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Green Transformation in Global Supply Chains and Its Impact on International Trade Competitiveness Analytical Study

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ABSTRACT

This article analyses the green transformation of global supply chains and its implications for international trade competitiveness, supported by an empirical case study on A.P. Moller–Maersk covering 2018–2024. The study examines how environmental regulations and sustainability requirements are reshaping competitiveness drivers and influencing firms' market access. Using the framework of Green Supply Chain Management (GSCM), the article assesses Maersk's progress in reducing emissions, increasing the share of alternative fuels, and improving operational efficiency. The results show a continuous decline in carbon intensity and significant investment in green technologies, strengthening the company's ability to comply with emerging environmental trade standards. The findings confirm that green transformation enhances long-term competitiveness and supports alignment with global low-carbon trade trends.

Keywords: GSCM, Green Transformation, Trade Competitiveness, Maersk, Decarbonization.

JEL Classification: F14 F18 L91 Q56 Q01 M11

Introduction:

The accelerating global transition toward sustainability has profoundly transformed the way firms, industries, and national economies operate. Climate change, resource depletion, and increasing societal pressure for environmentally responsible production have compelled organizations to reconfigure their supply chains and integrate environmental considerations into their strategic decision-making. At the heart of this transformation lies Green Supply Chain Management (GSCM), a comprehensive approach that embeds sustainability principles across procurement, production, logistics, distribution, and end-of-life product management.

In parallel, international trade has entered a new era in which environmental performance has become an essential determinant of market access and competitiveness. The emergence of stringent environmental regulations—such as the EU Carbon Border Adjustment Mechanism (CBAM), carbon-intensity labeling, ISO environmental standards, and ESG disclosure requirements—has reshaped global trade flows and placed increasing pressure on exporters, particularly those from developing economies, to comply with green criteria. Firms capable of adopting greener technologies, cleaner production processes, and low-carbon logistics are increasingly gaining preferential access to global markets and strengthening their competitive positions.

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Furthermore, technological advancements including digitalization, big data analytics, renewable-energy systems, and emission-monitoring tools are accelerating the global shift toward greener supply chains. These innovations not only support environmental compliance but also contribute to operational efficiency, cost reduction, and product differentiation.

Despite these opportunities, many challenges remain, especially for emerging and developing economies that face financial constraints, technological gaps, and evolving regulatory frameworks. This article seeks to analyze the theoretical foundations of GSCM and examine how green transformation enhances international trade competitiveness, while also identifying the main barriers and policy implications associated with this transition.

LITERATURE REVIEW:

1.1 The Concept of Traditional Supply Chains:

A traditional supply chain is defined as the network of organizations, resources, activities, and technologies involved in producing and delivering goods or services from suppliers to end consumers (Chopra, Supply Chain Management, 2016) . It encompasses all stages of production, storage, transportation, and distribution, aiming primarily to meet customer demand efficiently while minimizing costs.

- The main functions of a traditional supply chain include procurement, production, inventory management, logistics and distribution, and information management (Sarkis). Procurement involves sourcing raw materials and components from suppliers, whereas production or operations transform these inputs into finished goods. Inventory management ensures timely availability of products while controlling holding costs, and logistics and distribution focus on delivering products efficiently to retailers or end customers. Effective information management is essential to coordinate these functions, optimize planning, and enhance decision-making across the network.
- The primary objectives of traditional supply chains are cost efficiency, timely delivery, product quality, and coordination among supply chain partners to minimize disruptions. While these goals enhance operational and economic performance, traditional supply chains often overlook environmental and social dimensions. The increasing global emphasis on sustainability, resource efficiency, and climate responsibility has highlighted these limitations, paving the way for the development of Green Supply Chain Management (GSCM). GSCM extends the traditional supply chain concept by integrating environmental and social considerations across all supply chain activities, from procurement to production, logistics, and product end-of-life management.

1.2 Emergence of Green Supply Chain Management (GSCM) :

The limitations of traditional supply chains in addressing environmental and social concerns have led to the development of Green Supply Chain Management (GSCM). GSCM is defined as the integration of environmental thinking into supply chain management, encompassing product design, material sourcing, manufacturing processes, delivery of the final product, and end-of-life management of the product (Srivastava, Green supply-chain management: A state-of-the-art literature review, 2007). Unlike traditional supply chains, GSCM emphasizes sustainability objectives alongside economic performance, aiming to reduce environmental impacts while maintaining competitiveness.

- The emergence of GSCM has been driven by multiple factors. Regulatory pressures, such as environmental laws, carbon emission standards, and sustainability reporting requirements, have compelled firms to adopt cleaner production and low-carbon logistics practices

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(Handfield, SV Walton, & LK Seegers, 2005) . Market dynamics, including growing consumer demand for eco-friendly products and corporate social responsibility expectations, have further accelerated this trend. Additionally, global initiatives, such as the Paris Agreement and the Sustainable Development Goals (SDGs), have reinforced the need for firms to adopt environmentally responsible supply chain practices (Sarkis, 2012; Seuring & Müller, 2008).

- Key components of GSCM include green procurement, eco-design, green manufacturing, green logistics, and reverse logistics. Green procurement involves selecting suppliers based on their environmental performance, while eco-design focuses on minimizing resource consumption and maximizing product recyclability. Green manufacturing aims to reduce waste, emissions, and energy consumption, whereas green logistics seeks to optimize transportation and distribution in an environmentally friendly manner. Reverse logistics and circular economy practices ensure that products are recovered, recycled, or remanufactured at the end of their lifecycle. Together, these practices allow firms to achieve both environmental and operational objectives, enhancing their competitiveness in global markets (Zhu, Joseph Sarkis, & Kee-hung Lai, 2008).

1.3 Theoretical Perspectives Explaining Green Supply Chain Management (GSCM) :

Green Supply Chain Management (GSCM) is underpinned by several theoretical frameworks that help explain why firms adopt environmentally sustainable practices and how these practices influence performance. One of the most widely applied theories is Stakeholder Theory, which posits that organizations must respond to the needs and expectations of a broad range of stakeholders—including customers, suppliers, regulators, and society at large—to achieve legitimacy and long-term success (Freeman & John F. Mcvea, 2001) . In the context of GSCM, stakeholder pressures encourage firms to implement eco-friendly procurement, production, and logistics practices to meet environmental expectations and maintain competitive advantage.

- Another important framework is the Resource-Based View (RBV), which suggests that firms can achieve sustained competitive advantage by leveraging valuable, rare, inimitable, and non-substitutable resources (Barney, 1991) . Green capabilities, such as eco-design expertise, clean manufacturing technologies, and green logistics competencies, are considered strategic resources that enhance firm performance and enable differentiation in global markets (Sarkis, Qinghua Zhu, & Kee-hung Lai , An organizational theoretic review of green supply chain management literature, 2011).
- **Legitimacy Theory** also provides insights into GSCM adoption. It argues that firms undertake environmentally responsible practices to conform to societal norms, regulations, and expectations, thereby preserving legitimacy and reputation (suchman, 1995). Compliance with environmental regulations, voluntary green certifications, and public sustainability reporting are manifestations of this theory within supply chains.
- Finally, **Innovation Theory** emphasizes the role of technological and process innovation in achieving environmental and operational goals. The adoption of green technologies, digital supply chain solutions, and circular economy practices not only reduces environmental impacts but also enhances efficiency, cost-effectiveness, and market competitiveness (Porter & Claas van der Linde, 1995) .

These theoretical perspectives collectively explain why firms adopt GSCM, highlighting the interplay between external pressures, internal capabilities, legitimacy concerns, and innovation-driven performance. Understanding these frameworks provides a solid foundation for analyzing the impact of green supply chain practices on international trade competitiveness.

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Components and Practices of Green Supply Chain Management (GSCM Practices) :

Green Supply Chain Management (GSCM) encompasses a comprehensive set of practices that integrate environmental considerations across all stages of the supply chain. These practices aim to minimize environmental impacts while improving operational efficiency and enhancing firms' competitiveness in global markets. The adoption of GSCM has been driven by growing regulatory pressures, the rise of environmentally conscious consumers, and technological advancements that enable companies to monitor emissions, optimize energy use, and redesign processes in a sustainable manner.

3.1 Green Procurement:

Green procurement represents the first critical step toward establishing a sustainable supply chain. It involves selecting suppliers based on their environmental performance, such as the use of recyclable materials, lower energy consumption, eco-friendly production methods, and compliance with environmental regulations and certifications like ISO 14001. Leading global firms increasingly integrate environmental criteria into supplier evaluation to reduce ecological risks, enhance transparency, and strengthen long-term competitiveness (Carter & Rogers, 2008). Green procurement also contributes to improved material quality, reduced waste, and lower environmental compliance costs (Walker & Neil Jones, 2012).

3.2 Green Manufacturing:

Green manufacturing focuses on redesigning production processes to reduce pollution, eliminate hazardous materials, minimize waste, and improve energy and resource efficiency. This includes adopting clean technologies, improving process layout, recycling industrial inputs, and applying eco-efficiency measures that balance environmental objectives with operational performance. Companies implementing green manufacturing often experience reductions in production costs, improved environmental compliance, and enhanced reputation among global stakeholders (KING & MICHAEL J. LENOX, 2001). Moreover, the integration of digital technologies such as automation and real-time monitoring has accelerated the shift toward low-carbon, cleaner industrial systems.

3.3 Green Logistics and Transportation:

Green logistics aims to reduce the environmental footprint of transportation, warehousing, and distribution activities. Major practices include route optimization, modal shifts toward rail and maritime transport, the use of electric or hybrid vehicles, and the implementation of energy-efficient storage systems. Firms also rely on advanced information systems to plan shipments, reduce empty runs, and manage fuel consumption (McKinnon, ShAron cullinAnE, MichAEl brownE, & Anthony whitEing, 2015). These measures not only reduce greenhouse gas emissions but also improve delivery reliability and reduce operational costs in global supply chains.

3.4 Eco-Design and Sustainable Product Development:

Eco-design integrates environmental considerations into the early stages of product development. It focuses on reducing material intensity, improving recyclability, extending product life cycles, and minimizing energy consumption during use and disposal. Eco-design practices contribute to significant environmental improvements and help firms meet the rising demand for sustainable products in international markets (Pigosso, TC McAloone, & H Rozenfeld , 2017). Companies adopting eco-design often gain competitive advantage by differentiating their products through sustainability-oriented innovation.

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3.5 Reverse Logistics and Circular Economy Practices:

Reverse logistics refers to the process of collecting used products, packaging, or materials for reuse, recycling, remanufacturing, or safe disposal. It forms a key component of the circular economy, which seeks to close material loops and reduce resource extraction. Effective reverse logistics systems help firms recover value from post-consumer waste, comply with environmental regulations, and reduce the environmental impact of their operations (Wassenhove & VDR Guide , 2009). Circular practices, such as product take-back programs and remanufacturing, are increasingly adopted by global firms to reduce costs and meet sustainability requirements in international markets.

3.6 Green Information Systems and Digital Tools:

Digitalization plays a strategic role in enabling GSCM practices. Tools such as blockchain, big data analytics, Internet of Things (IoT), and carbon-tracking platforms enhance visibility, transparency, and traceability across supply chains. These technologies allow firms to monitor environmental performance in real time, assess supplier sustainability, and optimize resource use. The integration of digital technologies significantly supports green transformation and strengthens firms' competitiveness through improved decision-making and reduced operational inefficiencies.

2. Green Transformation in Global Supply Chains:

The green transformation of global supply chains has become one of the most significant structural shifts shaping international trade and global economic systems. This transformation results from the convergence of stricter environmental regulations, rapid technological advancement,

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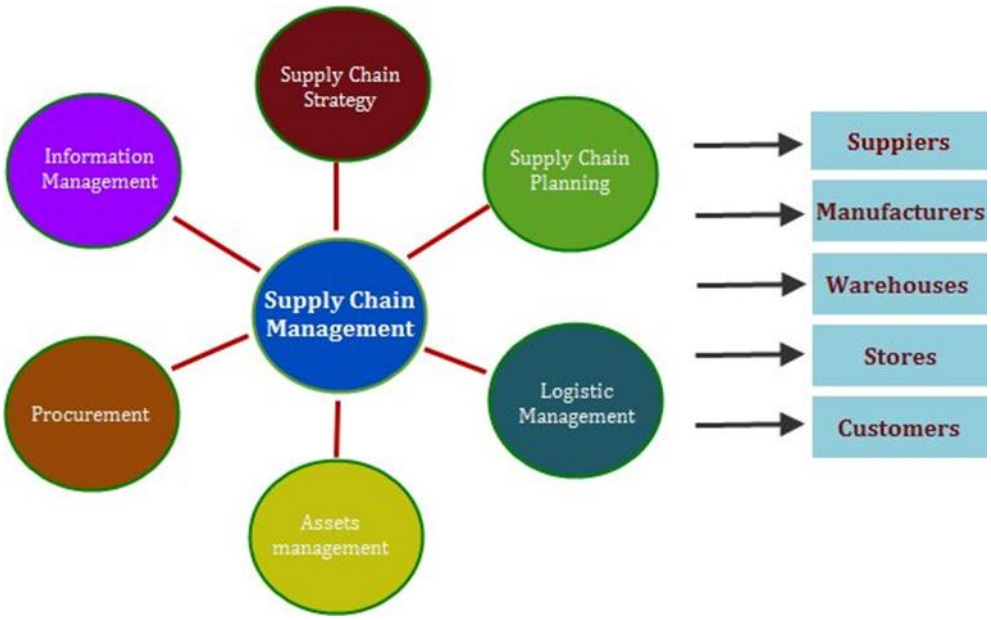

(Khosravi, Dariush Ahadi-Ravoshti, & Kazem Hashemi Majd, 2018)

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consumer awareness, and the strategic shift of firms toward sustainable production and logistics. In response to climate challenges and the global push to reduce carbon emissions, supply chains are increasingly redesigned to align with the principles of the circular economy, low-carbon production, and environmental transparency.

4.1 Drivers of Green Transformation in Global Supply Chains:

Several key drivers explain the ongoing shift toward green global supply chains. Regulatory pressure has intensified worldwide, most notably with the European Union's Carbon Border Adjustment Mechanism (CBAM), which requires exporters to comply with strict carbon emission standards. International environmental management systems such as ISO 14001, along with ESG reporting requirements, have also become essential tools for assessing firms' environmental performance (UNCTAD, 2022). Market forces reinforce these regulatory pressures, as global consumers increasingly prefer eco-friendly products, prompting firms to adopt sustainable practices to remain competitive.

4.2 Technological Transformation and Its Role in Enabling Greener Supply Chains:

Digital technologies have played a pivotal role in accelerating green transformation. Tools such as the Internet of Things (IoT), blockchain, big data analytics, and carbon-tracking systems allow firms to monitor environmental performance across all stages of the supply chain. These technologies enable real-time tracking of emissions, improved energy efficiency, optimized logistics operations, and enhanced traceability of raw materials. Advances in clean technologies—such as renewable energy systems, low-carbon manufacturing techniques, and electric mobility—further support the transition to greener global supply chains.

4.3 Reshaping International Trade Relations:

The green transition is reshaping global trade patterns by integrating environmental criteria into market access conditions. Countries with low-carbon production systems now enjoy a competitive advantage, particularly in markets implementing carbon-related trade measures. The growth of green trade is particularly evident in renewable energy technologies, electric vehicles, and environmentally friendly industrial inputs. Meanwhile, developing countries face structural challenges linked to limited green financing, technological gaps, and the high cost of environmental compliance, which may reduce their competitiveness in advanced markets (Bank, 2023).

4.4 Challenges of the Green Transformation:

Despite its global momentum, the green transformation faces several obstacles. The initial investment required for clean technologies remains high, particularly for small and medium-sized enterprises and suppliers in developing economies. Additional challenges include limited technical capacity, insufficient skilled labor in sustainability fields, and the difficulty of aligning traditional logistics networks with new environmental standards. A major barrier is also the lack of reliable environmental data, which complicates efforts to assess carbon footprints and improve performance across supply chain tiers (OECD, 2021).

4.5 Long-Term Benefits of Green Global Supply Chains:

Companies that successfully implement green transformation strategies gain considerable advantages. These include improved operational efficiency, long-term cost savings, enhanced market access, stronger corporate reputation, and compliance with evolving global standards. Green supply chains also enhance resilience by reducing exposure to environmental risks, regulatory uncertainty, and volatility in energy and raw material markets. Over time, green transformation strengthens firms' global competitiveness and contributes to more sustainable international trade systems.

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3. Green Transformation and International Trade Competitiveness:

5.1 Relationship between GSCM and Competitive Advantage:

Green Supply Chain Management (GSCM) enhances a firm's competitive advantage by improving product quality, fostering innovation, ensuring regulatory compliance, and strengthening corporate reputation. Companies that adopt sustainable sourcing, eco-design, and green logistics can reduce operational costs while increasing efficiency, achieving both environmental and economic benefits. By aligning supply chain practices with global sustainability standards, firms not only gain market access but also differentiate themselves in international markets, creating long-term strategic value (Carter & Dale S. Rogers, 2008).

5.2 Impact of Environmental Requirements on Market Access:

Environmental regulations increasingly shape market access for global products. In the European Union, mechanisms such as the Carbon Border Adjustment Mechanism (CBAM) and mandatory eco-labels require exporters to meet strict carbon and sustainability standards. In the United States, energy efficiency standards and low-carbon product incentives create opportunities for compliant firms. Similarly, major Asian markets, including China, Japan, and South Korea, emphasize environmental reporting and traceability. Firms that adopt green labeling, carbon tracking, and sustainable practices gain preferential access to these markets, while non-compliant exporters face restricted entry and potential trade barriers (UNCTAD, Global Value Chains and Sustainability, 2022)

5.3 Impact of Green Transformation on Costs and International Pricing:

The transition to green supply chains affects both operational costs and international pricing strategies. Environmental compliance—such as emissions reduction, certification, and eco-labeling—incurs additional costs for firms, typically ranging from 5% to 10% of production expenses depending on the sector. Additionally, investments in digital and green technologies, including IoT tracking, blockchain, and energy-efficient systems, further increase upfront costs. However, these investments often lead to long-term efficiency gains, lower energy consumption, and improved market access, allowing firms to maintain competitive pricing in international markets while meeting sustainability requirements.

5.4 International Competitiveness Indicators Affected by Green Transformation:

Green transformation directly influences key international competitiveness indicators. The Logistics Performance Index (LPI) improves as firms adopt sustainable supply chain practices, optimizing transportation, warehousing, and customs processes. The Global Competitiveness Index (GCI) benefits from enhanced infrastructure, innovation capacity, and environmental compliance, improving countries' and firms' rankings in global trade. Additionally, reductions in carbon emissions per unit of production and export not only meet regulatory requirements but also strengthen firms' reputational and market position in environmentally sensitive markets. Collectively, these indicators demonstrate that integrating GSCM practices enhances both operational efficiency and international trade competitiveness (World Bank, 2023)

6.Methodology, Result and Discussion:

The aim of this chapter is to measure and analyse the impact of green transformation in supply chains on the international competitiveness of Maersk company during the period from 2018 to 2024. The study relies on a comparative descriptive-analytical approach, using the company's official data from annual sustainability reports, along with logistics and financial performance indicators, to assess changes in both green transformation and trade competitiveness.

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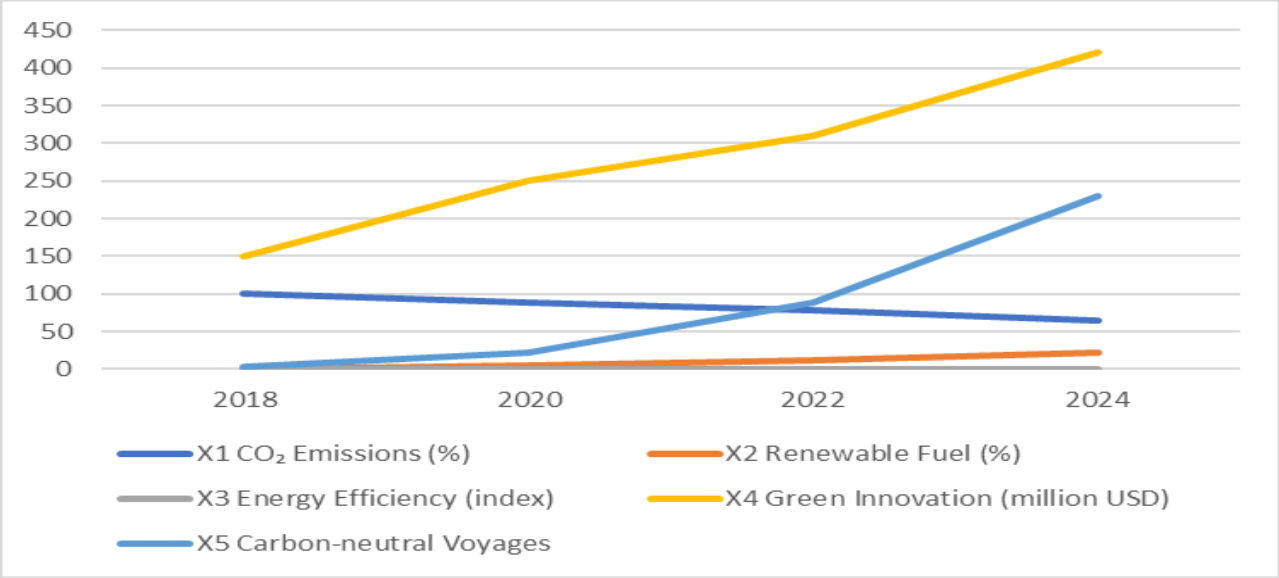
Table 1: presents Green Supply Chain Indicators (2018–2024)

Table 1: Green Supply Chain Indicators (2018–2024)

Year	X1 CO_2 Emissions (%)	X2 Renewable Fuel (%)	X3 Energy Efficiency (index)	X4 Green Innovation (million USD)	X5 Carbon-neutral Voyages
2018	100	0	1.0	150	3
2020	89	5	1.15	250	22
2022	78	11	1.20	310	89
2024	65	22	1.35	420	230

source: A.P. Moller – Maersk. Annual Report 2024. Maersk, 2024.

Chart1: Green Supply Chain Indicators (2018–2024)



Source: Author's calculation based on: A.P. Moller – Maersk. Annual Report 2024. Maersk, 2024.

- **CO_2 Emissions**: CO_2 emissions declined steadily from 100% in 2018 to 65% in 2024, representing a 35% reduction over six years.

This trend reflects the implementation of emission reduction policies, including the adoption of lower-carbon fuels and higher fleet efficiency.

Reduced emissions improve compliance with international environmental regulations and facilitate access to new carbon-regulated markets.

- **Renewable Fuel Usage:** The share of renewable fuel increased from 0% in 2018 to 22% in 2024, demonstrating Maersk's adoption of biofuels and low-emission alternatives.

This shift contributes directly to lowering Scope 1 and Scope 2 emissions and indicates a long-term commitment to green supply chain practices.

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The gradual increase reflects the company's ability to invest in new technologies without disrupting operational performance.

- **Energy Efficiency:** The Energy Efficiency Index rose from 1.0 to 1.35, reflecting an approximate 35% improvement in energy use efficiency.

Improvements are linked to operational strategies such as optimized shipping routes, advanced engine maintenance, and the use of energy-saving technologies.

Enhanced energy efficiency reduces operational costs and strengthens profitability, demonstrating the connection between sustainability and competitiveness.

- **Green Innovation**: Investment in green innovation increased from $150 million in 2018 to $420 million in 2024, a growth of 180%.

This indicates Maersk's focus on developing technologies to reduce emissions, improve fuel efficiency, and implement sustainable logistics solutions.

Green innovation enhances competitive advantage by providing environmentally friendly services that attract both customers and investors.

- **Carbon-neutral Voyages:** The number of carbon-neutral voyages increased dramatically from 3 in 2018 to 230 in 2024.

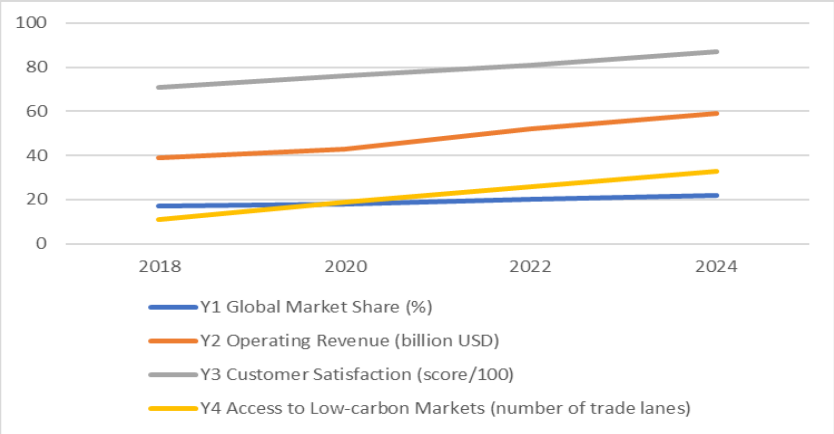
This significant growth demonstrates the practical implementation of green policies and translates directly into improved corporate reputation and customer trust.

Table 2: International Trade Competitiveness Indicators (2018–2024)

year	Y1 Global Market Share (%)	Y2 Operating Revenue (billion USD)	Y3 Customer Satisfaction (score/100)	Y4 Access to Low-carbon Markets (number of trade lanes)
2018	17	39	71	11
2020	18	43	76	19
2022	20	52	81	26
2024	22	59	87	33

source: A.P. Moller – Maersk. Annual Report 2024. Maersk, 2024.

Chart2: International Trade Competitiveness Indicators (2018–2024)



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Source: Author's calculation based on: A.P. Moller – Maersk. Annual Report 2024. Maersk, 2024.

- **Global Market Share (Y1) :** Maersk's global market share increased from 17% in 2018 to 22% in 2024, a growth of 5 percentage points over six years.

This upward trend suggests that the company's green initiatives may have enhanced its competitiveness by differentiating its services and complying with stricter environmental standards.

Increased market share also reflects customer preference for environmentally responsible shipping providers.

- **Operating Revenue (Y2) :** Operating revenue grew from $39 billion in 2018 to $59 billion in 2024, an increase of $20 billion.

Revenue growth coincides with investment in green supply chain initiatives, implying a positive financial impact of sustainability practices.

Green innovation and energy efficiency measures likely contributed to cost savings and higher operational margins.

- **Customer Satisfaction (Y3) :** Customer satisfaction scores rose from 71 in 2018 to 87 in 2024.

The increase demonstrates that clients respond positively to Maersk's sustainable operations, including carbon-neutral voyages and reduced emissions.

This improvement strengthens brand loyalty and supports market expansion.

- **Access to Low-carbon Markets (Y4):** Access to low-carbon trade lanes increased from 11 in 2018 to 33 in 2024.

This reflects Maersk's ability to enter and operate in regions with strict carbon regulations, such as the European Union under CBAM rules.

It highlights the strategic advantage of integrating green practices to expand market reach and comply with international regulations.

- All competitiveness indicators show consistent growth during 2018–2024.
- Improvements in market share, revenue, and customer satisfaction align with the implementation of green supply chain measures shown in Table 1.
- Enhanced access to low-carbon markets demonstrates a direct link between environmental compliance and business expansion.
- The data suggest that sustainability initiatives not only support environmental goals but also strengthen international trade competitiveness, confirming the strategic value of the green transition.

Conclusions and Recommendations:

- **Conclusions:**

The theoretical analysis demonstrates that the green transformation of global supply chains has become a fundamental driver of international trade competitiveness. The tightening of environmental

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regulations across the European Union, the United States, and Asia, combined with rising societal pressures for sustainability, has shifted green supply chain management (GSCM) from a voluntary practice to a strategic necessity. Integrating green principles into production, logistics, and distribution processes enhances product quality, supports innovation, strengthens regulatory compliance, and improves corporate reputation—factors that collectively reinforce competitive advantage in global markets.

Moreover, the literature indicates that green-oriented supply chains contribute to operational efficiency by reducing waste, optimizing resource use, and lowering carbon emissions. These improvements directly influence market access, as many importing regions now impose environmental conditions and carbon-related requirements on foreign products. Although the transition toward greener supply chain practices entails additional short-term costs, these investments yield long-term strategic benefits, particularly in a global context where carbon pricing, environmental standards, and sustainability certifications increasingly shape trade flows.

In sum, the theoretical foundations confirm that the green transformation of supply chains represents a systemic shift that goes beyond operational adjustments. It requires rethinking business models, integrating advanced technologies, and fostering stronger collaboration across the entire value chain to achieve sustainable competitiveness in the evolving global trade landscape.

The analysis of Maersk's green supply chain indicators (2018–2024) alongside its international trade competitiveness measures highlights a clear and positive relationship between sustainability initiatives and market performance:

Green Transition Drives Competitiveness:

Significant reductions in CO_2 emissions (35% decline) and increased use of renewable fuels (0% → 22%) correlate with growth in global market share (17% → 22%) and revenue ($39B → $59B).

Operational improvements such as energy efficiency and carbon-neutral voyages have enhanced customer satisfaction, demonstrating that environmental sustainability translates into tangible business advantages.

Innovation and Strategic Investment Matter:

Investments in green innovation increased by 180% over six years, fostering new technologies and services that support compliance with international regulations and expand access to low-carbon trade lanes.

The data suggest that innovation is a key driver linking environmental initiatives to competitiveness, particularly in regulated markets such as Europe.

Integrated Approach is Essential:

The combined improvements in environmental, operational, and market indicators show that a holistic approach—covering fuel choice, operational efficiency, and technological innovation—is more effective than isolated initiatives.

Maersk's example illustrates that sustainability can be embedded into the core business strategy to enhance both environmental and commercial outcomes.

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Sustainability as a Competitive Differentiator:

Enhanced access to low-carbon markets and higher customer satisfaction demonstrate that sustainability is increasingly a differentiating factor for global logistics providers.

Companies that fail to adopt green supply chain practices may face regulatory penalties, restricted market access, and reduced brand value.

Recommendations:

Strengthen the adoption of GSCM practices: Firms should embed green principles across all supply chain stages—from product design to transportation—supported by comprehensive tools for monitoring emissions and environmental performance.

Foster green partnerships across the value chain: Collaboration between suppliers, manufacturers, and logistics providers is essential to align decarbonization efforts, promote sustainable sourcing, and reduce the environmental footprint of traded products.

Invest in digitalization and innovation: Technologies such as blockchain, IoT, and advanced analytics can significantly enhance environmental traceability and transparency, supporting compliance with evolving international standards.

Build stronger internal capabilities for environmental compliance: Companies must develop systems to track emissions, ensure conformity with environmental regulations—particularly EU mechanisms such as CBAM—and integrate sustainability into strategic planning.

Align industrial and trade policies with sustainability requirements: Governments should support firms through green financing, incentives, and clear regulatory frameworks that facilitate the transition toward low-carbon trade competitiveness.

Adopt standardized environmental performance indicators: Using metrics such as the Green LPI, carbon intensity, and energy efficiency helps evaluate progress, guide decision-making, and improve reporting practices across international supply chains.

Based on these findings, the following recommendations are proposed for Maersk and similar multinational logistics companies:

Continue Investment in Green Technologies:

Maintain and expand investments in renewable fuels, energy-efficient vessel technologies, and digital innovations for route optimization to further reduce emissions and operating costs.

Expand Carbon-neutral Operations:

Increase the number of carbon-neutral voyages and green-certified trade lanes, leveraging these achievements in marketing and customer engagement strategies to enhance competitive positioning.

Integrate Sustainability into Strategic Planning:

Embed environmental indicators into corporate KPIs, including revenue targets, market expansion plans, and customer satisfaction metrics, ensuring that sustainability is an integral part of business decisions.

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Monitor and Report Progress Transparently:

Regularly publish detailed environmental and operational data in sustainability reports, ensuring transparency and accountability, which strengthens stakeholder trust and supports market access.

Leverage Sustainability for Market Access:

Actively target low-carbon trade lanes and markets with strict environmental regulations, using green practices as a competitive advantage to secure contracts and long-term partnerships.

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