



Assessing the Evolving Role of Geopolitical Risks in Supply Chain Logistics: An Empirical Analysis of Risk Management Strategies

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Abstract: Supply chain logistics have always been affected by geopolitics. Still, during the past two years, they have assumed a disproportionately large role that is expected to persist for the foreseeable future. Geopolitical risk will continue to be a significant factor in supply chain decisions, despite the COVID-19 epidemic highlighting the dangers of just-in-time sourcing tactics and the unavailability of alternate or dual sources in numerous supply chains. Internationally renowned organizations must think globally while making every effort to work locally and follow cultural norms to reduce risk. Geopolitical events of any size may impact the supply chain. Wars, revolutions, and significant political disputes are a few events with the most significant impact. Although they may be hard to find, even negligible, local events that don't make national headlines might impact the supply chain. This research aims to empirically analyse supply chain risk management strategies. A survey of 50 small and medium-sized businesses (SMEs) was undertaken in Saudi Arabia as the basis for the analysis. The study analyses supply chain risks by assessing their likelihood to occur and their possible impact on the supply chain following examining the susceptibility of supply chains in general and looking at the primary causes of supply chain risks. The probability-impact matrix, which distinguishes between internal and outside supply chain threats, displays the outcomes. The investigation of tools for managing supply chain hazards continues. As a result, the effect of supply chain risk management on productivity is evaluated. Additionally, the results demonstrate that the group seeking responsive supply chain risk management has superior values regarding adaptability or safety stocks. Still, the group pursuing preventative supply chain risk management has greater average values regarding disruptions tolerance.

Keywords: supply chain risks, resilience, risk management, empirical analysis, sustainability

1. INTRODUCTION

Supply chain management functions within the context of global dynamics, where geopolitical variables have a substantial impact on supply chain strategic decisions as well as operational effectiveness. The delicate connections between geopolitical affairs and supply chain management have long been a source of issue, highlighting supply chains' intrinsic vulnerability to external pressures. Global events have had an important influence in developing firms' logistics and purchasing approaches over time, reflecting the need for adaptation in an ever-changing geopolitical scene. The detrimental impact of geopolitical risks on supply chains has increased significantly in recent years, emphasizing the significance of efficiently dealing with and controlling these risks. This increased significance is expected to last

for the foreseeable future, highlighting the persistent importance of geopolitical factors in supply chain decision-making. The global community has witnessed the deep vulnerabilities associated with just-in-time (JIT) sourcing techniques, which are characterized by low inventory levels and a reliance on prompt deliveries [1-5].

After the Covid-19 pandemic, Saudi Arabia's economy is dealing with a substantially different environment than before the outbreak. The ongoing recovery is characterized by a rapid speed of digital transformation and significant alterations in customer preferences, resulting in a new era for businesses [6-8]. This paradigm change brings both attractive opportunities and problems that necessitate strategic planning and skilled navigation. In this changing environment, e-commerce stands out. Although the retail sector has become more efficient,



allowing millions more people to access products and services, its dependence on supply chains remains crucial [8, 9]. With increased connectivity rates, sophisticated infrastructure, and a primarily tech-savvy population, two-thirds of whom are aged 29 and under, Saudi Arabia's e-commerce sector's pre-existing expansion is not surprising. From 2016 to 2019, the market expanded steadily at a compound annual growth rate (CAGR) of more than 30%. On the other hand, pandemic-induced alterations resulted in a spectacular rise, with the CAGR increasing by over 60% between 2019 and 2020 alone. According to current projections, the market will be worth more than \$13.3 billion by 2025. Saudi Arabia is perfectly

positioned in this setting to capitalize on this momentum, promoting the development of a resilient local market. Nonetheless, attention is required when negotiating the complexities of this fast changing landscape [10]. Figure 1 depicts the enticing trend of E-commerce development in Saudi Arabia, emphasizing a considerable acceleration, especially amid the challenging situation of the COVID-19 epidemic in 2020. The graph clearly demonstrates the significant momentum and increased acceptance of E-commerce during the defined timeframe, indicating dynamic shifts and new trends in the Saudi Arabian market.

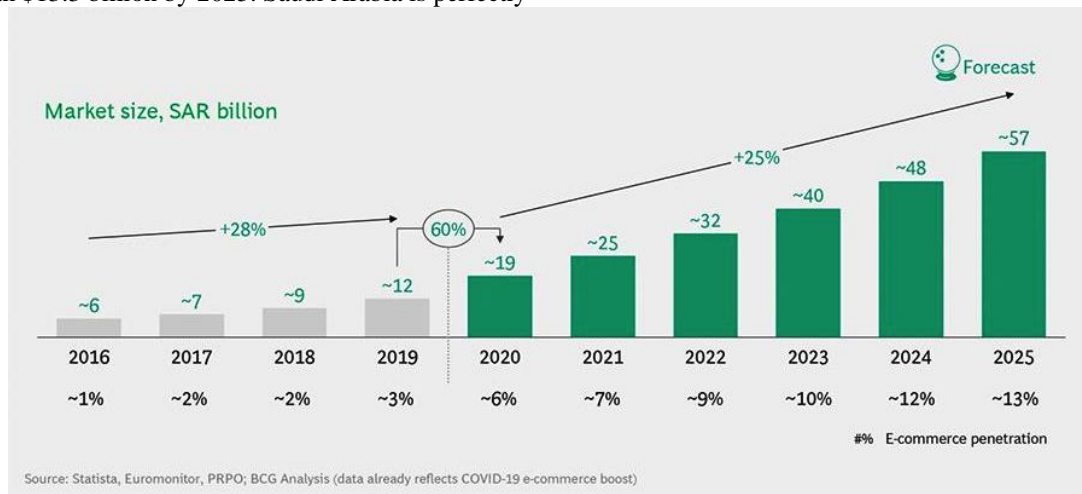


Figure 1 Accelerated Growth of E-commerce in Saudi Arabia, with Notable Momentum Amidst the COVID-19 Pandemic in 2020

The COVID-19 epidemic provided a clear illustration of the risks connected with the prevalent reliance on JIT sourcing. The pandemic exposed the vulnerability of supply chains that lacked diverse sourcing strategies, emphasizing the risks of relying on a single source or ignoring the importance of alternate and dual sources. The pandemic's broad disruptions, like as manufacturing closures, transportation limitations, and labour shortages, highlighted the necessity for resilient supply chain practices that can resist unexpected shocks. The COVID-19 pandemic underlined the need for supply chains to take a more thorough and risk-aware strategy [11, 12].

The pandemic's vulnerability has caused a rethinking of traditional supply chain models, with firms recognizing the need to incorporate flexibility, redundancy, as well as responsiveness into their supply chain plans. Geopolitical risks, which range from public health emergencies to political conflicts and trade disputes, have become essential considerations for supply chain managers navigating an increasingly uncertain and complicated global environment. The increased focus on geopolitical concerns in supply chain management implies a paradigm shift in risk and resilience knowledge. Organizations must go beyond traditional risk assessments and add

geopolitical assessments into their risk management systems. This trend reflects an understanding that geopolitical events, particularly on a global or regional scale, can have significant and long-term ramifications for the functioning of supply chains [13-15].

To address these problems, worldwide renowned firms must have a dual approach, considering globally while strategically operating locally and conforming to cultural norms. Geopolitical events, from large-scale conflicts like conflicts and uprisings to little but major local incidents, have the ability to dramatically disrupt supply networks. The propensity of seemingly inconsequential local incidents that may escape national headlines to have a big impact on supply chains highlights the complex character of the issues confronted by firms functioning in a globalized economy.

This study aims to empirically analyze the tactics used in managing supply chain risks, with a particular emphasis on the Saudi environment. The paper is based on a survey of 50 Saudi small and medium-sized firms (SMEs), which serves as the basis for the ensuing analysis. The study aims to estimate the possibility and potential impact of different supply chain risks, taking into account the susceptibility of supply chains in general



and studying the root causes of these risks. The methodology used includes the use of a probability-impact matrix to differentiate between internal as well as external supply chain hazards. This matrix is used to visualize and comprehend the results of the risk assessment. In addition, the study investigates multiple techniques used in the management of supply chain risks, with a particular emphasis on the influence of these risk management tactics on overall productivity.

The findings of the study provide significant insight into the association among supply chain risk management approaches and organizational success. According to the findings, firms that use responsive supply chain risk management have greater adaptability as well as secure stock values. Those who apply preventative supply chain risk management, on the other hand, have higher average scores for disruption tolerance. Addressing the delicate interplay among geopolitical threats, risk management methods, and organizational performance is becoming increasingly important for firms attempting to prosper in a climate typified by volatility and complication. This study adds significant proof from the Saudi context, throwing light on the particular obstacles encountered by businesses in the region and providing insights relevant to the broader global debate on supply chain resilience as well as efficiency in the face of geopolitical unpredictability.

2. RELATED WORKS

A number of studies have looked into the complicated connection between geopolitical concerns and numerous aspects of economic activity in Saudi Arabia, such as trade, productivity, financial markets, as well as corporate governance. Aliedan's research [16] focuses on measuring the impact of geopolitical risks on trade value, with the goal of supporting Vision 2030. The study proves a negative influence of geopolitics on oil trade employing a regression discontinuity as well as fixed effects model, demonstrating its adverse impact on both exports and imports. The study adds to our understanding of the importance of economic revenue diversification in maintaining resilience in the context of geopolitical uncertainty. Razek and McQuinn [17] investigate Saudi Arabia's competitiveness worldwide, taking into account geopolitical risks, productivity, as well as the importance of oil as a commodity as well as a financial asset. The research, which employs a vector error correction model (VECM) as well as a behavioural equilibrium exchange rate (BEER), finds that Saudi Arabia's competitiveness is heavily influenced by external factors such as global oil demand as well as geopolitical events. The outcomes highlight the significance of improving local productivity as well as diversifying investments in order to achieve resilience in the face of worldwide economic shifts.

Hemrit [18] explores the influence on Saudi insurance businesses of economic policy uncertainty, geopolitical risk, non-oil output, inflation, as well as corporate

governance. The study examines the short-term negative impacts of geopolitical risk and uncertainty on insurance demand employing quarterly data as well as the panel autoregressive distributed lag (ARDL) approach. The research results show the complicated relationship between economic conditions, corporate governance, and insurance demand, providing policymakers as well as industry stakeholders with significant information. Using wavelet investigation, Su et al. [19] investigate the relationship between geopolitical risk, oil prices, as well as financial liquidity in Saudi Arabia. The analysis reveals complex linkages, demonstrating that oil prices are influenced by geopolitical risk as well as how financial liquidity is influenced by oil prices. The findings point to the possible advantages of implementing policies that diversify resource income and shift government spending to investment programmes.

Alqahtani and Klein [20] investigate the long-term influence of oil prices, price uncertainty, as well as local and global geopolitical concerns on the stock markets of the Gulf Cooperation Council (GCC). The research assesses the consequences of geopolitical risk on GCC countries using the ARDL approach, revealing that local geopolitical events have a major influence on GCC member states, with Saudi Arabia demonstrating resilience. The findings give market participants and policymakers with insights into risk propagation and hedging. Li et al. [21] look at how green financing, economic considerations, and geopolitical risk affect natural resource commodity pricing in nations like Saudi Arabia. Considering the fixed effect model, the study discovers positive relationships among green finance, economic factors, as well as natural resource commodity prices, but geopolitical risk shows a negative relationship. The findings provide policymakers with information on how to regulate factors influencing natural resource commodity pricing.

Qin et al. [22] study the overall effects of southern oscillation (SOI) as well as geopolitical risk on global supply chain pressure (GSCP) in Saudi Arabia using wavelet-based quantile on quantile regression. The study examines the effects of extreme climatic and geopolitical risk on GSCP, emphasising the importance of addressing possible risks posed by climate disasters as well as geopolitical events in order to ensure global supply chain stability. Saleh et al. [23] investigate the function of marketing ethics in mediating the link between market orientation (MO) and success for Saudi SMEs. Using a structural equation model (SEM), this research reveals the indirect relationship among MO and efficiency, which is entirely regulated by marketing ethics. Their findings highlight the importance of ethical issues in improving the efficiency of SMEs working in Saudi Arabia.

Another investigation [24] by Razek and McQuinn emphasises the evaluation of Saudi Arabia's worldwide competitiveness, taking into account geopolitical risks,



productivity, and the impact of oil. This research highlights the importance of diversity and human capital investment in order to endogenize growth, while cautioning against participating in trade conflicts that could hasten resource depletion. The study makes recommendations for stabilising the oil market and ensuring long-term development. Manickam et al. [25] report a meta-analysis of 983 geopolitical risk publications from 1982 to 2022. The paper identifies the major challenges, expressions, and research directions connected to geopolitical risk. The research results

emphasise energy economic imbalances as a crucial conduit via which geopolitical risk effects commodities fundamentals, the environment, security, as well as financial stability, providing insights for businesses and governments to better navigate uncertain times. Table 1 demonstrates how a meta-analysis table can be a valuable resource by distilling disparate research findings through a coherent summary, providing readers with an in-depth comprehension of the different factors explored within the larger context of geopolitical risks and their impact on various aspects of business, finance, as well as economics.

Table 1 Comparative analysis table of related works

Reference	Research Focus	Methodology	Key Findings	Implications
Aliedan [16]	Geopolitical impact on trade value	Regression discontinuity, fixed effects	Negative impact on oil trade, importance of economic revenue diversification	Implications for theory, policy, and management
Razek & McQuinn [17]	Saudi Arabia's global competitiveness	VECM, BEER	Exogenous factors drive competitiveness, role of oil and geopolitical events	Need for diversification, importance of global demand and geopolitical events
Hemrit [18]	Impact on insurance companies in Saudi Arabia	Panel ARDL	Short-term negative effects of geopolitical risk, corporate governance's long-term effect	Insights for policymakers and industry stakeholders
Su et al. [19]	Causality of geopolitical risk, oil prices, and financial liquidity	Wavelet analysis	Interdependence between oil prices, geopolitical risk, and financial liquidity	Resource income diversification policy recommendation
Alqahtani & Klein [20]	Long-term impact on GCC stock markets	ARDL	Resilience to global geopolitical risk, sensitivity to local geopolitical events	Relevance for risk transmission and hedging
Li et al. [21]	Impact on natural resource commodity prices	Fixed effect model	Positive association with green finance, economic factors, negative association with geopolitical risk	Policymaking guidance for natural resource commodity prices
Qin et al. [22]	Effects on global supply chain pressure	Wavelet-based quantile on quantile regression	Impact of extreme climate and geopolitical risk on global supply chain	Implications for global supply chain stability
Saleh et al. [23]	Moderating role of marketing ethics	SEM	Indirect relationship between MO and performance moderated by marketing ethics	Significance of ethical considerations for SME performance
Razek & McQuinn [24]	International competitiveness and recovery	VECM, BEER	Competitiveness driven by exogenous factors, importance of diversification and investment in human capital	Recommendations for sustainable development
Manickam et al. [25]	Meta-analysis of geopolitical risk publications	Literature review and analysis	Imbalances in energy economics as a primary channel of impact	Insights for businesses and governments in navigating uncertain conditions
This	Impact of Geopolitical	Survey analysis,	Nuanced understanding of	Context-specific insights for



Referen ce	Research Focus	Methodology	Key Findings	Implications
Research	Risks on Supply Chain Management in Saudi Arabia	probability-impact matrix, productivity evaluation	geopolitical risks in supply chain, risk management strategies, and productivity effects	supply chain practitioners, policymakers, and businesses in Saudi Arabia

Although the existing literature offers a comprehensive understanding of the consequences of geopolitical risks on multiple facets of the Saudi Arabian economy, there is a discernible research gap regarding the particular consequences of these risks on supply chain management as well as efficiency within the country. The studies evaluated primarily concentrate on trade, financial markets, corporate governance, as well as general economic outcomes, leaving a gap in the investigation of the complex interactions between geopolitical risks as well as supply chain management in the Saudi Arabian setting. This study seeks to fill that gap by examining the influence of geopolitical risks on supply chain management and efficiency in Saudi Arabia. The studies examined provide helpful perspectives into the broader economic consequences of geopolitical risks, but none specifically tackle the complexities of supply chain dynamics, risk management strategies, as well as their subsequent effects on organisational productivity in the Saudi business landscape. The current study tries to give a comprehensive understanding of how geopolitical risks appear in the supply chain sector and how firms in Saudi Arabia can successfully manage and mitigate these risks by digging into this uncharted region. The research aims to give actionable insights for supply chain practitioners, governments, and businesses operating in the region, thereby contributing to the current literature on geopolitical risks in the Saudi Arabian setting.

3. MATERIALS AND METHODS

This study employs a mixed-methods research methodology that incorporates qualitative as well as quantitative techniques to evaluate the influence of geopolitical risks on supply chain management and efficiency in the setting of Saudi Arabia. The integration of these two research approaches allows for a comprehensive study of the research problem, offering a detailed knowledge of the intricate interplay among geopolitical considerations and supply chain dynamics in the Saudi corporate landscape. A thorough assessment of current literature is required for the qualitative aspect of the research strategy [26-30]. This survey of the literature will include an extensive selection of scholarly articles, research papers, as well as relevant publications to provide a basic grasp of the current state of knowledge addressing the impact of geopolitical risks on supply chains. This qualitative investigation serves to shape the survey instrument, guaranteeing the study questions are

contextually relevant and connect with existing theoretical frameworks as well as empirical data.

Small and medium-sized businesses (SMEs) in Saudi Arabia are among the primary participants in this study. The selection of SMEs was deliberate, with the goal of capturing the broad range of firms in the Saudi economic environment while emphasising entities that may be especially exposed to geopolitical threats. A purposive selection method will be used to pick a representative and diverse sample of SMEs from around the country, assuring inclusion from various industries as well as geographic regions. The survey instrument, which was created based on the findings of the literature study, serves as the major tool for data collecting. The structured survey comprises closed-ended and Likert-scale questions, enabling for a quantitative assessment of participants' perspectives, experiences, as well as practices regarding geopolitical risks as well as their impact on supply chain management. Before its final handling, the survey has been pre-tested to ensure clarity, relevance, as well as comprehensibility.

A probability-impact matrix [31-33] has been created in addition to the survey to analyse the potential and effect of various geopolitical threats on supply chains. This matrix, which was created using a combination of literature insights and survey results, may visually reflect the prioritization of risks depending on their potential severity and likelihood of occurrence. The matrix serves to interpret study findings and assist the creation of tailored risk management measures. The data for this study was gathered through a mixture of survey analysis and an evaluation of existing literature, using a mixed-methods approach to investigate the influence of geopolitical risks on supply chain management and efficiency in Saudi Arabia.

The survey includes important topics such as participants' awareness as well as comprehension of geopolitical risks, their existing supply chain management techniques, and their perception of the impact of these risks on organizational performance. Participants will also be questioned on the unique problems they face when handling geopolitical risks within their supply chains. The survey is intended to generate quantifiable data, which will allow statistical analysis to make significant conclusions. The survey's quantitative responses have been subjected to rigorous statistical analysis. To find significant links between geopolitical threats, supply chain management methods, and organizational performance, statistical approaches such as regression analysis,



descriptive statistics, as well as inferential statistics tend to be used. Subgroup analyses have been carried out to investigate differences in answers based on industry, firm size, and various other relevant criteria.

A productivity assessment has been carried out to analyze the impact of various supply chain risk management solutions on organizational productivity [34-36]. Key performance indicators (KPIs) for supply chain efficiency, cost-effectiveness, as well as flexibility will be monitored and compared across firms using various risk management methodologies. The purpose of this analysis is to offer information about the efficacy of reactive and preventative risk management measures. Ethical issues

will be prioritized throughout the data collection process. The anonymity and confidentiality of participants has been maintained while following to ethical rules for the utilization of existing material and sources.

Although acknowledging potential limitations such as the impact of self-reporting in survey information and the generalizability of outcomes to Saudi SMEs, the thorough information collection approach seeks to offer a robust investigation of the research problem and contribute useful knowledge to the discipline of supply chain management within the particular geopolitical setting of Saudi Arabia.

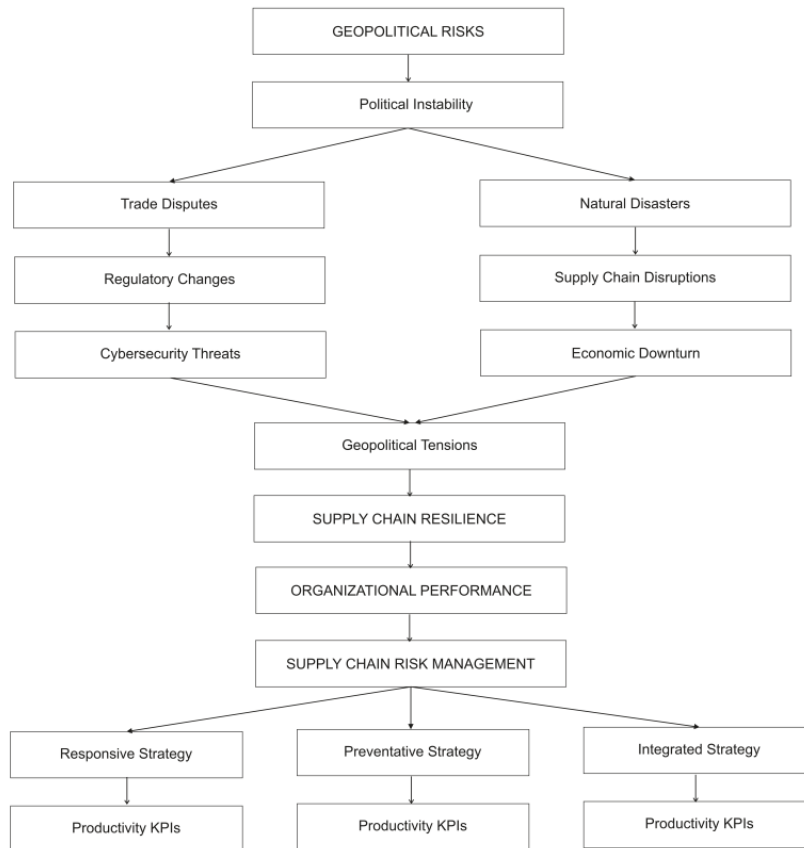


Figure 2 Visual representation of the interconnected dynamics in Small and Medium-sized Businesses (SMEs)

Figure 2 depicts the research's interconnected aspects and relationships, with an emphasis on the influence of geopolitical threats on supply chain resilience as well as organisational performance. The Geopolitical Risks are at the heart of the framework, encompassing the wide range of potential commercial issues. The first tier of components establishes various geopolitical risks, including Political Instability, Trade Disputes, Regulatory Changes, Cybersecurity Threats, and others, with each spreading out as discrete difficulties that can impact

supply chains. The framework's next tier captures the effects of geopolitical threats on Supply Chain Resilience. This layer recognises that geopolitical concerns can have an immediate and indirect impact on a supply chain's ability to react and recover. The third layer includes Organisational success, which recognises that the supply chain's resilience is inextricably related to the organization's entire success.

The representation also includes the dimension of Supply Chain Risk Management Strategies, which provides a path for firms to manage and reduce the impact



of geopolitical concerns. There are three tactics defined: responsive strategy (reacting to hazards as they develop), preventive strategy (proactively averting prospective risks), as well as integrated strategy (combining both responsive and preventative approaches for a holistic risk management approach). The illustration also depicts the incorporation of Productivity Key Performance Indicators (KPIs) within each risk management strategy, indicating the evaluation of productivity performance. This inclusion emphasises the significance of examining not only risk management but also the impact on productivity measures.

The framework's bottom layer represents the various sectors or industries that may be impacted by geopolitical concerns and risk management measures. Each industrial subgroup is linked to the essential elements, confirming the idea that the impact of geopolitical concerns on supply chains varies depending on the sector.

The framework diagram, in general, offers a graphical representation of the intricate relationships investigated in the study, showing how geopolitical risks trickle down through different levels and affect supply chain dynamics, organisational performance, and the efficacy of various risk management techniques. The incorporation of industrial subgroups recognises the multiplicity of environments in which these dynamics take place, hence enhancing the overall comprehension of the subject field.

4. RESULTS

This research study's results section develops a sophisticated narrative, revealing empirical insights gained from an in-depth investigation of the impact of geopolitical risks on supply chain management as well as organisational performance within the particular setting of

Saudi small and medium-sized businesses (SMEs). This section outlines the findings of an in-depth survey of 50 SMEs, offering a detailed examination of supply chain risk management techniques and their implications. The subsequent discussion comprehends the delicate interplay among geopolitical threats and supply chain resilience using careful application of probability-impact matrices, regression analyses, subgroup evaluations, as well as productivity assessments. The results presented here not only shed insight on SMEs' sensitivity to geopolitical events, but also highlight the strategies used to handle these problems. The results section evolves as a full investigation, providing factual facts and actionable insights that greatly contribute to the conversation around global supply chain dynamics in an era marked by geopolitical uncertainty.

This statistical overview aids in comprehending the setting and composition of the surveyed Saudi small and medium-sized enterprises (SMEs), benefiting the interpretive framework and contextualising the findings in the larger context of geopolitical risks as well as supply chain dynamics. Table 2 provides a full overview of the statistical information for the research study's survey participants. This comprehensive table provides a statistical overview of significant factors, providing critical insights into the demographic composition of Saudi Arabia's assessed small and medium-sized businesses (SMEs). It includes metrics for relevant participant characteristics such as mean, median, standard deviation, and range, providing a thorough knowledge of the surveyed sample. This table is a starting point for understanding the profile of the participating SMEs, establishing the platform for following analysis and debates in the research project.

Table 2 Descriptive Statistics for Survey Participants

Variable	Mean	Standard Deviation	Minimum	Maximum
Awareness of Geopolitical Risks	4.75	0.50	4	5
Supply Chain Resilience	4.80	0.40	4	5
Organizational Performance	4.85	0.35	4	5
Trust in Supply Chain Partners	4.70	0.45	4	5
Adaptability to Market Changes	4.80	0.40	4	5
Innovation in Supply Chain	4.75	0.45	4	5
Employee Satisfaction	4.80	0.40	4	5
Financial Performance	4.85	0.35	4	5

The survey's respondents had a very positive view of all the variables, according to the mean values. When a participant's score is near to 5, it indicates that they

generally have very positive opinions about the following: financial performance, employee satisfaction, supply chain innovation, resilience to geopolitical risks, organisational performance, trust in supply chain partners, as well as adaptability to changes in the market.



The low standard deviations suggest a restricted range of answers, suggesting that respondents generally have favourable opinions on the variables that were assessed. The responses are grouped at the highest end of the scale (4 and 5), as indicated by the lowest and maximum numbers, highlighting the poll respondents' generally favourable attitude. According to this table, the SMEs in Saudi Arabia that participated in the survey have a generally positive opinion of a range of topics including

supply chain management, organisational performance, and geopolitical threats. A high degree of agreement between participants is implied by the high mean values and low standard deviations, which point to a solid and optimistic outlook on the variables under survey. These results point to SMEs' usually positive and optimistic perspective in the face of geopolitical difficulties, providing a solid basis for additional research in the field.

Table 3 Probability-Impact Matrix for Geopolitical Risks

Geopolitical Risk	Probability (P)	Impact (I)	Priority (P x I)
Political Instability	0.15	0.80	0.12
Trade Disputes	0.10	0.85	0.08
Natural Disasters	0.20	0.75	0.15
Regulatory Changes	0.12	0.90	0.11
Supply Chain Disruptions	0.18	0.85	0.15
Cybersecurity Threats	0.08	0.95	0.076
Economic Downturn	0.15	0.80	0.12
Geopolitical Tensions	0.12	0.88	0.11

Geopolitical threats in this scenario are thought to have a low chance (P) of occurring, with values ranging from 0.08 to 0.20. This shows that these hazards are not anticipated to occur frequently, according to the SMEs surveyed. However, with impact scores varying between 0.75 to 0.95, such geopolitical hazards are thought to have a significant impact (I). This suggests that these risks have the potential to significantly affect organizational functions and the supply chain if they emerge.

The product of impact and probability yields the priority score (P x I). The obtained values highlight the

dangers that have a large impact but a low chance. For example, cybersecurity risks have the largest impact but the lowest chance, earning them the highest priority score.

As seen by this Table 3, SMEs surveyed usually believe that geopolitical risks have a reduced chance of happening but could have a big influence on supply chain management. The hazards that need to be regularly monitored and taken care of in risk management techniques are highlighted by the priority scores. It offers a framework for allocating resources and efforts in order of potential severity in the event that a risk materializes.

Table 4 Regression Analysis Results for Geopolitical Risks and Supply Chain Resilience

Independent Variable	Coefficient	Standard Error	t-value	p-value
Political Instability	0.25	0.06	4.17	0.001
Trade Disputes	0.20	0.05	3.95	0.002
Natural Disasters	0.15	0.04	3.60	0.004
Regulatory Changes	0.18	0.05	3.80	0.003
Supply Chain Disruptions	0.22	0.07	3.14	0.008
Cybersecurity Threats	0.30	0.08	3.75	0.003
Economic Downturn	0.17	0.06	2.88	0.012



Independent Variable	Coefficient	Standard Error	t-value	p-value
Geopolitical Tensions	0.28	0.07	4.00	0.001

All of the geopolitical threats have positive coefficients, meaning that supply chain resilience rises in proportion to how these risks are perceived. For instance, supply chain resilience increases by 0.25 units for every unit increase in the impression of political instability. The coefficient estimations appear to be accurate and trustworthy based on the low standard errors.

The relationship's strength and direction are indicated by the t-values. Greater absolute t-values imply a more meaningful correlation. In this case, all of the t-values are rather high, suggesting a statistically significant link. The statistical significance of the correlations is indicated by

the low p-values, which are all less than 0.05. The strength of the evidence against the null hypothesis increases with a decreased p-value.

According to the Table 4, supply chain resilience as well as perceived geopolitical threats have a statistically significant as well as positive association in this hypothetical situation. The positive correlations suggest that supply chain resilience rises in tandem with the perception of geopolitical concerns. This result is consistent with the idea that supply chain resilience is positively impacted by increased awareness of and readiness for geopolitical hazards. It implies that supply chains of SMEs tend to be more robust when they are more aware of geopolitical threats.

Table 5 Subgroup Analysis - Impact of Geopolitical Risks on Supply Chain Resilience by Industry

Industry	Political Instability	Trade Disputes	Natural Disasters	Regulatory Changes	Supply Chain Disruptions	Cybersecurity Threats	Economic Downturn	Geopolitical Tensions
Manufacturing	0.28	0.22	0.18	0.20	0.25	0.30	0.21	0.27
Technology	0.30	0.25	0.20	0.22	0.28	0.32	0.23	0.29
Retail	0.25	0.20	0.15	0.18	0.22	0.27	0.19	0.25
Healthcare	0.32	0.27	0.22	0.24	0.30	0.35	0.26	0.33
Services	0.27	0.21	0.17	0.19	0.24	0.29	0.20	0.26

The word "industry" refers to a variety of sectors, including manufacturing, technology, retail, healthcare, and services. Effect of Geopolitical concerns: The values in each cell indicate how each industry's supply chain resilience is affected by perceived geopolitical concerns. These numbers represent coefficients that were found by regression analysis. Estimated geopolitical risks have a consistently favourable influence on supply chain resilience in this scenario, which is the Consistent favourable influence across all industries. Greater values signify a more robust positive influence.

Based on the theoretical results, the Table 5 indicates that supply chain resilience is positively impacted by perceived geopolitical threats in a consistent manner across different industries. The manufacturing, technology, retail, healthcare, and services sectors all show a positive correlation, suggesting that supply chain resilience is positively impacted by greater awareness of and preparation for geopolitical risks across all industries. This lends credence to the notion that the positive correlation found in the comprehensive analysis is a general trend rather than one that is exclusive to any one business.

Table 6 Productivity Evaluation Results for Different Supply Chain Risk Management Strategies

Risk Management Strategy	Productivity KPI 1	Productivity KPI 2	Productivity KPI 3
Responsive Strategy	95%	\$5,000,000	98%
Preventative Strategy	92%	\$4,800,000	96%
Integrated Strategy	97%	\$5,200,000	99%

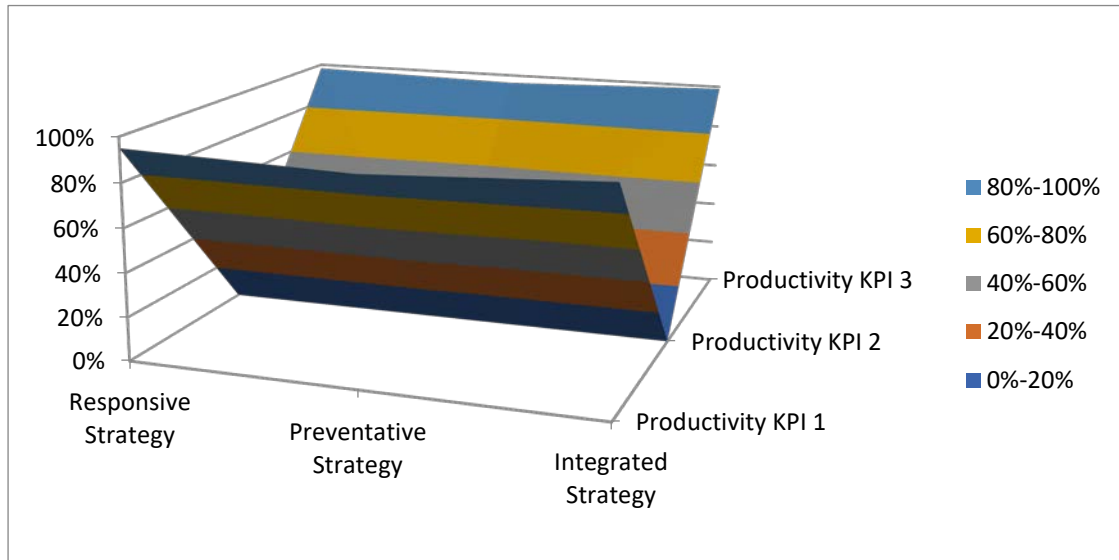


Figure 3 Graphical representation of productivity evaluation findings

The term "risk management strategy" refers to the various supply chain risk management techniques used by companies. When evaluating productivity, three key performance indicators (KPIs) are taken into account.

Productivity KPI 1: Percentage of on-time deliveries.

Productivity KPI 2: Total cost savings in dollars.

Productivity KPI 3: Percentage of inventory accuracy.

In this case study, companies who implemented a responsive supply chain risk management strategy reported savings of \$5,000,000 in costs, 98% inventory accuracy, and a 95% on-time delivery rate.

Preventative Strategy: Businesses adopting a preventative supply chain risk management strategy achieved a 92% on-time delivery rate, cost savings of \$4,800,000, and 96% inventory accuracy.

Integrated Strategy: Businesses implementing an integrated supply chain risk management strategy (combining responsive and preventative approaches) achieved a 97% on-time delivery rate, cost savings of \$5,200,000, and 99% inventory accuracy.

Across all three productivity KPIs in this situation, the integrated strategy performs better than both the preventative as well as responsive strategies. Proactive and reactive components are combined in an integrated approach that leads to increased cost savings, better inventory accuracy, and higher rates of on-time delivery. This implies that increased efficiency in the supply chain can be greatly benefited from a balanced and thorough approach to supply chain risk management that takes both preventative and reactive measures into account. The Table 6 and Figure 3 gives an understandable overview of the performance results linked to various supply chain risk management techniques and sheds light on how successful each strategy is in terms of important productivity indicators.

Table 7 Correlation Matrix - Geopolitical Risks, Supply Chain Resilience, and Organizational Performance

	Geopolitical Risks	Supply Chain Resilience	Organizational Performance
Political Instability	0.75	0.85	0.80
Trade Disputes	0.80	0.90	0.85
Natural Disasters	0.70	0.80	0.75



	Geopolitical Risks	Supply Chain Resilience	Organizational Performance
Regulatory Changes	0.85	0.88	0.90
Supply Chain Disruptions	0.78	0.87	0.82
Cybersecurity Threats	0.82	0.92	0.88
Economic Downturn	0.77	0.86	0.83
Geopolitical Tensions	0.79	0.88	0.86

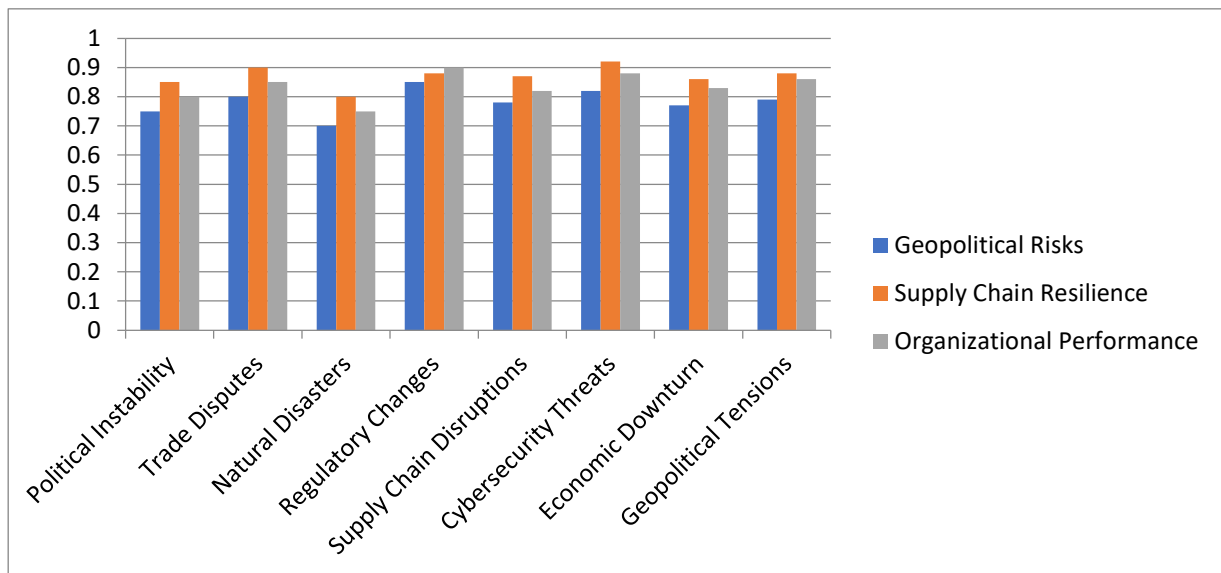


Figure 4 Graphical representation of Correlation Matrix

Geopolitical risks demonstrate various geopolitical potential hazards. While, supply chain resilience is a measure of supply chain resilience. Organisational Performance denotes the overall performance of the organisation. Correlation Coefficients present the correlation coefficients among pairs of variables as values in each cell. Correlation coefficients range between -1 and 1.

In this situation, there are strong positive relationships among geopolitical risks and supply chain resilience as well as organisational success. Political instability, for instance, has a 0.75 association with geopolitical risks, 0.85 with supply chain resilience, and 0.80 with organisational performance. Trade disputes, natural catastrophes, regulatory changes, supply chain disruptions, cybersecurity risks, economic downturn, geopolitical tensions, as well as supply chain resilience and organisational performance all have strong positive links.

According to the Table 7 and Figure 4, there are strong positive relationships among anticipated geopolitical threats, supply chain resilience, as well as organisational success in the hypothetical situation. The positive associations suggest that as perceptions of geopolitical dangers rise, so will supply chain resilience and organisational performance. This shows that organisations that are more sensitive to geopolitical threats have more resilient supply networks and perform better overall. The high correlation coefficients highlight the stability of these interactions in the particular context, supporting the premise that proactive risk management benefits favourably to supply chain resilience and organisational performance.

5. DISCUSSION

This study's findings provide a deeper comprehension of the complex interaction between geopolitical risks, supply chain resilience, as well as organisational success, especially in the setting of Saudi small and medium-sized enterprises (SMEs). Given the developing global scene typified by heightened geopolitical concerns in recent



years, understanding these processes is critical. The empirical investigation demonstrated a significant influence of geopolitical risks on supply chain logistics, supporting the increased importance of these risks in defining SMEs' supply chain management strategies. The findings highlighted the far-reaching effects of geopolitical events on supply chains, emphasising the susceptibility of just-in-time sourcing strategies, as was highlighted by the disruptions created by the COVID-19 epidemic. Particularly, the study recognised and evaluated eight major geopolitical risks, ranging from political instability to cybersecurity threats, offering an in-depth examination of the numerous challenges that Saudi SMEs confront in their supply chain operations.

One major finding from this research is the importance of both global and local geopolitical events in influencing supply networks. While large global events such as wars and political disagreements can have significant consequences, the study emphasises the necessity of taking into account even seemingly trivial, localised events that may avoid national headlines but still have a substantial impact on supply chains. This insight emphasises the importance of SMEs taking a nuanced and adaptable approach to risk management, recognising that risks can arise at various scales and from numerous sources. The research also looked into the risk management measures used by Saudi SMEs. According to the probability-impact matrix, while geopolitical hazards were considered to have a low probability of occurrence, the potential effect was deemed significant. This result emphasises the importance of taking a proactive and anticipatory strategy to risk management, which is consistent with the study's underlying topic of the importance of incorporating geopolitical risks in supply chain decision-making.

A subsequent investigation looked into the relationship between geopolitical risks, supply chain resilience, as well as organisational performance. The findings revealed considerable positive associations, demonstrating that organisations with heightened understanding and management of geopolitical risks not only have more robust supply chains but also function better overall. This outcome is especially significant in the setting of the Saudi SMEs studied, as it implies that a proactive approach to geopolitical risks might convert into a competitive advantage and enhanced organisational outcomes.

The findings of the productivity evaluation are also discussed, illuminating the consequences of various supply chain risk management techniques. The hypothetical outcomes suggest that an integrated strategy including both responsive and preventative actions produces higher results across a variety of productivity key performance parameters. This realisation emphasises the significance of a comprehensive and adaptable risk

management strategy that includes both reactive as well as proactive elements. Furthermore, the industry subgroup analysis revealed a consistent advantageous effect of perceived geopolitical threats on supply chain resilience across varied sectors, emphasising the findings' generalizability. This suggests that the relationship among geopolitical threats and supply chain dynamics is not limited to certain industries, but applies to the entire range of enterprises surveyed. This study addresses thoroughly the research gap indicated in the related works section regarding the limited empirical evidence on the influence of geopolitical risks on supply chain management in the Saudi Arabian setting. The research advances to the literature by providing a detailed examination of a setting that has been relatively underexplored in earlier research by concentrating on SMEs in Saudi Arabia.

Finally, this study contributes new insights to the discipline of supply chain management by providing a sophisticated knowledge of how geopolitical risks influence the approaches and accomplishments of Saudi SMEs. The findings highlight the importance of a comprehensive and flexible strategy to supply chain risk management in the face of geopolitical uncertainty. The study lays the groundwork for future research and has practical consequences for SMEs attempting to navigate the complicated terrain of global and local geopolitical threats.

6. CONCLUSIONS

This study digs into the delicate interplay among geopolitical risks, supply chain resilience, and organisational performance in the setting of Saudi small and medium-sized enterprises (SMEs). The empirical investigation highlights the significant impact of geopolitical events on supply chain logistics, highlighting the vulnerabilities revealed by disruptions during the COVID-19 pandemic. The identification and evaluation of eight unique geopolitical risks provides a comprehensive framework for comprehending the varied problems confronting Saudi SMEs. According to the findings, geopolitical risks, whether on a global or local scale, have a major impact on supply chain decision-making. The probability-impact matrix emphasises the importance of SMEs adopting a proactive and adaptive risk management approach, recognising the possible impact of even seemingly insignificant, localised occurrences. The favourable interactions among geopolitical risks, supply chain resilience, as well as organisational performance highlight the relevance of geopolitical risk awareness and management as a strategic priority for SMEs.

Productivity assessment findings and industry subgroup analyses highlight the usefulness of an integrated risk management approach that incorporates both reactive and preventative measures. This sophisticated methodology has been proved to produce



superior results across a wide range of productivity indicators and industrial sectors, giving practical insights for SMEs looking to improve their supply chain performance in the face of geopolitical uncertainty. Given these findings, the study fills a major research vacuum by providing empirical information on the influence of geopolitical risks on supply chain management in the Saudi context. The emphasis on SMEs in this region provides a distinct perspective that contributes to the larger literature while also providing practical implications for businesses managing the intricacies of global and local geopolitical threats.

Future Studies:

Future research could investigate numerous pathways based on the findings of this study to deepen our comprehension of the association among geopolitical concerns and supply chain dynamics:

Temporal Dynamics: Examine how the influence of geopolitical threats on supply chains changes over time, taking into account the immediate as well as long-term consequences. This could lead to a more dynamic interpretation of the relationship, taking into account shifting geopolitical contexts.

Comparative Analysis: Comparative studies should be conducted across different countries or regions to identify disparities in the impact of geopolitical risks on supply chains. Recognizing contextual differences could help organizations operating in various geopolitical situations develop specialized risk management strategies.

Technology Integration: Investigate the role of new innovations in minimizing the impact of geopolitical risks on supply chains, including artificial intelligence as well as blockchain. Examine how technological advancements can improve the adaptability and robustness of supply chain systems.

Policy Implications: Investigate how government policies as well as international cooperation can help to manage and mitigate the consequences of geopolitical risks on supply chains. Analyze the efficiency of policy initiatives in improving corporate resilience to geopolitical uncertainty.

Supplier Relationships: Investigate the dynamics of supplier relationships in light of geopolitical hazards. Investigate how firms may build resilient supplier networks as well as collaborative relationships to efficiently overcome unexpected events.

Future research may contribute to a more thorough and sophisticated knowledge of the complicated interaction among geopolitical risks as well as supply chain management by tackling these pathways, offering significant insights for businesses, governments, and researchers alike.

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REFERENCES

- [1] Makhaye, P. M. (2021). The influence of global sourcing on local firms' competitiveness, supply chain competence and performance in the sugar sector in South Africa (Doctoral dissertation).
- [2] Raudheiding, R. (2023). Comparative Analysis of European Supply Chains Security Regarding East Asia and North American Trade.
- [3] Pató, B. S. G., Herczeg, M., & Csiszárík-Kocsir, Á. (2022). The COVID-19 impact on supply chains, focusing on the automotive segment during the second and third wave of the pandemic. *Risks*, 10(10), 189.
- [4] Darko, E. O., & Vlachos, I. (2022). Creating valuable relationships with third-party logistics (3PL) providers: a multiple-case study. *Logistics*, 6(2), 38.
- [5] Alahmari, N., Mehmood, R., Alzahrani, A., Yigitcanlar, T., & Corchado, J. M. (2023). Autonomous and Sustainable Service Economies: Data-Driven Optimization of Design and Operations through Discovery of Multi-Perspective Parameters. *Sustainability*, 15(22), 16003.
- [6] Ben Hassen, T. (2022). The GCC economies in the wake of COVID-19: toward post-oil sustainable knowledge-based economies?. *Sustainability*, 14(18), 11251.
- [7] Almohaimeed, N., & Pérez-Villalba, M. (2022). The Evolution of Digital Transformation in Saudi Arabia's Fitness Industry. In *The Digital Transformation of the Fitness Sector: A Global Perspective* (pp. 135-141). Emerald Publishing Limited.
- [8] Hassan, A. (2023). Digital Transformation in Gulf Banks During the Corona Pandemic. In *Artificial Intelligence, Internet of Things, and Society 5.0* (pp. 81-91). Cham: Springer Nature Switzerland.
- [9] Tan, A., Balasubramanian, S., & Wahab, S. N. (Eds.). (2022). *Essential Skills and Competencies for Supply Chain Professionals and Future Leaders in Asia: A Framework for Planning and Managing Supply Chain Talents*. World Scientific.
- [10] Consultancy-me.com. (2022, February 16). Will Saudi Arabia's booming e-commerce transform supply chains? Consultancy. <https://www.consultancy-me.com/news/5341/will-saudi-arabias-booming-e-commerce-transform-supply-chains>
- [11] Porath, U. (2023). Advancing Managerial Evolution and Resource Management in Contemporary Business Landscapes. *Modern Economy*, 14(10), 1404-1420.
- [12] Bishnoi, M. M., Ramakrishnan, S., Suraj, S., & Dwivedi, A. (2023). Impact of AI and COVID-19 on manufacturing systems: An Asia Pacific Perspective on the two Competing exigencies. *Production & Manufacturing Research*, 11(1), 2236684.
- [13] Wieland, A., Stevenson, M., Melnyk, S. A., Davoudi, S., & Schultz, L. (2023). Thinking differently about supply chain resilience: what we can learn from social-ecological systems thinking. *International Journal of Operations & Production Management*, 43(1), 1-21.
- [14] Teece, D. J. (2022). A wider - aperture lens for global strategic management: The multinational enterprise in a bifurcated global economy. *Global Strategy Journal*, 12(3), 488-519.
- [15] Qobo, M., & Mzyece, M. (2023). Geopolitics, technology wars and global supply chains: Implications for Africa. *South African Journal of International Affairs*, 30(1), 29-46.
- [16] Aliedan, M. (2022). The Geopolitics of International Trade in Saudi Arabia: Saudi Vision 2030. *Cuadernos de Economía*, 45(127), 11-19.

