

Sustainable and Green Logistics Practices: A Global and Middle East Perspective

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Abstract: Sustainability has become a defining imperative for modern logistics systems. Logistics activities account for a significant share of global GHG—often cited as up to ~11% of global greenhouse-gas emissions (Source [Link](#)). As global trade volumes increase, logistics networks are under pressure to decouple growth from carbon output. This study examines sustainable and green logistics practices from a Global and Middle East perspective. Drawing on qualitative and comparative analysis of international frameworks, industry innovations, and regional initiatives, it highlights how governments and enterprises are transitioning toward low-carbon logistics. It identifies digitalization, renewable energy, and regulatory integration as the three pillars supporting this transformation. The paper concludes that Sustainable logistics is not only an environmental necessity but also a strategic enabler of long-term efficiency and competitiveness.

Keywords: Sustainability · Green Logistics · Saudi Arabia Vision 2030 · Digital Transformation · Middle East

1. Introduction

Global logistics networks move tens of billions of tons of goods each year, serving as the arteries of world trade and economic activity (ITF / World Bank, 2023). Yet this scale comes at a cost: Freight Transport alone produces nearly **~8 percent** of total CO₂ emissions (Source [link](#)). As climate agreements tighten and consumer expectations evolve, logistics actors face mounting pressure to redesign operations for sustainability.

Over the past decade, governments, corporations, and multilateral bodies have launched programs to Green supply chains through cleaner fuels, intermodal shifts, and smarter resource management. In this context, the Middle East — historically an energy-exporting region — is repositioning itself as a renewable and logistics powerhouse. **Saudi Arabia's Vision 2030**, the UAE's Green Agenda 2050, and Oman's Vision 2040 all recognize logistics as central to sustainable diversification.

This study explores the global landscape of sustainable logistics and assesses how Middle Eastern initiatives contribute to the worldwide shift toward carbon-neutral transport and trade.

This research is significant as it bridges global sustainability frameworks with region-specific transitions in the Middle East, offering actionable insights for policymakers and logistics planners.

2. Global Context of Green Logistics

2.1 Evolution of Sustainability in Logistics

Early sustainability programs in logistics emerged during the 1990s focusing on fuel-efficiency and recycling. The 2000s saw corporate environmental reporting expand into full ESG frameworks, integrating carbon metrics and ethical sourcing. Today, “green logistics” encompasses every step — from procurement to final-mile delivery — and aligns environmental goals with economic performance.

2.2 Policy Frameworks and Emission Trends

Global CO₂ emissions from freight are projected to rise significantly without intervention. Regional policy frameworks (such as in the EU and U.S.) aim to deepen cuts in transport emissions, and the Paris Agreement has prompted numerous countries to incorporate transport-sector considerations into their national climate plans.

Table 1: Summarizes key regional strategies

Region	Main Policy	Target Year	Key Focus
Europe	EU Green Deal	2050	Carbon-neutral transport
Middle East	Vision 2030 / 2050 Agendas	2060	Renewables & Green hydrogen-powered

3. Methodology

This research employs a **qualitative comparative approach** based on secondary data. Reports from the World Bank, International Transport Forum (ITF), UN Environment Program (UNEP), and regional ministries (2020–2025) form the primary dataset. Peer-reviewed articles and consulting white papers (e.g., PwC, McKinsey) were also reviewed.

Analytical techniques included content analysis of policy documents, benchmarking of regional practices, and cross-case comparison between developed and emerging markets. All data is publicly available; no company-specific information is used.

4. Drivers of Green Logistics

Sustainability in logistics is propelled by four interlinked drivers: (1) Environmental responsibility, (2) Regulatory compliance, (3) Technological innovation, and (4) Economic resilience.

- **Environmental:** Growing climate awareness and corporate carbon disclosures compel greener operations.
- **Regulatory:** Carbon taxes and emission quotas create financial incentives for efficiency.

- **Technological:** Electrification and IoT enable optimization at unprecedented scale.
- **Economic:** Fuel price volatility and customer demands make sustainability a competitive advantage.

5. Sustainable Transport Technologies

5.1 Electrification and Alternative Fuels

Electric trucks are gaining traction for short and medium hauls; hydrogen and LNG serve heavy freight. The energy density of modern batteries now exceeds 250 Wh/kg, making electric vehicles feasible for city distribution.

5.2 Intermodal Transport

Shifting cargo from road to rail or sea substantially cuts emissions per ton-km (McKinsey, 2023). Europe's Alpine Corridor ([Link](#)) and China's Belt and Road rail links ([Link](#)) are benchmarks. For the Middle East, projects like the Saudi Land Bridge will enable similar intermodal benefits.

5.3 Autonomous and Connected Logistics

Autonomous vehicles and AI-driven route optimization reduce empty runs and driver fatigue, improving both safety and sustainability.

6. Green Warehousing and Smart Infrastructure

The World Economic Forum (WEF) states that the logistics sector accounts for up to **11% of global greenhouse-gas emissions** ([Link](#)), which includes freight, warehousing and ports. Green buildings use solar roofs, smart lighting, and thermal insulation to cut consumption case-dependent up to 30–40 percent. Automation and high-density storage further reduce space and power needs.

Case Example: DHL's Dubai sites have been solar-roofed, producing ~11,000+ MWh annually and offsetting around 5,000 t CO₂ per year. (Source [Link](#))

7. Digital Transformation in Sustainability

Digitalization functions as the nervous system of Green Logistics. Blockchain ensures data integrity in carbon tracking; AI predicts vehicle maintenance; IoT sensors monitor fuel consumption in real time.

Table 2: Summarizes key digital enablers

Technology	Sustainability Benefit	Example
AI Analytics	Predicts demand to avoid over-production	Amazon forecast models
IoT Sensors	Real-time fleet monitoring	Maersk containers
Blockchain	Traceable carbon ledger	IBM TradeLens
Digital Twins	Simulate network efficiency	Siemens ports
Cloud Platforms	Collaborative data sharing	FASAH KSA

Digital integration has significantly improved port efficiency, leading to faster cargo clearance and shorter dwell times in

countries with advanced logistics systems (World Bank, 2023).

8. Circular Economy and Reverse Logistics

Circular logistics manages product returns, recycling, and remanufacturing. Companies increasingly design “closed-loop” systems to recover materials and minimize waste. Reverse logistics centers have become mainstream in Europe and Asia.

Example: IKEA's reverse logistics and circular design programs emphasize recycling and material recovery, showcasing how sustainable operations can also enhance efficiency and profitability.

9. Economic and Operational Impact

Green logistics practices can deliver measurable cost reductions through fuel efficiency, lower maintenance, and better asset utilization, often achieving savings in the 5–20 % range depending on operation scale and technology use. Moreover, companies with strong ESG profiles enjoy better access to capital and brand loyalty.

10. Middle East Focus: Regional Transformation

10.1 Strategic Vision

The Middle East is rapidly adopting sustainability as a core pillar of economic diversification. **Saudi Arabia's Vision 2030** targets net-zero by 2060, and the **National Transport and Logistics Strategy (NTLS)** positions the Kingdom as a top-10 global logistics hub.

The UAE's **Green Agenda 2050** and Oman's **Vision 2040** similarly prioritize low-carbon transport and renewable-energy logistics zones. These initiatives aim to shift the region from hydrocarbon dependency to sustainable mobility leadership.

10.2 Saudi Arabia: Leading Vision 2030 Reforms

Saudi Arabia's transport sector accounts for about one-fifth of national greenhouse gas emissions. The Ministry of Transport and Logistics Services is advancing sustainability initiatives through its National Transport and Logistics Strategy, promoting low-carbon mobility and green-corridor development.

“We are ushering in a new green era for the region; in which we are collectively leading and reaping its fruits, in our joint belief that the effects of climate change are not limited to the natural environment only, but also to the economy and security of our nations” - **HRH Mohammed bin Salman, Crown Prince and Prime Minister of Saudi Arabia. (Saudi Green Initiative 2024)** (Source [Link](#))

Key Initiatives:

- **NEOM Green Hydrogen Company (NGHC):** Is building the world's largest green hydrogen plant that will use 100% renewable energy. (Source [Link](#))

- **Red Sea Global Logistics:** RSG Becomes First Saudi Company to Use Only Sustainable Fuels in All Land Supply Chain Vehicles. (Source Link)

10.3 United Arab Emirates

The UAE hosts several of the region's most advanced green ports and warehouses. **DP World's Jebel Ali Port** operates hybrid cranes and electric yard vehicles; its Carbon Calculator monitors emissions per container move. (Source Link)

10.4 Oman and Qatar

Oman's **Duqm Port** project called **HYPORT Duqm** is under development. It will use on-site wind + solar to produce green hydrogen and its derivative (green ammonia) for export. (Source Link)

Qatar's **Hamad Port** has introduced digital automation and is piloting solar PV installations, demonstrating progress toward smart & sustainable port operations.

Together, these initiatives reflect the Middle East's transition from oil dependency to clean logistics innovation.

11. Challenges in the Regional Transition

Despite progress, the region faces obstacles: Challenges include high capital costs for EV fleets, insufficient charging infrastructure, and a shortage of green logistics specialists. Policy harmonization across GCC countries is still developing. However, public-private partnerships and foreign investments are bridging these gaps.

12. Future Outlook: Green Trade Corridors

Green Corridors aim to link global ports and industrial zones through carbon-neutral routes. Regional initiatives in the Gulf are moving toward cleaner maritime trade, aligned with international efforts to decarbonize global logistics.

13. Results and Discussion Summary

- 1) Sustainable logistics practices are economically viable when supported by policy incentives.
- 2) Digital technologies are key to measuring and reducing emissions.
- 3) The Middle East is emerging as a leader in renewable logistics innovation.
- 4) Regional collaboration could accelerate green corridor development.

14. Conclusion

Green logistics is transforming from a compliance requirement to a strategic advantage. Globally, nations are investing in clean transport and renewable energy; the Middle East is positioning itself as a renewable logistics hub linking three continents.

Saudi Arabia's and the rest of Middle East's pioneering projects demonstrate that carbon-neutral logistics is

achievable within a decade through innovation and investment, coupled with greater regional policy integration.

15. Recommendations

- Adopt a regional carbon-tracking platform to standardize metrics.
- Encourage joint R&D for hydrogen and EV transport technologies.
- Create Green Logistics Training Centers to build local skills.
- Expand renewable-energy zones in industrial cities and ports.

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