Appendix 2: SAS output

Appendix 3: Regression analysis

Appendix 1: Data sources

Logistics performance index from World Bank

Source link: https://data360.worldbank.org/en/dataset/WB_LPI

GDP from world bank

Source link:

https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

Export value from world bank

Source link:

https://data.worldbank.org/indicator/NE.EXP.GNFS.CD

Import value from world bank

Source link:

https://data.worldbank.org/indicator/NE.IMP.GNFS.CD

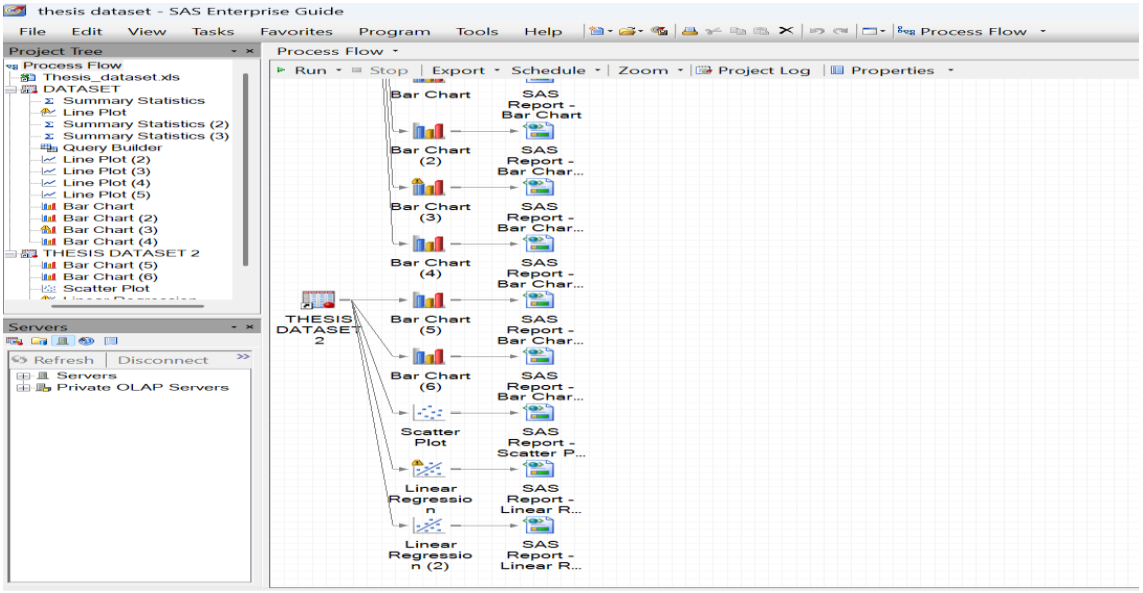
Diversification Index from UNCTADstat

Source link:

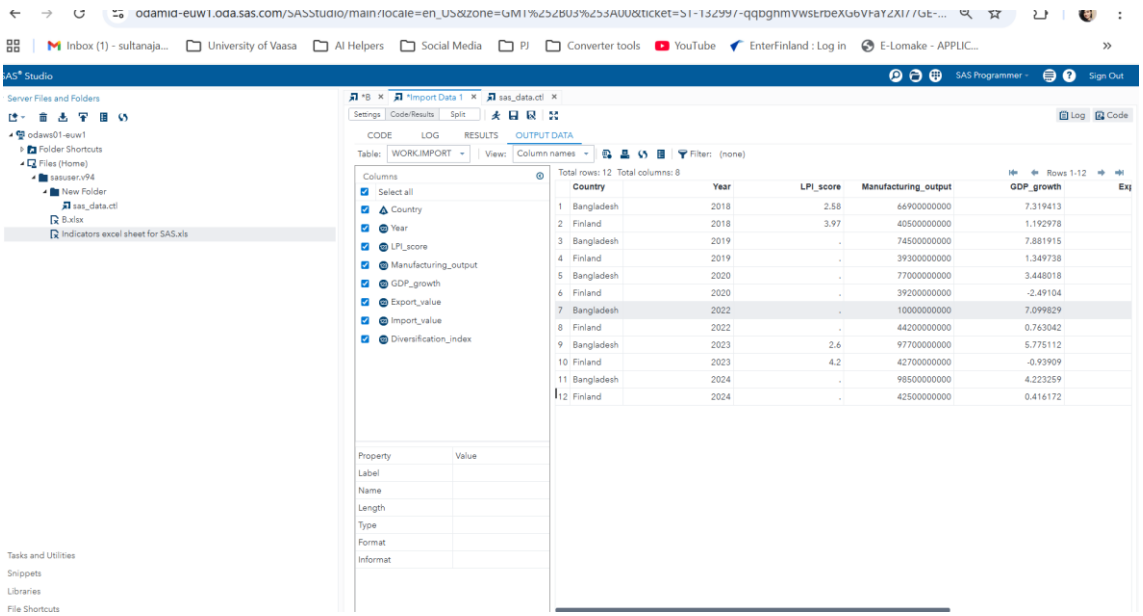
https://unctadstat.unctad.org/datacentre/dataviewer/US.ConcentDiversIndices

Appendix 2: SAS output

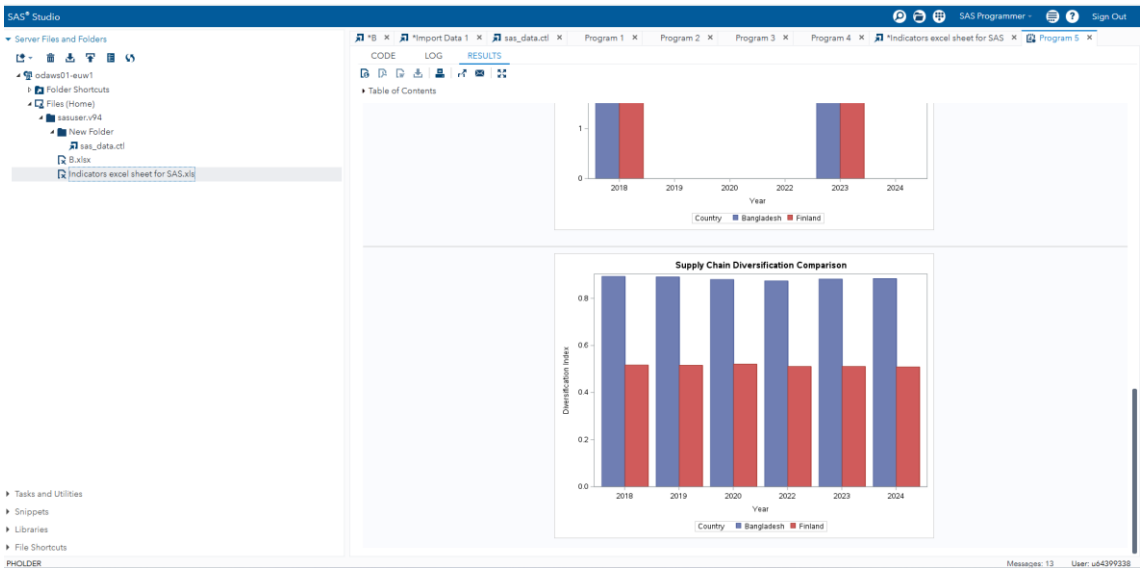
SAS Enterprise Guide interface



SAS studio interface

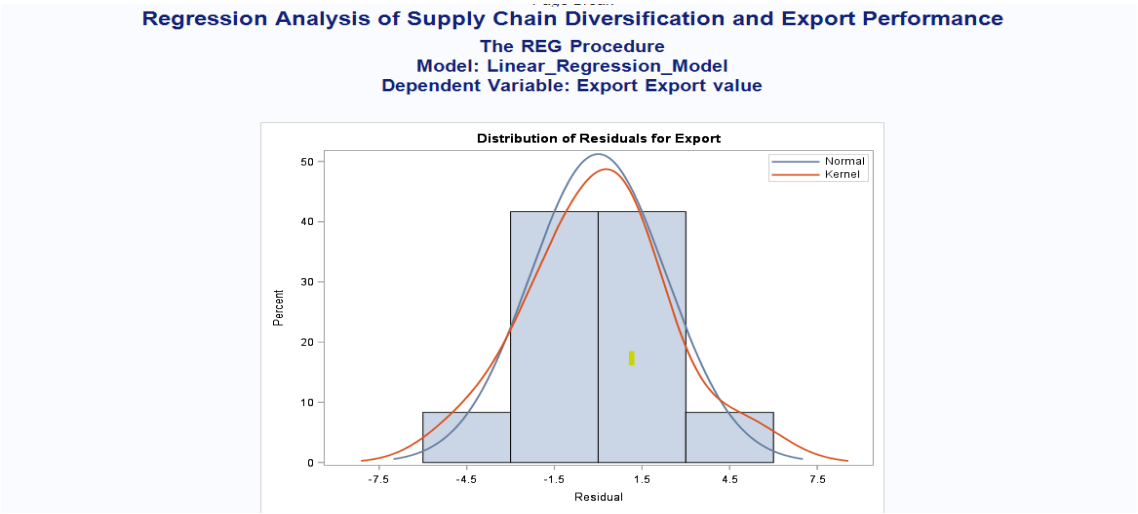


SAS studio interface



Appendix 3: Regression analysis

Export and Diversification residual



Fit Diagonestic for export