

Enhancing Supply Chain Resilience through Strategic Risk Management: A Multidimensional Approach

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Abstract

Growing global uncertainty and persistent supply-chain vulnerabilities make resilience a priority for Bangladesh. This study shows how strategic risk management (SRM) can strengthen resilience through a multidimensional lens. We assess resilience across financial, operational, technological, environmental, regulatory, and organisational domains by using a secondary literature review of 26 peer-reviewed articles and the MIT Supply Chain Management (SCM) framework. We identify major disruption drivers in digital immaturity, fragmented governance, and climate exposure, and evaluate proactive practices such as predictive analytics, blockchain integration, and cross-sector collaboration. Strategic levers, including intelligent redundancy, human–technology synergy, and collaborative risk ecosystems, emerge as key enablers. We also discuss barriers to data fragmentation, cost resilience tradeoffs, organisational inertia, and regulatory gaps, and outline policy and technology pathways to address them. The contribution is a multidimensional framework that adapts global resilience strategies to an emerging-economy context and points to future work on antifragility, ethical governance, and institutional learning. Overall, the findings underscore the need to embed resilience in national infrastructure planning and supply-chain policy so that Bangladesh can move from reactive structures to adaptive, forward-looking systems that learn and improve through disruption.

Keywords

Supply Chain Resilience; Strategic Risk Management; Multidimensional Framework; Emerging Economies; Predictive Analytics; Human–Technology Integration; Antifragility.

1. Introduction

Globally, modern supply chains focus on identifying the systematic risk and solving the problem, such as from geopolitical conflicts to the Covid-19 Pandemic (Yang et al., 2025). Bangladesh has faced the same challenges, especially in the logistics and textile sector, such as limited ability of resilience, weak digital infrastructure, and divided governance (Hajarath & Vummadi, 2024). Supply chain resilience means being able to handle, adapt, and recover from disruptions, but it must maintain the operational service levels (Afifa & Santoso, 2022). Traditional risk management has depended on supplier networks, logistics, and production processes that have to focus on cost reduction, increase flexibility, and use proper capabilities (Cuihong et al., 2025).

Bangladeshi food sectors are facing some common challenges that show the weaknesses in supplier coordination and logistics planning, such as environmental issues and labour shortages in pandemic situations, which significantly affected small and medium enterprises (SMEs) in many ways (Michel-Villarreal et al., 2021). The demand inflection and logistics limitations become more weaknesses due to the low visibility and food shortage in supply chain sectors (Afifa & Santoso, 2022). Moreover, there are other challenges faced in Bangladeshi supply chain sectors, such as not being able to properly use artificial intelligence (AI), blockchain, and IoT due to high capital cost and improper training (Onukwulu et al., 2023). However, the global supply chain is focusing on digitalisation, but Bangladesh is still facing these outdated problems (Etemadi et al., 2021) (Figure 1).

Research Background: Supply Chain Disruptions and Resilience

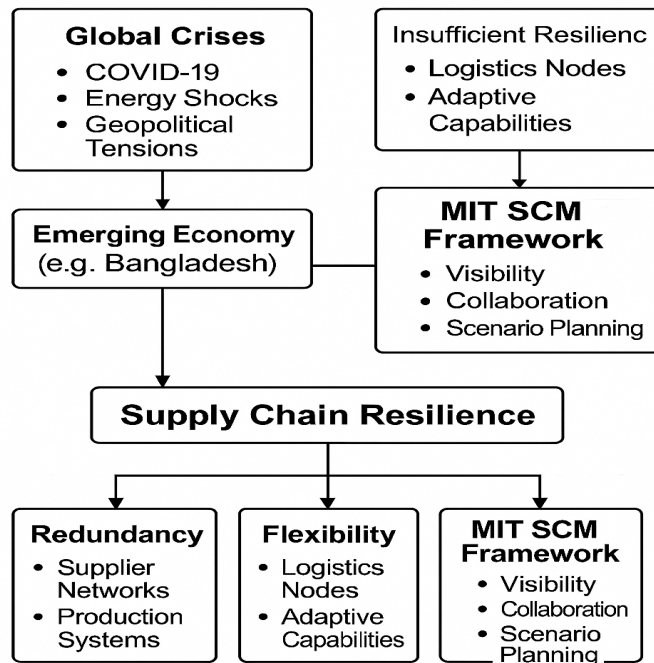


Figure 1. Research Background

Naturally, the Bangladeshi supply chain sector is facing a gap in supply chain resilience between the conception and the implementation (Etemadi et al., 2021). Moreover, most companies or organisations do not follow the instruction across the supply chain of a proactive, data-driven strategy, but they only invest in the traditional strategy, for example, buffer inventory or multi-sourcing tendency (Malmstedt & Bäckstrand, 2022). The limited resources and low-level analytical skills cause delays in solving problems related to supply chain risk management using AI and machine learning (Hossain et al., 2023). Some critical situations make the supply chain unstable, such as weak government rules, limited collaboration in digital platforms, and poor logistic combined data (Afifa & Santoso, 2022). As a result, these weaknesses create delayed response times and high vulnerability to market shocks and climate events (Chukwu et al., 2023). Bangladeshi SMEs also face struggles because of uncertainty and insufficient conditions in both the public and private sectors. This suggests a systemic failure in national supply chain architectures to institutionalize resilience planning (Atieh Ali et al., 2024).

A secondary literature review methodology to evidence across sectors and technologies, focusing on systemic weakness, response mechanisms, and strategies relevant to the Bangladeshi context. How strategic risk management practices can strengthen and increase capacities in Bangladesh because of supply chain delays (Yang et al., 2025; Cuihong et al., 2025; Afifa & Santoso, 2022). For the growing economy the supply chain resilience is important because of digital and organizational impacts such as predictive analytics, AI, blockchain, and supportive governance

in building (Etemadi et al., 2021; Lim et al., 2023; Atieh Ali et al., 2024). The research is limited because of the absence of primary data. Based on experience in field studies, the current scope does not include industry surveys that are beyond its current scope. Findings are also limited by the publication dates and sectoral focus of the review-based literature, though they remain methodologically robust (Das et al., 2024; Gani et al., 2023).

2. Literature Review

Supply chain resilience came from the theoretical and complex systems concept, because it says that it is important that supply chain resilience can manage the situations in any difficult and unstable situation, and it can continue its process (Afifa & Santoso, 2022). In the literature review, resilience is not a fixed quality but rather an ongoing ability to adapt to changing circumstances (Das et al., 2024). Resilience is very important in Bangladesh due to the problems they are facing, such as climate risk, weak infrastructure, and high dependence on the global market (Michel-Villarreal et al., 2021). Recent research widely agrees that resilience consists of three main parts, such as preparedness, response, and recovery. These aspects are particularly important for SMEs in the local food and textile sectors in Bangladesh (Afifa & Santoso, 2022). Empirical research shows that resilience does not come from excess stock or unnecessary but rather is built strategically through the redesign and coordination of the supply chain, especially those supply networks that are broken or fragmented (Umar & Wilson, 2021) (Table 1).

Table 1. Resilience dimension

Resilience Dimension	Key Challenges Identified	Recommended Strategic Responses	Sources
Financial Risk	Liquidity constraints, underutilized financial modeling tools	Scenario-based modeling, predictive analytics, financial stress testing	Das et al. (2024), Onukwulu et al. (2023)
Operational Risk	Supply delays, labor disruptions, poor supplier coordination	Diversification, digital visibility, flexible logistics networks	Michel-Villarreal et al. (2021), Moktadir et al. (2023)
Technological Risk	Cybersecurity gaps, low digital maturity, infrastructure issues	Modular tech adoption, platform interoperability, risk-aware tech scaling	Hossain et al. (2023), Gani et al. (2023)
Environmental Risk	Floods, climate shocks, lack of predictive environmental modeling	Eco-efficiency metrics, climate mapping, circular logistics	Chukwu et al. (2023), Moktadir et al. (2023)
Regulatory Risk	Trade policy uncertainty, lack of foresight, reactive compliance	Regulatory scenario planning, cross-border compliance frameworks	Coşkun & Erturgut (2024), Atieh Ali et al. (2024)
Organizational Risk	Leadership gaps, skill shortages, centralized decision-making	Leadership training, distributed governance, ethical integration	Santoso et al. (2022), Onukwulu et al. (2023)

Supply chain strategic risk management refers to a structured approach to identifying, analyzing, and mitigating risks across the entire network (Yang et al., 2025). Recent literature said that Bangladesh has a limited recovery capacity, so it is important to have that kind of ability to predict the future risk and have an alternative way to solve it (Malmstedt & Bäckstrand, 2022). When machine learning adds in supply chain risk management, it increases effectiveness in many ways, such as identifying the pattern, abnormal movement, and advance warning. It increases the chances of risk management in Bangladesh (Hossain et al., 2023). At the same time, it also increases efficiency and makes a design between the leadership, governance, and digital platform in a growing economy of a national organization (Santoso et al., 2022). It is important to remember that managing supply chain risk must attain a balance between being cost-effective and being more flexible. This is almost nonexistent in Bangladesh, which must balance cost-effectiveness and improved flexibility, but it is almost missing in Bangladesh's manufacturing sectors (Moktadir et al., 2023). Most traditional supply chain models focus on cost reduction and diversity reduction. In Bangladesh, they mostly focus on keeping track of their stock and finding different sources of supply, but they don't fix the problems with digital and real-world solutions (Das et al., 2024). Recent literature has highlighted the importance of AI-based risk prediction and blockchain-based supplier verification systems, which are particularly important for the food and

apparel supply chains in Bangladesh (Lim et al., 2023; Etemadi et al., 2021). In a situation like Bangladesh, most of the market shocks face the political and climate risks to make the situation more complex (Chukwu et al., 2023).

If we talk about food sectors, it has been observed that small food supply chains (SFSCs) have been able to show significant resilience during COVID-19 by digital technology and social capital (Michel-Villarreal et al., 2021). During the pandemic situation, Bangladesh has faced a heavily unstable situation because of raw material and labor shortages. In that situation, it proves that a decentralized and digital platform can be a real-time solution (Umar & Wilson, 2021). Blockchain can be a potential for solving multiple-layer risk in the supply chain and increasing the data transformations (Mena et al., 2021). On the other hand, it has been shown that rural logistics can be effective if we use this as a vertical and horizontal partnership (Chukwu et al., 2023). In the Industry 4.0 sectors, some technologies can identify the upcoming risk and solve the problem significantly, such as smart sensors, analytics, and predictive scheduling (Moktadir et al., 2023) (Table 2).

Table 2. Practice type

Practice Type	Description	Bangladesh Context Insight	Supporting Studies
Reactive Risk Strategy	Post-disruption responses like buffer stock or emergency sourcing	Dominant approach but proved insufficient during COVID-19	Afifa & Santoso (2022), Michel-Villarreal et al. (2021)
Proactive Risk Strategy	Early warning systems, predictive modeling, scenario planning	Limited use due to infrastructure and mindset gaps	Onukwulu et al. (2023), Das et al. (2024)
Redundancy & Flexibility	Dual sourcing, safety stock, logistics rerouting capabilities	Rarely used due to cost focus, but effective when adopted	Santoso et al. (2022), Moktadir et al. (2023)
Collaboration & Partnerships	Horizontal & vertical partnerships, platform-based coordination	Weak coordination; trust and data-sharing need development	Chukwu et al. (2023), Umar & Wilson (2021)
Human–Tech Integration	AI-assisted decision making with human oversight and feedback	Digital literacy low; integration efforts are emerging	Hossain et al. (2023), Atieh Ali et al. (2024)
Policy & Governance	Multi-stakeholder governance, regulatory foresight, resilience metrics	Fragmented policy environment; need for proactive frameworks	Coşkun & Erturgut (2024), Raja & Vummadi (2024)

Internationally, supply chain risk management conceptually and technologically has been highly advanced, but unfortunately, Bangladeshi supply chain risk management has not improved like that (Hossain et al., 2023). First, the Bangladeshi supply chain is not used to blockchain and AI in pilot projects but also has some limitations of these resources; as a result, the local sector has few real-world case studies (Hossain et al., 2023; Lim et al., 2023). Secondly, the resilience model sectors are facing a lack of specific customization (Das et al., 2024). Bangladesh faces critical challenges, such as those in food systems, the textile sector, and the energy supply chain, which current models cannot solve (Das et al., 2024; Raja & Vummadi, 2024). Thirdly, there are some structural issues, such as lack of leadership, ethical governance, and internal collaboration planning (Chukwu et al., 2023; Gani et al., 2023). Finally, most studies show that in a growing economy like Bangladesh, it is highly important that cross-sectoral and theoretical design can be a long-term solution (Coşkun & Erturgut, 2024; Onukwulu et al., 2023).

3. Research Methodology

Based on the Bangladeshi concept, the secondary literature review approach is used to understand how strategic risk management enhances supply chain resilience. This literature review shows a structure for identifying the gaps in theoretical development, conceptual similarities, and practical application of resilience frameworks used in different industries such as food, textiles, and manufacturing (Afifa & Santoso, 2022). This system is related to Bangladeshi infrastructure and institutional realities because it is difficult to collect primary data (Michel Villarreal et al., 2021). On the other hand, research has a huge amount of secondary information that makes it easy to analyse for proof

(Moktadir et al., 2023). For doing this research, we collected sources from peer-reviewed academic journals, institutional white papers, and global databases such as Scopus, Web of Science, and the MIT Libraries Digital Repository (Onukwulu et al., 2023). Some of the keywords are listed

1. “Supply Chain Resilience”
2. “Strategic Risk Management”
3. “Predictive Analytics in SCM”
4. “Blockchain and AI in Emerging Supply Chains”
5. “Bangladesh Supply Chain”

The search begins from 2021 to 2025 step by step, and it also included pre- and post-pandemic situations and included the importance of industry, region, and technology-enabled research (Etemadi et al., 2021; Das et al., 2024). Finally, we selected 26 literature reviews; these are relevant in Bangladeshi economic sectors for thematic relevance, methodological quality, and contextual fit (Lim et al., 2023).

1. We discuss the theoretical foundations of resilience (Umar & Wilson, 2021).
2. Strategically use tools and frameworks in risk management (Malmstedt & Bäckstrand, 2022).
3. Technological tools such as AI, ML, and blockchain (Hossain et al., 2023; Lim et al., 2023).
4. Food, energy, and apparel sector disruption (Michel-Villarreal et al., 2021; Gani et al., 2023).

Each theme is explained with conceptual models in the literature review; this system helps enable the separation in research, such as literature convergence, contextual divergence, and structural limitations in a growing economic country like Bangladesh (Das et al., 2024).

This secondary literature review analysis is affected by some inherent limitations, such as

1. Primary data is absent from Bangladeshi industrial sectors (Chukwu et al., 2023; Afifa & Santoso, 2022).
2. Technological case study potential publication bias (Chukwu et al., 2023; Afifa & Santoso, 2022).
3. Depending on conceptual generalisations rather than locally traditional validated models (Chukwu et al., 2023; Afifa & Santoso, 2022).

Moreover, it can highlight structural development, but it may not be present in real-world Bangladeshi supply chains due to governance, culture, and infrastructure reasons (Coşkun & Erturgut, 2024).

4. Multidimensional Framework for Supply Chain Resilience

Economic crisis is one of the most significant problems in the supply chain, especially in growing economic countries like Bangladesh, for example, where currency volatility, inflation, and disrupted trade flows make the supply chain performance weaker and create a crisis (Das et al., 2024). This crisis highly affected small and medium-sized enterprises, such as not being able to pay suppliers on time, working capital constraints, and failing to maintain safety stocks during the crisis (Afifa & Santoso, 2022). They need a strategic model for properly managing the risk, such as economic models and stress testing, but unfortunately Bangladeshi organisations are not used to these models (Etemadi et al., 2021). Industry 4.0 plays an important role for the long term based on identifying the cash flow and financial prediction (Onukwulu et al., 2023). But the problem is the high maintenance cost and technological limitation become big challenges for Bangladesh (Malmstedt & Bäckstrand, 2022).

After the Covid-19 pandemic situation, the operational risk increased day by day in Bangladesh because of supply delays, capacity shortages, and labour disruption (Michel-Villarreal et al., 2021). Moreover, separate logistic systems and multiple supply layers make the situation weaker and increase the risk (Afifa & Santoso, 2022). The MIT SCM structure highly promotes the process of visibility and redundancy because of important tools for operational risk management, and accepting this in Bangladesh means supply diversity, productive inventory management, and quick responsive logistic design (Umar & Wilson, 2021). Research shows that if the design ability is limited and implications face problems, then it should be a wise idea to share real-time data and reduce the operational friction (Chukwu et al., 2023). But the problem is it highly depends on a lean strategy, and there is not enough flexibility available for the textile sector, making the system weaker (Moktadir et al., 2023).

Technology can make the supply chain stronger, but it also creates more risks, such as cybersecurity weakness, system failure, less acceptable design, Bangladeshi infrastructural limitations, and workforce unpreparedness, which make

the situations riskier (Hossain et al., 2023). MIT SCM technological resilience means a combination of platform and infrastructural redundancy, but unfortunately it is absent in Bangladeshi small- and medium-sized enterprises (Gani et al., 2023). It is important that blockchain, IoT technology, supplier identification, and logistic automation are identified as a transformative force (Lim et al., 2023). Recently, resilience structures have given rise to highly risky situations in the supply chain, and easily transformed tools and systems are also included, but Bangladesh has not yet developed that kind of scale (Santoso et al., 2022) (Table 3).

Table 3. Dimension

Dimension	Key Challenges in Bangladesh	Strategic Risk Management Approaches	Key References
Financial Risk	Currency volatility, liquidity crises, underutilized financial forecasting tools	Scenario-based modeling, financial stress testing, predictive analytics	Das et al. (2024), Etemadi et al. (2021), Onukwulu et al. (2023)
Operational Risk	Supply delays, capacity bottlenecks, lean systems without flexibility	Supplier diversification, inventory visibility, responsive logistics networks	Michel-Villarreal et al. (2021), Afifa & Santoso (2022), Umar & Wilson (2021)
Technological Risk	Cybersecurity gaps, low AI/blockchain adoption, digital immaturity	Modular architecture, platform interoperability, AI and IoT implementation	Hossain et al. (2023), Lim et al. (2023), Mena et al. (2021)
Environmental Risk	Climate shocks (floods, cyclones), weak climate modeling	Climate mapping, eco-efficiency metrics, circular logistics	Das et al. (2024), Moktadir et al. (2023), Chukwu et al. (2023)
Regulatory/Geopolitical Risk	Unpredictable policies, weak foresight, tariff exposure	Regulatory scenario planning, trade policy intelligence, multi-country sourcing	Coşkun & Erturgut (2024), Atieh Ali et al. (2024), Raja & Vummadi (2024)
Organizational Risk	Leadership gaps, centralized decision-making, skill shortages	Decentralized leadership, cross-functional training, ethical governance	Santoso et al. (2022), Onukwulu et al. (2023), Gani et al. (2023)

The Bangladeshi supply chain is also facing environmental issues in the food and agricultural sector, such as floods, storms, and high temperatures, that make the supply chain more challenging (Das et al., 2024). Due to high maintenance costs and inconsistent rules and regulations, limitations are created in Bangladesh in some sectors, such as eco-efficiency metrics, green supplier assessment, and circular logistics (Chukwu et al., 2023). In Bangladesh, environmental risk is common in agricultural sectors, but it can be solved by digital mapping, and a proactive supply chain's combination can be a strategy in unstable moments (Moktadir et al., 2023).

From the geographical side, Bangladesh is also facing some challenges, especially tariff shifts and border restrictions from the US, China, and Western countries (Raja & Vummadi, 2024). Moreover, many Bangladeshi organisations have not developed the necessary systems or processes for regulation, and they are typically reactive in common practices (Coşkun & Erturgut, 2024). Human resources risk, lack of leadership, and lack of a skilled workforce also proved Bangladeshi organisations' supply chain weakness (Chukwu et al., 2023). As a result, it creates uncertainty for financial rules, industrial investors, and suppliers, so it proved that it can be solved by a combination of multi-stockholder and collaborative policy frameworks (Atieh Ali et al., 2024).

5. Challenges and Limitations

Bangladeshi supply chain resilience has a problem of expansion due to a lack of integration, high quality and absence of real-time data, especially in shareholders (Afifa & Santoso, 2022). Agricultural and textile sectors are highly affected because of inconsistent data in the inventory, logistics, and production sections (Mena et al., 2021). MIT SCM models suggest that decision-taking from data for supply chain resilience would be a wise idea, but research

shows that most of the Bangladeshi organisations do not have enough quality and systematic data management (Etemadi et al., 2021). Moreover, both the public and private sectors are interoperability weak; as a result, it becomes more challenging to take any decision based on data for future predictions and analysis (Chukwu et al., 2023) (Table 4).

Table 4. Challenge category

Challenge Category	Specific Challenges	Impact on Resilience Efforts	Supporting References
Technological Infrastructure	Low digital literacy, lack of data integration platforms	Hinders real-time visibility and predictive analytics	Hossain et al. (2023), Gani et al. (2023)
Financial Constraints	High cost of risk management tools, limited access to capital	Reduces ability to invest in proactive risk strategies	Das et al. (2024), Santoso et al. (2022)
Policy & Regulatory Gaps	Absence of clear national SCM risk policies, reactive governance	Delays in emergency response and compliance planning	Coşkun & Erturgut (2024), Atieh Ali et al. (2024)
Human Capital Limitations	Skills shortages, lack of interdisciplinary training	Weakens organizational agility and innovation adoption	Onukwulu et al. (2023), Moktadir et al. (2023)
Organizational Culture	Resistance to change, centralized decision-making	Slows down adoption of digital and decentralized resilience models	Santoso et al. (2022), Michel-Villarreal et al. (2021)
Data & Cybersecurity Risks	Data breaches, poor cybersecurity posture	Undermines trust in AI/ML tools for SCM	Lim et al. (2023), Hossain et al. (2023)

It is necessary for creating a resilient supply chain with these elements, such as redundancy, digital instruments, and flexibility, but Bangladesh follows a strategy of cost reductions, so the situation becomes a contrast (Moktadir et al., 2023). MIT SCM suggests long-term value over short-term cost, but most local sectors want immediate value completion and are not interested in investing in resilience (Yang et al., 2025). Sometimes cost reduction makes the situations more difficult and uncertain, especially with IoT or blockchain or similar digital platforms (Etemadi et al., 2021). Some organisations have technological empowerment but still they cannot use these due to economical limitations (Lim et al., 2023).

Financially growing economic countries like Bangladesh face limitations and challenges in infrastructure, social-political, and educational sectors that make it more difficult to establish a global resilience structure (Michel-Villarreal et al., 2021). MIT SCM models are considered data-driven and expeditional in structure, but these models are not strategically useful and are risky due to low-speed internet, limited electricity, low AI preparedness, and skill shortages (Onukwulu et al., 2023). Additionally, weak government, fragile industrial policy, and fewer public-private combinations cause implementation delays (Das et al., 2024).

6. Future Directions for Research and Practice

Day by day research has been increased, but still improving countries like Bangladesh could not fill up the gap of supply chain resilience by doing multi-dimensional analysis (Afifa & Santoso, 2022). Many current models do not properly capture the interdependence of the formal and informal sectors, which play a major role in Bangladesh's economy, such as the agriculture and ready-made garments sectors (Michel-Villarreal et al., 2021). At the same time, many workplaces focus on technology but do not have enough practice in institutional culture and organisation (Etemadi et al., 2021). There are also limited resources and weak infrastructure that prove that global tools like blockchain or AI are still insufficient (Onukwulu et al., 2023). It is important for developing resilience, such as leadership, ethics, transparency, and collaboration, which are of secondary importance (Chukwu et al., 2023).

Supply chain technologies like AI, blockchain, and predictive analytics can completely change the way to identify the risks addressed (Etemadi et al., 2021).

Bangladeshi predictive analysis can help significantly in agriculture and logistics sectors because it can predict early warnings (Onukwulu et al., 2023). But technological implementation is still difficult due to weak infrastructure, the absence of interoperability, and local industry does not have enough digital workforce (Lim et al., 2023). MIT SCM shows that advanced technologies are not enough; organisational transformation is highly impactful, but in the Bangladeshi context, it should get more importance (Das et al., 2024). Moreover, technological use also focuses on data privacy, cybersecurity, and ethical governance sectors, which are also important (Gani et al., 2023).

Ecosystem policy plays a major role, but it started from the institutional level (Coşkun & Erturgut, 2024). Bangladeshi policymaking is still risky due to organisational weaknesses and limited participation in the private sector (Raja & Vummadi, 2024). The MIT SCM vision shows that it is important to act as a government to increase resilience in multi-stakeholder platforms to increase collaboration between industry and academia because it is important for established supply chain policies (Atieh Ali et al., 2024). Data transparency laws and ethical systems are also needed for supply chains because they increase trust, transparency, and stability (Mena et al., 2021).

Future supply chains should not only be resilient, but they should also have the ability to bounce back stronger from setbacks (Umar & Wilson, 2021). Human-technology is important, where AI does not replace humans but suggests that a hybrid system will be created (Hossain et al., 2023). Bangladesh can also create some resilience and innovation centres to analyse the situations, such as an analysis lab and a regional digital risk coordination centre (Michel-Villarreal et al., 2021).

7. Conclusion

This research is based on Bangladeshi supply chain risk management for improvement of resilience by multi-dimensional strategy critical analyses. The literature review shows that resilience is not the only concept but focuses on other areas such as enough capacity, financial issues, consistent dimensions, advanced technology, environmental safety, proper policymaking, and effective human resources. In Bangladesh, weak infrastructure, improper policies, and digital gaps make the situation challenging, but it can be solved by coordinated, predictive analysis to improve resilience. Research mainly focuses on building a foundational model to properly manage the risk to improve resilience and expand the future, such as predictive analysis, AI, and networks. It also shows that Bangladesh is a growing economic country, but it has some weaknesses that impact its global strategy, such as supply chain and blockchain-related issues. But Bangladesh needs long-term solutions, so research suggests some strategies, such as intelligent redundancy, ecosystem-based collaboration, and financial modelling, for improving some sectors, such as food, clothing, and energy supply chains. While these challenges, from governance fragmentation to digital skills shortages, are real, they can be addressed through integrated institutional initiatives, technology-human synergy, and ethical governance frameworks. The research also confirms that in these times of increasing global uncertainty, building multi-dimensional, technology-enabled, ethically driven, and context-sensitive supply chains is not only possible, it is now essential.

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