6

Supply Chain Sustainability, Risk Management, and Competitive Advantage in International Trade

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Abstract

Sustainability is a goal that has gained increasing importance within corporations as governments and non-governmental organisations tighten the screws and impose less and less friendly policies and practices to curb climate change and enhance human rights. The purpose of sustainable supply chain management is to mitigate social and environmental impacts across supply chains, thus harmonising sourcing strategies globally with sustainability goals, both ecologically and ethically. Not only do sustainable practices reduce firms' exposure to ESG-related risks and protect reputations and brand image, but they are also important sources of competitive advantage through cost reductions, revenue enhancements, and access to financing. Much of the literature focuses on general descriptions of supply chain risk or sustainability problems, but very few studies investigate and contextualise the multilateral connections, especially in global supply chains. International supply chains are associated with a wide variety of risks that affect logistics, physical distribution, product quality, and corporate reputation. These risks have changed tremendously over time, and various models have been advanced to classify them. Modern supply chain disruption is not limited to individual organisations and industries. Among the disruptions are not only environmental and social risks caused by climate change or human rights infringements, but also geopolitical and economic risks arising from trade wars, tariffs, or economic recessions. New technologies, emerging markets, and structural changes have greatly transformed the global supply chain. Businesses are under pressure from the government, investors, and customers to report their sustainability performance globally. Another important element related to risk in international supply chains is the measurement and disclosure of sustainability performance. A clear sustainability model will help companies demonstrate their commitment to sustainability in supply chain management and to meet the expectations of the macro environment and the main stakeholders, thereby avoiding negative effects on reputation, market access, or sustainable financing. (Martin & GAUDENZI, 2015)

Keywords: *Risk management, sustainable supply chains, supply chain sustainability, and competitive advantage.*

1. Introduction

Although international trade has been considered the key driver of the economic growth of the global economies, its role in inter and intra-country inequality has remained one of the persisting issues that has set international organisations, national governments and non-governmental organisations in search of complementary policies and regulations to curtail the effects of international trade on inequality. Hypothetically, through international trade, specialisation based on comparative advantage is possible, and small economies can grow faster than large economies. The existing cross-country evidence indicates a positive relationship between trade intensity and growth, lending credence to the pro-trade policies of international organisations such as the World Trade Organisation and the Organisation for Economic Co-operation and Development. Nevertheless, some industrialised countries have also been shown to exhibit a positive correlation between a target increase in trade intensity and an increase in intra-country inequality, which helps explain why some countries have been advocating complementary policies (Martin & GAUDENZI, 2015).

2. Sustainable Supply Chains Conceptual Foundations.

Sustainable supply chain identification is a topical managerial issue because more stakeholders are realising the social, environmental, and economic consequences (Martin & GAUDENZI, 2015). Sustainable supply chain management involves the planning and operation of value-adding activities to ensure that economic, environmental, and social goals are met in an integrated approach, with performance across these three triple bottom line areas being interdependent. However, there are several basic factors to consider before using the term. Supply chains involve the physical movement of products, the related movement of information, and the flow of money among the supply chain members involved in the search, acquisition, development, production, storage, distribution, sale, consumption, recycling, and disposal of goods. In the first place, competing supply chains may be defined by sustainability, with each linked to a specific level of sustainability risk.

The sustainability risk is one of the determinants of supply chain configuration and management. Decisions made in the supply chain design will not help eliminate or even reduce the risk; they will determine which performance measure will be affected, to what extent, and by how much. To define and analyse a

sustainable supply chain, a comprehensive specification of the concept of sustainability risk, the circumstances affecting it, and the performance aspects by which it manifests is essential. Sustainability risk encompasses environmental, social, and economic risks and can be subdivided into individual consumer, business, and societal risks.

3. Global Supply Chain Risk Landscape.

Global supply chain risks are common in operations spanning sourcing, transportation, production, distribution, and disposal. These operations, however, not only create economic value but also other social and environmental externalities. Such risks should be dealt with in multi-faceted ways. It is important to note that growing stakeholder demand to improve supply chain sustainability is associated with new challenges (Martin & GAUDENZI, 2015). Specifically, unfavourable environmental conditions, accidents and security challenges, political upheavals, supplier bankruptcies, transport disruptions, and various crises are common in global supply chains. Companies should work to reduce potential negative risks and capitalise on opportunities to maintain their market shares. All these external risks cannot be evaded per se. However, even when it is impossible to avoid the risk, its sources can still be classified. There are two broad categories of environmental and social risks and geopolitical and economic risks. Environment and social risk may occur due to environmental destruction, exploitation of natural resources, pollution and wastes, social injustice, child labour, the treatment of migrant workers, capital-intensive investments, inhuman or undesirable working conditions, whistle blowing (which attracts disastrous publicity in case of revelation of the malpractices in governance), and non-renewable and carbon intensive sources of energy (e.g. coal mining). Comparatively, possible geopolitical and economic risks include brand-related discrimination of some nationality or political regime business, extreme economic swings in any exchanged rate, abrupt and drastic changes in the price of some materials easily found in other suppliers, wars, and economic sanctions (later excessive economic sanctions) when some player outlawed further business, economic doldrums and price spikes to astronomical levels on certain materials (hoarding) and cost issues (price skyrocketing) when access to a central supplier became challenging, etc. the balancing of risk management between one of these two.

There are some types of risk, both assessed and unmeasured, that contribute to the perception of risk in the supply chain. The COVID-19 crisis and lockdowns have also contributed to the increased public health risks being added to supply chain risk maps in most organisations. Therefore, the general risk environment of global supply chains is reflected in overall sustainability more than in the supply chains' vulnerability.

3.1. Environmental and Social Risks.

Global supply chains pose significant risks to organisations, and they often lack the organisational capacity to monitor them effectively. The costs, customer service, and investment plans can be deeply affected by disruptions caused by defects, raw material shortages, natural disasters, terrorism, or political turmoil. Therefore, supply chain disruptions may reduce firms' profitability and erode substantial shareholder value. More companies under the umbrella of supply chain risk management are weighing sustainability-related risks, including consumer preferences, regulations, carbon footprints, and the impacts of global warming. Consequently, companies are adopting a sustainability agenda of supply chain and products across the triple bottom line: financial, environmental, and social performance.

Risk type	**Description**	**Typical causes**	**Main impacts on firms**
Environmental destruction	Degradation of ecosystems and natural habitats along the supply chain	Over-extraction of resources, unsustainable land use, deforestation, and poor environmental control	Supply disruption, regulatory penalties, loss of eco-conscious customers
Resource exploitation	Unsustainable use of natural resources beyond regeneration capacity	Intensive mining, overfishing, water overuse, and non-renewable energy dependence	Input scarcity, price volatility, and reputational risk with investors and NGOs

Risk type	Description	Typical causes	Main impacts on firms
Pollution and waste	Air, water, and soil pollution, plus unmanaged industrial and packaging waste	Inefficient production, lack of waste treatment, and weak enforcement of environmental standards	Compliance costs, fines, stricter regulations, and community opposition
Social injustice	Violations of basic labour and human rights in the supply chain	Discrimination, low wages, excessive hours, and a lack of social protection	Brand damage, consumer boycotts, legal action, investor divestment
Child labour	Employment of underage workers in production or sourcing activities	Weak labour inspection, informal suppliers, and cost-cutting pressures	Severe reputational crises, import bans, and contract cancellations
Migrant worker abuse	Unfair or unsafe treatment of migrant workers	Recruitment fees, tied visas, unsafe housing, and limited grievance channels	Litigation risk, sanctions from buyers, and negative media coverage
Inhuman working conditions	Unsafe, unhealthy, or degrading workplaces	Poor safety management, inadequate training, neglect of standards	Accidents, production stoppages, compensation

Risk type	Description	Typical causes	Main impacts on firms
			claims, loss of trust
Whistle-blowing scandals	Public disclosure of malpractice in governance or operations	Retaliation against whistleblowers, opaque governance, and ignored complaints	Sudden reputational collapse, regulatory investigations, investor pressure
Carbon-intensive energy use	Heavy reliance on fossil fuels and high-carbon processes (e.g., coal-based power, mining)	Lack of energy transition strategy, cheap fossil subsidies, and outdated technologies	Exposure to carbon pricing, higher operating costs, and climate-related scrutiny

Sustainable supply chain risk management can be addressed in two complementary ways. First, it is possible to pay attention to risk management in the context of the sustainability of production processes, i.e., manufacturing with high environmental or social performance. Second, the supplier portfolio could be optimised or restructured to achieve better performance, such as expanding the supply chain to more supply points for homogeneous products that can be supplied easily from various points. This dimension enhances risk management in sustainable supply chains, as it concerns the risk of non-compliance with the standards of sustainability on the supplier side, so the attention should be re-centred on the production side of sustainability along the Awarding the Plan (Shafiq et al., 2017), in which the gradual improvement of the supplier production process is needed and

preferable. The term sustainability risk is categorised as events or changes associated with the sustainability of the supply that cause significant non-conformity to sustainability criteria, either environmental, social, or both. Sustainable risk can cause significant supply disruptions and extreme effects on production, delivery, volume, and customer service.

3.2. Geopolitical and Economic Risks.

Foreign politics and war may disrupt the supply to a chosen location, prompting companies to seek alternative suppliers and raise prices. An example of such tensions is the Russian-Ukrainian conflict. The war and associated sanctions have resulted in an acute deficit in the supply of wheat, corn, vegetable oil, and fertilisers used to produce them, with an impact on food prices and inflation. The supply blockade in Ukraine has also triggered the European nations to abandon reliance on Russian gas and switch to substitutes and renewable energy sources on a scale never seen before, albeit at a price. The impact of COVID-19 was also comparable globally. The region remains at risk of instability, which has jeopardised the peace and security of Southeast Asia and posed a threat to the supply of semiconductors that power cars and computers. The US-China trade war has raised tariffs on a significant number of Chinese exports to the US. It has caused US companies to outsource production to avoid the impact of tariffs and concerns about national security. These risks could be modelled as proportionate supply disruption. However, most recent developments have emphasised the second-order effects of port closures in a specific region, affecting supply chains in other regions.

Other key sources of risk to the supply chain include economic crises driven by public health, geopolitical tensions, and climate change. Such economic phenomena are manifested in extreme weather events that directly affect the supply of raw materials, reduced production of finished products in Asia due to water shortages and energy shortages caused by heatwaves, and an energy price shock that has never been experienced before. Moreover, economic crises are usually met with high protectionism as governments find it necessary to protect local supply chains against international competition. One can describe such variations in trade policy using a factor-demand model of international trade.

3.3.Modelling and Resilience to Supply Chain Disruption.

A disruption occurs when something interferes with the usual operation of a supply chain. Depending on the extent of disruption, various models have been developed. In the event of disruptions, firms face significant financial losses

when they fail to mitigate their effects. Thus, businesses ought to assess the susceptibility of their supply chains to all forms of disruptions and build resilience to such disruptions. Resilience can be described as the ability of a supply chain to anticipate and prepare for unforeseen disruptions, and to adapt and recover after their impact.

There is a large body of literature on supply chain disruption modelling. A systematic literature review revealed several recurring themes in research on disruption modelling in supply chains. The three major types of supply chain disruption most commonly examined are inventory and capacity constraints, supplier disruptions, and transportation disruptions between suppliers and manufacturers. The generalised supply chain disruption and recovery modelling proposed four models, depending on the type of disruption and the number of occurrences. The issues of infrastructure network and facility location design have been taken into consideration within the context of disruption, and recovery activities have also been considered. The facilities may be configured to be less prone to attacker perturbation, or the network may be designed so that the recovery time, should something go wrong, is expected to be minimal. (Ebrahim NEJAD, 2019)

4. Sustainability Performance Measurement and Disclosure.

The companies must proactively quantify, track, and report on their sustainability risks and performance. Sustainability performance measurement and disclosure are also significant for evaluating a firm's environmental and social impacts (Shafiq et al., 2017). The result of eco-efficiency is a product that improves economic demand and has the least environmental impact over its life cycle. Environmental performance may also be divided into process-related and product-related categories. The focus of policies and procedures would include major suppliers, and supply enhancement initiatives would be implemented to become effective within organisations. Economic viability, sustainability monitoring, and human rights, labour, and community social monitoring are deemed to be critical elements of sustainability performance assessment. Other industry-level aspects, such as industry munificence, industry dynamism, and industry complexity, contribute greatly to sustainability performance. The concept of sustainable supply chains is intended to improve sustainability performance and risk management. It is important to track progress through systematic policies and procedures, as well as communication with the main suppliers (Chereau, 2014).

4.1. Environmental Metrics, Social Metrics and Governance Metrics.

The sustainability metrics have advanced to the point that they are a source of

competitive advantage. To begin with, these indicators of environmental, social, and governance (ESG) provide insight into the sustainability performance of firms and their supply chains (Shafiq et al., 2017). Increased governance indicators are used to reduce supply chain risks and achieve higher sustainability outcomes. Improvements in suppliers' environmental and social performance are the primary focus of initiatives aimed at supporting organisational sustainability. The transformations in the pillar of governance tend to mirror those in the environmental and social pillars, which are still more commonly observed.

The extended scope of sustainability evaluation is also applicable in international business settings, where social concerns are given greater importance and sustainability reporting is compulsory (Guo & Wu, 2022). There is then a need to have a balance between economic, environmental, and social issues. Trade policies also play a pivotal role in ensuring that the markets convey a consistent message.

4.2. Supply Chain Transparency and Traceability.

Supply chain transparency and traceability play a crucial role in managing social and environmental impacts. Transparency refers to stakeholders' access to supply chain information, and traceability refers to the ability to track a product's history, location, and transformation (Sodhi & Tang, 2019). The development of social media, the growing awareness of corporate responsibility among stakeholders, and the evolving demand for safe and pure products have forced corporations to reveal information about their supply chains (Sali et al., 2020). These disclosures are essential to responsible sourcing; consumers understand the brand's commitment to product safety, social responsibility, and environmental stewardship, and non-disclosure signals an irresponsible supply chain (Harrison et al., 2020). Therefore, the intentions to purchase, recommend, and share purchased products are positively associated with consumers' attitudes towards suppliers whose brands are held responsible or deemed responsible for mitigating the negative effects of the supply chain (Guruu et al., 2020). Transparency has a positive impact on competitiveness and capitalises on brand trust and reputation, particularly in international trade. The fact that distributed energy systems are low in renewable energy systems is associated with high costs and low demand. Growth in power delivery systems through sustainable innovations in distributed energy systems, powered by emerging technologies that ensure system transparency, can promote sustainability.

4.3. Standards, Certifications, Frameworks of Reports.

Firms with ambitions embrace similar sustainability operations and supply chains within the organisation. The standards support the implementation of sustainability policies worldwide and enable collective reporting to stakeholders. Some of the common standards and certifications that can be instrumental include ISO 9000, ISO 14000, ISO 50001, Responsible Care, SA 8000, the Ethical Trading Initiative, the Fair Labour Association's Workplace Code of Conduct, and numerous sector-specific standards (M. Blair et al., 2008). There are single-industry organisations and multi-industry consortia in the automotive, electronics, food, transportation, chemicals, retail, and clothing industries that are at the forefront of developing sustainability standards, including energy efficiency, product end-of-life, and supply-chain management.

When a single company seeks to be sustainable, it can provide an incentive for suppliers to adopt the industry's commonly used sustainability standards and obtain related certifications. Formal collaborative initiatives are usually hastened by participation. Companies carry forward (and occasionally strengthen) parallel integrated direction and standardisation initiatives where that is feasible, even when the overall economic situation is more stringent and numerous shocks occur at both ends of the supply chain and within the company. Maintaining the choice and standardisation of certain sustainability standards and certification processes has long-term advantages for the firm, the supply chain, and society.

5. Risk Management in International Trade: Strategies.

Risk management portfolio improves a firm's ability to overcome disruptions, ensuring the continuity of global supply chains (Luke & Heyns, 2018). Supplier diversification, such as eliminating single-source dependencies, reducing susceptibility to local threats, and planning supply contracts, is essential in times of increased uncertainty (Elahi, 2010). The presence of a safety stock prior to expected disruptions and the immediate replenishment of the stock help maintain service levels and eliminate customer uncertainty. The uncertainty in demand makes systemic supply-side disruptions more exposed, forcing firms to build more region-specific supplier bases. The involvement of supply chain partners in financing programs, joint inventory management programs, or common forecasting can also reduce demand uncertainty, allowing risks to be shared.

The War in Ukraine and the pandemic have increased a firm's vulnerability to systemic geopolitical risks across the global supply chain. The financial instability of international trade

activities, driven by the concomitant increase in interest rates and inflation, increases counterparty credit risk, in addition to the complex alignment of trade.

5.1. Supplier Portfolio Design and Diversification.

The growing popularity of supply chain resilience and risk management has prompted companies to review their supply chain portfolios, with diversification and dual-sourcing arrangements among the options. Portfolio design entails choosing the composition (the suppliers to be included in the portfolio) and structure (the allocation of orders among the suppliers) to balance trade-offs between sustainability performance and risk reduction. Geographical locations can differ in their environmental, social, and resilience traits (Park et al., 2018), and dependence on suppliers with varying capabilities can also cushion against disturbances caused by the government or externalities (Yim, 2010). Such a portfolio design is relevant and critical to global companies actively participating in sustainability practices.

5.2. Demand and Inventory Management in Uncertainty.

Under uncertainty, the pattern of demand changes, and more often than not, the time replenishment orders are made does not coincide with the time supplies arrive. General strategies to handle such uncertainty include demand forecasting, management of the level of safety stock in upstream inventories, or both. Demand patterns and uncertainty strongly influence control strategies. The results of changing replenishment order timing and using fixed order cycles could lead to a decrease in upstream safety stock without an increase in service levels. Service policies can be defined through coordination to ensure material replenishment across the entire supply chain. The coordination here is influenced not only by transport time and stock levels but also by location and, perhaps, product-mix strategies.

These non-market-introduced policies tend to creep into the inter-regional trade due to their inter-temporal implications and the dampening of scarcity and incentive prices through hoarding. Some international journals have reviewed several inventory models published in the past few decades under uncertainty. To date, research in this field has been rather intermittent.

Inventory control has been identified as comprising two types of systems: deterministic and stochastic (Banik Pathik, 2013; Joseph Schaefer, 2014). Continuous time and constant lead time define deterministic systems. The management's decision gives rise to two scenarios: when to replenish and how much to replenish. The re-ordering point

and re-ordering quantity must be decided upon together. The concept of a safety stock is not used in such systems, since taking buffers does not add any cost to the system.

5.3. Cooperation, Agreement and Supply Chain Financing.

Establishing sustainable supply chain systems is a way to guarantee competitive advantage and reduce supply chain risks. Logistics works in sync with other supply chain partners to plan and manage logistics assets. This kind of collaboration is best for maximising energy use, reducing carbon emissions, improving waste management, and supporting monitoring and reporting across the supply chain. The exploration of the effect of logistics collaboration on supply chain performance indicates that reducing logistics costs is among the risk-reduction plans. Green practices also increase revenue by providing sustainable products and offering customer incentives.

Contracts will enable the management of supply chain and sustainability disruption risks. A biofuel supply chain with multiple suppliers and interrelated risks involves a contract with a high arrival time and a discount to increase safety. The risk is reduced in a two-level supplier-retailer structure with stochastic demand, and is addressed through trade credit financing in the supply chain partnerships. In additional structures where initial and continuous demand are known, supply chains may reduce interdependencies by using flexible prices and financial structures (Anh PHAN et al., 2019) at the customer, retailer, and inventory levels.

Investment decisions can also be financed through supply chain finance, provided one of the parties needs capital. As trade volume increases and capital becomes scarce, it is more appropriate to mitigate risks by financing supply chains with open payments to all buyers and startup suppliers (León-Bravo et al., 2017). In trade finance, however, a bank lending to a buyer holding an asset is used to conduct a trade through a platform that inflates trade volume but requires only a small amount of trade finance. The importance of maintaining supply chain financing during an expansion depends on the timing of market recovery.

6. The Practical Competitive Advantage of Sustainability.

A sustainable supply chain gives businesses in international markets an opportunity to build a competitive advantage, as is the case with productivity generated through regional economic policies (Sun et al., 2022). Competitiveness refers to a firm's perceived high performance compared to that of its counterparts in the same industry line. The notion of sustainable supply chain management helps

companies that seek such a competitive advantage by building on sustainable operations. Sustainable supply chain management entails environmentally friendly purchasing, product innovation, and developing environmentally friendly suppliers.

6.1. Total Cost of Ownership and Cost Implications.

The concept of Sustainable Supply Chain Management (SSCM) in developing economies such as Indonesia or Iran may be quite useful for enhancing environmental and business outcomes. Sustainable procurement that promotes the use of green inputs directly influences cost performance because suppliers of green inputs tend to have different cost structures. Green logistics, sustainable distribution, and green packaging will help reduce waste and CO2 emissions. This is where the reduction of waste and the costs associated with it comes in as the primary means by which environmental improvement would be attained and, as a result, the overall cost performance would be positively impacted. The initial investments in sustainable practices are likely to hamper supply chain competitiveness. The lack of differentiation between environmental and cost variables complicates the degree of commitment to SSCM set by public agencies (Somjai & Jermsittiparsert, 2019).

However, despite the need for a systematic formal cost-impact assessment of Sustainable Supply Chain Management (SSCM) practices to reveal their applicability on a systemic scale, the scant literature addresses this fundamental problem. The analytical fact of considering the total cost of ownership (TCO) is not even documented. Built within the context of business and production engineering, the notion of total cost of ownership provides detailed descriptions of various cost aspects, yet it has traditionally paid little attention to SSCM (Barau Singhry, 2015). Green supply chain adoption would result in cost savings and improved performance, but initial investment in environmental management systems and supply chain collaboration may be required. The sustainability of the ownership cost is determined by the effort invested in sustainability. Stakeholder pressure, training programs, upstream supply chain security, and the balance between the environment and cost are essential issues affecting adoption, potential long-term savings, and overall cost control.

6.2. Customer Preference, Market Access and Brand Value.

There are three issues related to international trade: Supply Chain Sustainability, Risk Management, and Competitive Advantage.

Economic rationality of operating a global supply chain sustainably depends on marketing, financial, and production theories, according to which socially responsible behaviour boosts sales, reduces costs, reduces financial risk, and increases profits. The existing production methods, including lean production and quality control, lead to sustainable corporate behaviour, thereby guaranteeing increases in stock valuations. These effects include benefits for stakeholders, such as employees, customers, the environment, and the community. Lean production affects consumers and financial risk, as reflected in ethical issues such as working conditions in foreign plants. The majority of corporate social responsibility efforts are driven by community pressure. However, there is an opportunity to present an economic argument in support of sustainable activities, focusing on the advantages to shareholders and broader societal concerns.

The issue of sustainable development is one of the emerging phenomena that attracts the interest of the global communities and corporations. High rates of market competition and globalisation have radically transformed the demand and supply chain, and sustainable practices have been integrated. The prevailing market instability ensures that corporations employ sustainable supply chain practices to achieve their objectives. The sustainable supply chain model helps firms devise policies that support the sustainability agenda, translating into a strong market stance. Such strategies align with the firm's objectives to gain a competitive advantage through improved performance, financial performance, and worker dedication. Companies that develop such strategies have a high likelihood of succeeding beyond the stakeholders in a dynamic business environment, thereby boosting long-term value and competitiveness (Mefford, 2011).

6.3. Circular Economy, Innovation and Technology.

Textile transformation is highly dependent on innovation and technology, which is the second-largest pollutant industry after oil (Arogyaswamy, 2019). Constant innovation advances the circular economy by revitalising production processes that have been deemed difficult to venture into. Automation, sustainability, and digitalisation are all brought together in a sustainable, cyclical transition. The introduction of bio-engineered fabrics made from recycled materials and even pollutants is a revolution attracting increased attention (A. Ashford, 2009). Innovation is about rethinking products, supplies, and business processes, moving from a linear to a circular model.

7. International Trade Architecture, Regulation and Policy.

Global value chain development is shaped by the international trade architecture, which prescribes myriad regulations and standards for supply chains and outlines how they should operate. The World Trade Organisation regulates multilateral trading rules. It facilitates trade; one such example is the Trade Facilitation Agreement, signed by WTO Member States in 2016, which seeks to streamline the movement of goods between nations (Ashfaqul Islam Babool, 2007). Sustainability and supply chains: Trade policy and regulation are common across international boundaries; the European Union has introduced the European Green Deal, and the regulation of deforestation-free supply chains has been discussed at the Organisation for Economic Co-operation and Development (A. Ashford, 2009). Interventions such as these are mandatory requirements and measures for the sustainability of international trade and investment in value chains. They may be considered as sustainability standards and regulations in cross-border trade.

Traditionally, participating in certain global trade policy matters has led progressive developing nations to engage in multilateral trade deliberations or to conform to new international trade standards to enter large international markets. The promotion and protection process in the developing countries to achieve the aim of the realisation of developing markets, which includes both officially-defined preferential treatment and integrated-systems approaches toward helping those exporters to the high-growth niche in upgrading value-chain assemblies of manufactured-products sub-sectors, efforts to achieve this result in structural transformation, economy-wide growth in productivity, and long-term sustainable economic growth (Rota et al., 2014). It is a viable opportunity that will enable the equal, sustainable development of business and platform under dedicated international trade policies on sustainable supply-chain issues, regardless of whether international trade sustainability standards might become tougher. These committed policies would enable collective international economic policy action in response to new preceding risks, and the construction of policy-makers and scheming risk-pool practices among other economies and trade-partner nexuses that would display relative similarity, thereby providing coordinated action in reduction.

7.1. Trade Policies and Sustainability Standards.

Although trade typically enhances economic growth, employment creation, and poverty reduction, it may at the same time contribute to climate change,

biodiversity loss, habitat destruction, water pollution, and social inequalities (Kanashiro Uehara, 2023). On the other hand, international trade has developed into the primary medium through which economy-wide socio-environmental effects are transmitted across borders, while also defining the sustainability criteria for both the nation and the economies that supply it. International trade has been linked to up to 70 per cent of the world's biophysical and social supply-chain footprints. Exporting and importing are associated with significantly different sustainability effects in different countries. Trends in the sustainability-performance trade-off have tended to favour developing economies over developed economies. Trade has significantly boosted the achievement of the Sustainable Development Goals (SDGs) in most high-income economies; by contrast, trade has undermined the efficiency of resource use and the management of natural resources in most middle- and low-income economies. Trade and SDG performance in these two latter groups have become increasingly negatively related.

This rise in international trade since the 1980s has been manifested by the spread of a wide range of sustainability standards, both regulatory and voluntary, at bilateral, regional and multilateral levels, including certification schemes, sustainability standards, and Environmental, Social and Governance (ESG) initiatives, and specific provisions in trade agreements. Despite the importance of trade restrictiveness as a key factor, the integration of sustainability principles into trade agreements is becoming more prominent (Distelhorst and M Locke, 2019). International trade agreements are expanding to include clauses on labour compliance, environmental standards, and governance improvements that inform member states on how to articulate, adopt, and implement sustainability principles in their local and international supply chains.

7.2. Multilateral Co-ordination and Risk Pooling.

Due to the growing complexity and high level of interdependence among risks in supply chain management, uncertainty cannot be uniformly distributed across all parties, making multilateral coordination a viable solution. Market information can be distributed among trading partners through collaborative approaches, such as information-sharing alliances and partnerships, in which information is shared to form a shared vision (Luke & Heyns, 2018). Risk-pooling can also be achieved through enhanced coordination of supply and demand across the entire supply chain. Governments should develop a collective mechanism to encourage information exchange among countries to coordinate their supply chains and establish arrangements that promote risk-pooling. This will also help

ensure a level playing field in government supply chains, preventing unfair competition and trade disputes among countries (Chereau, 2014).

8. Case Studies under International Trade Situations.

Risk mapping is usually the first step once the establishment managers react to entry into global markets by canvassing risks. Risk heat-map synthesis is a field that supply chain risk strategy formulation managers resort to. Although these two undertakings are neither extensive nor inclusive, mapping enables more detailed analysis (D. Woolley, 2010).

Risk managers have several methods for capping losses at the national level. Countries may achieve supplier isolation through interdiction or spot-market infrastructure. Extraction countries deal with threats posed by supply by blocking the flow of exporters who are highly exposed to forecast demand uncertainty. Buffering is one way storage investments reduce or avoid volatility (Labaran Ali et al., 2019).

8.1. Clusters and Regional Synergies in the Industry.

Industrial clusters form when firms in certain industries merge into a geographically concentrated region. Traditionally, these structures have provided companies with several benefits: they have increased efficiency in the supply chains; they have recruited a skilled labour that can change employers without any significant problems; they have reduced the cost of transactions because there is an already existing ecosystem (C. R. Carpinetti and H. P. Lima, 2013). Cluster firms can increase their competitive advantage due to their capacity to cooperate, exchange knowledge and experience, and operate in intermediate markets, as well as to transfer suppliers and subcontractors, making these transfers more efficient (Sofiyessi et al., 2019). As a driving force of economic growth, industrial clusters have been repeatedly included in government policy agendas.

Although definitions of industrial clusters vary, several features can be generalised across them. Clusters are either geographically, organizationally or institutionally proximate. Newcomers to a cluster usually need enough information about it and cannot evolve on their own. Every cluster is prone to hold certain ethos or norms, training, and employment practices applicable to its type of business. The process of establishing employee confidence at the cluster level is labour-intensive, as it takes a long time to build experience across trades.

8.2. Emerging Markets and Supply Chain Upgrading.

Suppliers in emerging economies are forced to implement a wide range of sustainability activities to enhance supply chain performance and business processes. For firms in these regions, supplier social sustainability practices positively influence supply chain performance, especially environmental sustainability practices, which are critical for resource conservation and productivity in labour-intensive activities. There are a few studies in the literature that provide systematic assessments of resource use and reduction measures by emerging-market suppliers. Cooperation with external stakeholders, including public and non-profit organisations, becomes one of the most vital drivers of sustainable supply chain management in such circumstances, contributing to successful implementation, gaining the support of domestic authorities, and securing a competitive advantage and lower costs (Sánchez Flores et al., 2020). Fostering innovation at the product, process, and business-model levels, such as the proliferation of green supply chain practices, is another priority. Innovation in technology, replenishment of in-house operations, and joint research-and-development initiatives constitute these particular types of innovation that are of precedence. The barriers to implementing sustainable supply chain management practices are national in scope, compared to those facing firms operating in the advanced economy, and this needs to be diagnosed and addressed by both the enterprise and its suppliers.

8.3. Trade Network Crisis Response and Recovery.

The COVID-19 pandemic led to a surge in global demand for medical supplies. The supply disruption, alongside the sudden increase in demand, was of Asian origin. When several trade partners faced a crisis simultaneously, they had to re-strategise their sourcing. The crisis underscored the importance of a multiproduct, multisupplier model that limits dependence on a single channel per supplier (Pinkwart et al., 2022).

The pandemic demonstrated that pre-COVID-19 value chains were set too precisely, given low capital and inventory expenses. With that kind of reasoning, order cycles could even become lengthy enough to be informally tolerated. With the rise in commodity prices, firms merely placed more orders. Shipments were made when the price increased or when goods were stored at the destination points. These drum-buffer-rope concepts, which were initially applicable to flow processes, were found to be constrained in situations of abrupt, changing crises, where quick resupply was needed to change the status quo, indicating that too much coordination restraint was required with outside parties.

The Great Trade Collapse was also a temporary collapse of trade flows during the Great Recession that had never been experienced before. As investment projects were being terminated, demand for components and intermediate goods immediately vanished. Trade and financial interconnections served as magnifying mechanisms within a multiproduct, multi-supplier system. When trade-finance conditions were met, the demand pulse, in terms of vehicle flow, also needed to be discarded. Therefore, the dynamic growth and accelerating intensification of international product flows became self-destructive under several fixed external horizons (Escaith, 2009).

9. Practitioner Methodological Concerns.

The importance of sustainable supply chains in addressing environmental, social, and economic issues, and the role of risk management in positioning environmental and sustainability-related measures, are increasingly relevant to organisations (Martin & GAUDENZI, 2015). Recent globalisation efforts in climate change, decoupling social development and economic growth, the sustainability crisis, and the emergence of Circular Economy efforts are creating an urgent need for action by the European Union. The current COVID-19 crisis underscores the need for resilience and sustainable solutions across the discussed spheres.

The risk-management model will take into consideration the issue of maintaining the triple bottom line of people, planet, and profit; it will also consider risk when examining sustainability; this is vital in a good situational analysis.

9.1. Models of Measuring Sustainability and Risk.

The literature-based sustainability and risk-assessment models discuss the rising complexity of the interrelationships between supply-chain sustainability and risk, both at the global and sustainable supply chain levels (Martin & GAUDENZI, 2015). The literature identifies that the issue of sustainable supply chain risk can be resolved at both the organisational and supply chain levels, and that sustainability is a goal, with cultural norms or organisation-specific demands as the focal point of the sustainability criteria.

9.2. Decision Support, Data and Analytics.

Data-rich organisations can leverage state-of-the-art data analytics services to expand the lead and depth of choices available for decision-making and optimisation. The ability to leverage data analytics capabilities makes it more agile and is linked to much higher supply

chain performance (Fosso Wamba & Akter, 2019). Supply chain performance cannot be managed without performance measurement. The balanced scorecard and SCOR-based measurement are among the approaches proposed. The development of business intelligence technologies has emphasised the emergence of data, analytics, and decision support. Business intelligence strengthens supply chains, leading to better inventory management, planning, forecasting, and general decision-making. With data mining methods, it is possible to model, visualise, and analyse attributes and relationships, thereby facilitating more efficient performance management in complex supply chains (Stefanovic, 2014).

9.3. Management and Stakeholder Involvement.

Sustainable supply chain governance enables stakeholder engagement by establishing quantifiable, feasible organisational priorities grounded in feedback and stakeholder concerns. The governance mechanisms' competence to sustain a competitive advantage of an organisation is based on the implementation of effective stakeholder engagement mechanisms, which are identified by fostering the impact of stakeholders on an organisation through the following literature-based taxonomy (Rajindra et al., 2019): market, communication, investment, logistical, and technology.

The identified mechanisms of governance are indicative of a multi-stakeholder contextualization, with a focus on engaged, academia-focused stakeholders. Governance strategies that facilitate the disclosure of appropriate information to stakeholders enable both proactive and reactive engagement, and society legitimises concerns and protects the organisation's reputation. Specifically, the governance motive of enhancing supply chain efficiency, among several strategic goals, is underpinned by the possibility of establishing an engagement mechanism with customers. Market mechanisms are also a prior approach to disclosing supply chain malpractice, which partially enables the recipient organisation to raise a specific customer issue with stakeholders engaged in the activity, such as regulatory authorities, labour organisations, NGOs, and community organisations.

10. Conclusion

The paper aims to present a rigorous, evidence-based, yet practical study of Supply Chain Sustainability, Risk Management, and Competitive Advantage in International Trade.

Cross-border delivery of goods is integral to contemporary business. Markets have shifted from the national economy to the global economy, from regional groupings to a globalised economy, in an attempt to acquire goods. The smooth flow of goods

has made the global value chain (GVC) very easy, due to the interconnection of factories, supplies, and final consumers in various economies, and this has, in turn, led to the prosperity of trade and commerce at the global level.

Sustainability and risk are two major forces that are currently influencing supply chains and their management practices. The dangers of climate change and environmental damage have increased the concern and efforts towards sustainability. The COVID-19 pandemic, a black swan event, has revealed the inadequacy of global supply chains to respond to the multitude of risks never seen before in a tragic way. Consequently, both forces seem powerful and indispensable, and supply chain sustainability is becoming a significant factor in the modern global arena.

Further steps and development in the sphere of Supply Chain Sustainability, Risk Management, and Competitive Advantage in International Trade have also been taken timely and interpreted and contextualized the progress and implication and given illustrative examples of four aspects, including the conceptual basis of sustainable supplychain; the landscape of risk in global supplychain; measurement and disclosure of sustainability performance; and the strategy to manage risks in international trade (Martin & GAUDENZI, 2015).

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