

SECTION «ECONOMIC SCIENCES»

TRANSFORMATION OF TRADE LOGISTICS AND TOURISM INDUSTRY IN THE CONTEXT OF ESG AND GREEN ECONOMY: A STRATEGY FOR SUSTAINABLE DEVELOPMENT OF GLOBAL SUPPLY CHAINS

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DOI: <https://doi.org/10.30525/978-9934-26-651-5-30>

Abstract. This work synthesizes the full topic of transforming trade logistics and the tourism industry under ESG and the green economy by showing how regulatory pressure, investor expectations, carbon related cost mechanisms, and physical climate risks jointly redefine what competitiveness means in global supply chains. It consolidates the argument that sustainability is no longer a reputational add on, it becomes a measurable management discipline that requires defensible data, standardized calculation methods, robust governance, and value chain due diligence that extends beyond direct operations into suppliers and subcontractors. The Summary also integrates the practical pathway for implementation, starting with baseline definition and internal controls for reporting, moving through digital enabled measurement systems, then scaling operational decarbonization in transport, facilities, and circularity, and finally expanding transformation across the value chain while embedding resilience against disruptions such as heat, floods, storms, and wildfires. Across both sectors, the central conclusion is that credible transparency, auditable evidence, and coordinated investment portfolios enable organizations to reduce emissions intensity, manage social and environmental risks, protect access to finance and markets, and build long term resilience and profitability, while aligning global supply chains with the trajectory of the green economy.

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Introduction

The relevance of the topic of transforming trade logistics and the tourism industry in the context of environmental, social and governance (ESG) criteria and the green economy arises from the transition from voluntary declarations to formalized requirements for transparency, accountability and comparability of data in global supply chains. Businesses are increasingly dependent on access to financing, insurance and partnerships, and these are already tied to the quality of non-financial reporting, the feasibility of decarbonization plans and the ability to manage risks in value chains. At the same time, regulatory pressure is increasing in the European Union through the introduction of corporate sustainability reporting, where the first companies will apply the rules by the financial year 2024, and the reports will be published in 2025. Additionally, the Global Value Chains Due Diligence Directive has already entered into force on 25 July 2024, making legal responsibility for environmental and human rights impacts a practical part of supply chain and service management. For trade logistics, ESG and the green economy are changing not only technological approaches but also the very position on competitiveness, as the carbon footprint of transportation, warehousing and port operations directly affects the price, timing and reliability of deliveries. This therefore stimulates a review of routes, modal combinations, carrier contracts, packaging standards and approaches to inventory management. The maritime component of global trade is particularly illustrative, where the European Union has already extended the Emissions Trading System to maritime transport from 1 January 2024, and the requirements for surrendering quotas are increasing gradually. In parallel, the International Maritime Organization has set targets to reduce carbon intensity by at least 40% by 2030 and a target of achieving net zero emissions around 2050, which forms a long-term trajectory for investments in fuel and fleets. It is not uncommon for such market signals to drive companies to continue investing in decarbonization, even when global emissions pricing mechanisms are debatable or postponed. The importance of the topic is further enhanced by the carbon regulation of foreign trade, as it transfers climate requirements from the company's internal environment to the entire supply chain, including suppliers of raw materials and semi-finished products in third countries. The carbon import adjustment mechanism has a transition period from 1 October 2023 to

31 December 2025, and from 1 January 2026 a regime with the need to purchase certificates to cover embedded emissions in certain product groups will be launched. This approach forces companies to establish batch-level emissions data collection, supplier verification and consensus assessment methodologies, otherwise they risk losing margins, contracts or markets. At the same time, the geo-economic impact of the mechanism is already becoming a subject of trade negotiations, highlighting its systemic impact on global value chains, not just individual companies.

The tourism industry is no less critical for research, as it combines transport, accommodation, food, events and retail, and therefore creates a complex demand chain that generates significant emissions worldwide. Scientific estimates show that in 2019, tourism-related emissions reached 5.2 gigatonnes of CO₂ equivalent, or 8.8% of global greenhouse gas emissions, and tourism growth rates may exceed the global average. At the same time, profile international estimates indicate that transport emissions from international tourism could increase by 45% between 2016 and 2030 if technologies and behavioral patterns do not change. The European Union is already introducing mandatory shares of sustainable aviation fuels from 2025 at a level of 2%, with subsequent increases, which directly changes the cost of air transport and competition between destinations, and also pushes for a reformatting of tourism products and seasonality. Thus, this study is important due to the need for a joint strategy for the sustainable development of global supply chains, where trade logistics and tourism mutually reinforce impacts and risks. Solutions should cover fuel transition, energy efficiency of warehouses and hotel infrastructure, route optimization, waste reduction, as well as management of social aspects, in particular labor conditions in supply chains and the impact on local communities. A key prerequisite is a qualitative assessment of emissions and traceability, where solutions based on applied digital technologies are needed for data collection, verification, planning and reporting, otherwise companies will not be able to prove compliance to investors, regulators or partners. At the same time, the problem of harmonizing the boundaries of responsibility and methodologies remains in the tourism sector, which makes it difficult to compare results and form incentives, so the scientific substantiation of approaches to assessment and management acquires applied value for business and authorities.

1. Regulatory and Market Drivers of the ESG and Green Economy Transformation of the Trade Logistics and Tourism Industries

Environmental, social and governance (ESG) criteria have evolved from a reputational supplement to a mandatory management component that determines access to capital, insurance conditions, borrowing costs and the ability to remain in international supply chains. This is especially noticeable for trade logistics and tourism, as both sectors operate at the intersection of transport infrastructure, energy consumption, human resources management and interaction with local communities, and therefore have a wide range of impacts that investors and partners seek to see in numbers and procedures. Consequently, this creates a new culture of accountability, where what is important is not slogans, but data, methods of their collection, verification and a clear plan for the transition to a green economy. That is why corporate sustainability reporting has acquired a practical dimension in the European Union, and the first companies will apply the rules by the financial year 2024, publishing reports in 2025, while the regulator is gradually clarifying the standards to reduce ambiguities for business. In parallel, sustainable finance instruments are setting a common definition of what activities are considered environmentally sustainable, and thus investment decisions are increasingly linked to real changes in value chains, and not just to internal company policies.

The Sustainable Development Due Diligence Directive requires companies to identify, prevent, reduce and eliminate negative impacts on human rights and the environment in their own operations, in subsidiaries and in relationships in the value chain, including with suppliers and contractors in the external environment. For trade logistics, this means that the criteria for selecting a carrier, warehouse operator, port terminal, packaging provider, security service or outsourced personnel are subject to formalised review, with risks recorded, remediation plans and evidence of implementation. For the tourism industry, the consequences are no less severe, because a typical tourist service is a complex one, and risks arise at every stage, from working conditions in a hotel or restaurant to the ethics of the food supply chain, souvenirs, textiles, and the environmental impact of mass-visited places [1-3]. Thus, this is no longer a discussion about good intentions, but a managerial responsibility

that affects contracts, prices, terms, and the possibility of cooperation with international brands.

Table 1 organizes the external forces that are pushing both trade logistics and the tourism industry toward ESG aligned operations and the green economy. The key point is that these drivers do not act in isolation, they stack on top of each other and create a new definition of commercial viability. Reporting expectations make transparency non negotiable, due diligence rules turn social and environmental risks into legal and contractual liabilities, and carbon related mechanisms make emissions behave like a price component that can move margins. When these pressures combine, organizations are no longer competing only on speed, cost, and service quality, they also compete on the credibility of their data, the robustness of their supplier controls, and the maturity of their transition plans. This is why the table emphasizes what the driver demands and which evidence must exist, because the ability to document a claim is becoming as important as the claim itself.

Climate policy has begun to directly change the rules of foreign trade, and the Carbon Import Adjustment Mechanism plays a key role here. Its design is important for the topic, as it forces companies to consider emissions as part of the cost of goods before they cross the border, and to build a transparent data chain on embedded emissions. The transition phase lasts from 2023 to 2025, and from 2026 the mechanism will move to a full-fledged regime, where importers not only report, but also purchase certificates to cover emissions inherent in certain groups of goods. For trade logistics, this means that customers will increasingly demand from suppliers and carriers verified data on energy efficiency, fuel composition, routes, losses, waste, as well as on the methodology for calculating indicators. For the tourism industry, the effect is indirect but powerful, since a significant part of the tourism product relies on imported materials and goods, and the carbon cost is gradually passed on to the end consumer. At the same time, businesses face regulatory uncertainty regarding the detail of the rules and possible simplifications, so risk management should include scenario planning and working with suppliers in advance, rather than when the costs have already materialized.

Table 1

**External drivers of transformation,
what they mean for trade logistics and the tourism industry**

Driver	What it practically demands	Implications for trade logistics	Implications for the tourism industry
1	2	3	4
Sustainability reporting obligations and investor expectations	Comparable, audited sustainability information, clear transition plans, and evidence that targets are linked to budgets, governance, and operational controls	Shippers and logistics providers must disclose emissions, energy use, safety performance, labor practices, and supplier risks, contracts increasingly require verified emissions factors per lane and per service	Hotels, tour operators, airlines, and destination managers must evidence emissions reduction plans, water and waste management, labor standards, and community impacts, marketing claims must match measurable performance
Supply chain due diligence, human rights, and environmental accountability	Systematic identification and mitigation of adverse impacts across the value chain, not only within the organization, proof of action and remediation when issues occur	Carrier selection and subcontracting require structured screening, documentation of working conditions, safety, wage compliance, and environmental practices across ports, warehouses, and last mile operations	Tourism supply chains are multi tier, food, laundry, cleaning chemicals, construction, and excursions require responsible sourcing, local community impacts must be assessed and managed
Carbon cost pass through and border related carbon rules	Emissions become a cost factor, documentation is required for embedded emissions, pricing and contracting start reflecting carbon intensity	Route choice, modal split, and warehouse network design shift, carbon efficient services become competitive, low data maturity becomes a direct commercial risk	Tourism packages become more price sensitive due to transport emissions costs, long haul and carbon intensive experiences face higher scrutiny, destinations compete on low impact mobility and verified sustainability

(End of Table 1)

1	2	3	4
Decarbonization standards in transport and energy transition	Gradual tightening of fuel and energy requirements, greater use of low carbon fuels, electrification, and energy efficiency	Fleet renewal, fuel strategy, port and warehouse electrification, shore power readiness, charging infrastructure planning, operational optimization to reduce fuel burn	Sustainable aviation fuel adoption affects airfare, rail and coach substitution grows in many markets, hotels face higher expectations for electrification and renewable procurement
Customer and brand pressure, credibility of sustainability claims	Claims must be specific, measurable, and verifiable, greenwashing risk becomes material, transparency is expected	Logistics providers are asked for emissions per shipment, evidence of low carbon options, and proof of labor and safety standards in subcontracting	Tourists and corporate travel buyers increasingly require verified labels, transparent impacts, and credible community benefits
Physical climate risks and resilience	Continuity planning for heat, floods, storms, wildfires, and water stress, adaptation actions, and stress tests	Ports, warehouses, and transport corridors face disruption, inventory policies and safety stocks change, insurance costs increase, resilience becomes a performance dimension	Destinations face seasonality shifts, water stress, and extreme weather, safety planning for tourists becomes critical, infrastructure investment priorities change

Source: Formed by the author

Table 2 translates sustainability ambition into an operating model that can actually run day to day across global supply chains. It focuses on governance, procurement, mobility design, facilities and energy, circularity, workforce and community, and customer transparency. The logic is simple, a strategy without owners, controls, and routines will collapse into fragmented initiatives that cannot be scaled or verified. Trade logistics needs an operating model because emissions and social risks sit across

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functions, network planning influences transport intensity, procurement controls carrier selection, operations determine fuel burn, and finance governs investments and reporting. Tourism needs the same discipline because the product is assembled from many suppliers, accommodation and mobility interact, and destination relationships determine whether growth is compatible with environmental and community capacity.

Table 2

**Integrated operating model for sustainable global supply chains
in logistics and tourism**

Operating model component	What good looks like in practice	Trade logistics examples	Tourism industry examples	Solutions based on applied digital technologies that support execution
1	2	3	4	5
Governance and accountability	Clear decision rights, board and executive oversight, cross functional ownership, incentives aligned with targets, escalation paths for breaches	Procurement, network planning, operations, and finance share ownership of emissions and safety outcomes, carrier compliance is governed, not ad hoc	Sustainability owners exist for mobility, accommodation, food, excursions, and destination relations, community engagement has accountable owners	Workflow for approvals, audit trails for changes, role based access to data, automated alerts for threshold breaches
Sustainable procurement and supplier management	Supplier entry requirements include labor and environment, risk scoring is updated, corrective actions are tracked, termination criteria exist	Carrier and warehouse tenders include emissions disclosure, safety records, and labor standards, subcontractor transparency is required	Food, laundry, cleaning, construction, and activity providers are screened, local sourcing is measured, community impacts are managed	Supplier portals, digital questionnaires, risk scoring engines, corrective action tracking, document management

1	2	3	4	5
Low carbon transport and mobility design	Modal strategy is explicit, optimization reduces empty runs, electrification and low carbon fuels are planned and measured	Shift from road to rail where feasible, route optimization for last mile, consolidation hubs reduce partial loads	Promote rail plus hotel packages, support coach and shared mobility, enable longer stays with fewer trips where appropriate	Routing optimization, telematics, demand forecasting, carbon calculators with verified factors
Facilities, energy, and infrastructure	Energy efficiency investments are prioritized, electrification is planned, renewable procurement is credible, maintenance supports performance	Warehouse energy management, electric material handling equipment, smart heating and cooling, refrigeration loss control	Hotel energy retrofits, smart building management, heat pumps, efficient laundry, water management	Energy management platforms, building management integration, sensor data, predictive maintenance
Circularity and waste	Waste prevention, reuse, and high quality recycling are designed into operations, packaging strategy is measurable	Returnable packaging, pallet pooling, reduced single use materials, reverse logistics for returns and repairs	Reuse systems in hospitality, food waste reduction, refillable amenities, sustainable event management	Inventory and waste tracking, reverse logistics traceability, analytics for loss drivers
Social impact, workforce, and community	Safe work, fair terms, training, diversity and inclusion practices, community benefit, grievance channels that work	Driver safety programs, fatigue management, subcontractor wage compliance, safe warehouse practices	Decent work across seasonal staff, safe excursions, respectful destination management, community benefit sharing	Incident reporting tools, training platforms, grievance management systems, workforce scheduling analytics

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(End of Table 2)

1	2	3	4	5
Customer transparency and product design	Clear service offers with measurable impacts, credible claims, tailored reporting for business customers	Shipment level emissions statements, low impact service tiers, transparent assumptions	Carbon aware packages, verified eco labels, transparent destination impacts and community contributions	Customer dashboards, reporting APIs, digital passports where relevant, claim approval workflows

Source: Formed by the author

Transport, as a key component of logistics, has received specific emission pricing mechanisms and fuel standards, and these are transforming the economics of transport. The extension of the Emissions Trading Scheme to maritime transport means that emissions from 1 January 2024 will be gradually covered by quotas, with the first surrender obligations arising in 2025 for emissions in 2024, with a gradual increase in the coverage share until full coverage. For global supply chains, this changes the negotiating position of the parties, as freight rates, port selection, vessel speed, port technology and inventory planning start to take the carbon component into account as a regular payment. In parallel, FuelEU Maritime sets regulatory limits for the average annual greenhouse gas emission intensity of energy used by ships, with a starting reduction starting in 2025. This therefore stimulates investments in fleet modernization, alternative fuels, shore-side power supply, optimization of logistics schemes and increased planning accuracy. In this area, the role of solutions based on applied digital technologies for fuel monitoring, routing, downtime management and data documentation is becoming critical, because without this, companies will lose not only money, but also the trust of partners.

Climate requirements are increasingly determining the product, its price and the geography of demand. The ReFuelEU Aviation regulation sets a minimum share of sustainable aviation fuels in the fuel mix at European Union airports, with a starting level of 2% from 2025, then the share increases over the coming decades. For the tourism industry, this means that the change in the fuel structure is gradually translated into the tariff policy

of air carriers, and therefore affects the competitiveness of destinations, seasonality, travel duration and the combination of modes of transport. At the same time, scientific assessments show that tourism accounts for a significant share of global greenhouse gas emissions, in particular for 2019, the estimate of 8.8% underlines that without systemic changes, the sector will not be able to align growth with the trajectory of the green economy. At the same time, the market is already showing tensions between regulatory targets and the actual production volumes of sustainable aviation fuels, and discussions on the pace of tightening requirements are becoming part of the strategic risks for tour operators, airlines, hotel chains and authorities responsible for tourism policy. Logistics provides the tourism industry with goods, products, equipment and services, while tourism creates peak demand for transportation and accommodation, which increases the load on energy systems, transport hubs and urban infrastructure. Therefore, a sustainable supply chain strategy should not only include reducing emissions, but also increasing resilience to physical climate risks, such as heat, floods, fires, storms that disrupt routes, ports, airports and tourist areas. At the same time, business decisions should take into account the social component, in particular working conditions, staff safety, fair procurement practices and interaction with communities, because this is where reputational crises often arise, which quickly turn into financial losses. Additionally, discussions are ongoing in the European Union about possible adjustments to the scope and timing of certain reporting and due diligence requirements, and this reinforces the need not to rely on minimum compliance, but to build a flexible data and risk management system that will be viable under different scenarios. Thus, this makes the topic both practical for business and important for the scientific substantiation of effective management approaches.

A complete understanding of transformation requires a strategic lens that treats trade logistics and the tourism industry as interconnected systems rather than separate sectors. Logistics shapes the availability, price, and reliability of goods and services that tourism depends on, while tourism creates concentrated and highly seasonal demand that reshapes freight flows, passenger mobility, inventory policies, and capacity planning. In this combined system, environmental, social, and governance expectations become a set of constraints and opportunities that influence every strategic

choice, including where to locate hubs and warehouses, which corridors to prioritize, how to design multimodal networks, and how to develop tourism products that fit within environmental limits and community expectations [4-5]. When organizations treat sustainability as a network design problem, they can move beyond isolated initiatives and instead redesign flows, contracts, and service portfolios so that lower impact outcomes are achieved together with higher resilience and better service quality. This is why the strategic focus shifts from single site improvements to end to end value chain outcomes, where decision makers must see how actions in procurement, transport, facilities, accommodation, and destination management interact, and where trade offs must be made explicit, documented, and continuously reviewed.

A central strategic task is segmentation, because not every route, supplier, and tourism product has the same impact profile or the same improvement potential. For trade logistics, segmentation often starts with lanes, modes, and customer service tiers, then expands to commodity classes and packaging systems, because these determine load factors, refrigeration needs, spoilage risk, and the feasibility of consolidation. For tourism, segmentation typically starts with trip distance, mobility mix, accommodation type, and intensity of activities, then expands to seasonality and destination sensitivity, because these drive both emissions and local pressures such as water stress, waste generation, and crowding. Once segmentation is in place, organizations can build a portfolio strategy where low impact options are designed as first class offers rather than exceptions, and where high impact areas receive targeted innovation and investment. In practice, this means developing differentiated packages and logistics services that include transparent impact statements, credible improvement plans, and clear customer choices, while also protecting affordability and accessibility. A mature strategy makes these options commercially viable by linking them to pricing logic, procurement incentives, and service design, so sustainability becomes a repeatable part of how products are built and sold, not an afterthought. A second strategic pillar is the integration of circularity, because global supply chains cannot align with the green economy if they remain dominated by linear flows of materials, packaging, and short lived assets. For trade logistics, circularity shows up in returnable transport items, pallet pooling, reusable packaging, reverse logistics for returns and repairs,

and improved inventory management that reduces waste and obsolescence. For tourism, circularity appears in reuse systems in hospitality, refill and bulk purchasing models, repair and refurbishment of furniture and equipment, food waste prevention programs, and procurement standards that prioritize durability, reparability, and responsible end of life handling. The strategic point is that circularity is not only an environmental measure, it is also a resilience measure, because it reduces exposure to material price shocks, supplier disruptions, and regulatory constraints on waste and single use products. Organizations can scale circularity only when it is embedded into contract structures, service standards, and performance indicators, which requires coordination across many partners, including manufacturers, logistics providers, property operators, and local waste and recycling systems. Solutions based on applied digital technologies become essential here, because they enable traceability of assets and packaging, measurement of return rates and losses, and analytics that identify where leakage occurs in reverse flows, making circularity operationally manageable rather than aspirational.

A robust approach treats data as a governed asset with clear ownership, controlled methods, and auditable trails that connect calculations to primary evidence such as fuel records, meter readings, procurement data, and supplier attestations. In trade logistics, trust is often built through shipment level reporting, lane level performance benchmarking, and supplier data sharing agreements that cover subcontracted legs and last mile operations. In tourism, trust requires coherence across the full package, including mobility, accommodation, food, excursions, and destination impacts, which means collecting data from many small providers and aligning definitions so results can be compared and improved. The strategic challenge is that the most material impacts often sit outside direct operations, and therefore depend on supplier cooperation, capacity building, and shared standards that reduce reporting burden while increasing reliability [6-7]. Digital infrastructure supports this work through automated workflows, document management, calculation engines with version control, and customer reporting dashboards, which together reduce the risk of inconsistent numbers and uncontrolled marketing claims. Over time, the strategic advantage comes from using the same data system for compliance, for customer transparency, and for internal optimization, so the

organization learns faster than competitors and can demonstrate progress with confidence.

A fourth strategic pillar is capital allocation and financing readiness, because sustainability and resilience require investment, and investment requires a credible business case that survives volatility in energy prices, demand cycles, and geopolitical disruptions. In logistics, the most common investment decisions involve fleet modernization, electrification of material handling equipment, energy efficiency in warehouses, and infrastructure readiness for low carbon fuels and charging. In tourism, investments typically include building retrofits, electrification and heating upgrades, water efficiency, waste systems, and digital systems that support demand management, operational efficiency, and transparency. The strategic issue is that many benefits are distributed across the value chain, while costs are often concentrated in a single organization, which creates a coordination problem that must be solved through contracting models, shared savings arrangements, and long term partnerships. A strong strategy therefore pairs technical decarbonization pathways with commercial mechanisms, including green clauses in contracts, incentives linked to verified performance, and procurement policies that reward credible improvements. It also integrates transition risk and physical climate risk into financial planning, because a sustainable supply chain strategy that ignores disruption risk can quickly become unprofitable when corridors fail, destinations suffer extreme weather, or insurance costs spike. When capital allocation includes both mitigation and adaptation, organizations build durability, and that durability becomes a competitive advantage in markets where reliability and trust are increasingly scarce. A fifth strategic pillar is governance and social legitimacy, because global supply chains operate within communities, labor markets, and ecosystems, and long term viability depends on maintaining permission to operate. In trade logistics, social legitimacy relates to safety, fair treatment of drivers and warehouse staff, transparency in subcontracting, and responsible behavior in local communities around ports, terminals, and distribution centers. In tourism, legitimacy is even more visible, because the industry interacts directly with residents, local services, and cultural and natural heritage, and therefore must manage issues such as overcrowding, resource pressure, and equitable distribution of benefits. A strategic approach treats these social dimensions as measurable and managed, with grievance

mechanisms that function, clear standards for suppliers, and community engagement that is continuous rather than occasional. It also recognizes that reputational risk now travels rapidly through digital channels, and that inconsistency between claims and reality can destroy brand trust and contract relationships in a short period. By embedding social safeguards into procurement, operations, staff training, and partner selection, organizations reduce the likelihood of crises, improve retention and service quality, and strengthen their ability to collaborate with public authorities and destination managers. The overall strategic conclusion is that sustainable global supply chains are built through coordination, credible data, disciplined investment, and community legitimacy, and when these elements are aligned, trade logistics and tourism can deliver lower impact outcomes while improving resilience, reliability, and long term competitiveness.

A credible transition to sustainability in global supply chains increasingly depends on digitalization, because most high impact decisions require timely, granular, and verifiable information across many partners. Trade logistics needs visibility into shipment level activity, subcontracted legs, fuel and electricity use, and operational drivers such as load factors and idle time [8-11]. The tourism industry needs comparable visibility across mobility, accommodation, food and beverage, excursions, and destination services that are often delivered by small providers. When these sectors lack data consistency, they tend to over rely on generic assumptions, which weakens decision making and exposes organizations to disputes, audit findings, and greenwashing risk. Digitalization therefore becomes the practical bridge between strategy and proof, because it creates the capability to measure, steer, and demonstrate outcomes with an evidence chain that can withstand scrutiny. In logistics, telematics, transport management systems, warehouse management systems, smart meters, and fuel records can be integrated so that emissions intensity, energy intensity, and safety performance are updated frequently and linked to specific lanes, facilities, and suppliers. In tourism, property management systems, utility metering, waste tracking, procurement systems, and booking data can be connected to translate guest nights and itineraries into measurable resource use and impact profiles. The value of integration is not only measurement, it is operational control, because it exposes where inefficiency and risk concentrate, such as empty kilometres, refrigeration losses, peak

energy loads, or suppliers that repeatedly fail compliance checks. When integration is built with strong governance, including clear ownership, version control for methods, and audit trails, the same system can support internal steering, customer reporting, and assurance readiness without constant manual work.

In logistics this includes route and load optimization, consolidation planning, network design modelling, inventory policy tuning, and scenario analysis that incorporates carbon cost variables and disruption risks. These capabilities matter because emissions reductions in logistics often depend on operational patterns rather than a single technology switch, and small improvements in load factor or routing can deliver meaningful reductions when applied across a large network. In tourism, analytics can support demand shaping, seasonality management, and product design that reduces mobility intensity while protecting customer value, for example by bundling rail based itineraries, promoting longer stays with fewer transfers, or managing visitor flows in sensitive areas. In both sectors, digital twins and simulation models can help decision makers test trade offs between cost, service level, emissions, and resilience before committing capital, which reduces the risk of stranded investments and improves the credibility of transition plans. Digital product and asset passports, secure document exchange, standardized supplier data portals, and controlled calculation engines can reduce the burden of repeated questionnaires and create a shared source of truth for key indicators. In logistics, traceability supports shipment level emissions statements, subcontractor transparency, and evidence for compliance across cross border movements. In tourism, traceability supports responsible sourcing for food and materials, verification of accommodation practices, and credibility for destination level commitments that depend on many providers. Trust infrastructure also protects organizations from unintentional inconsistency, because it enforces method discipline and prevents marketing claims from drifting away from what data can support. When designed well, it supports smaller suppliers by providing simple templates and assisted reporting, which improves inclusion and reduces the risk that sustainability requirements push value chain partners out of the market.

Innovation also sits in physical and operational technologies that reduce impact directly, and digital systems accelerate their adoption by making

performance visible and manageable. Logistics innovation includes electrification of material handling, energy management in warehouses, smart charging, predictive maintenance that keeps vehicles and equipment operating efficiently, and automation that reduces waste and rework. Tourism innovation includes smart building controls, heat pumps and electrification, water efficiency systems, waste prevention and reuse programs, and digital guest engagement that nudges behaviour without degrading experience. The common theme is that technology creates improvement only when it is embedded into operating routines and contracts, meaning performance thresholds are tracked, exceptions trigger action, and suppliers are rewarded for verified progress. Digitalization makes this feasible across networks that would otherwise be too complex to manage.

Finally, digital transformation introduces its own risk dimension, so a mature sustainability strategy also addresses cybersecurity, data privacy, and workforce readiness. Both logistics and tourism rely on critical systems that, if disrupted, can halt operations and create safety risks, so resilience must include secure architectures, access controls, and contingency plans for digital failures. Equally important is capability building, because the best data system fails if users do not trust it, do not understand it, or cannot translate insights into action. Organizations that succeed treat digitalization as a managed change program with training, clear roles, and practical incentives, and they prioritize interoperability so partners can exchange data without expensive bespoke integrations. In this way, Section 6 completes the transformation narrative by showing that innovation and solutions based on applied digital technologies are not optional extras, they are the enabling infrastructure that allows sustainable supply chain strategies in trade logistics and tourism to be measured, verified, improved, and scaled.

2. Tools, data and practices for implementing sustainability in global supply chains for trade logistics and the tourism industry

A strategic approach to the topic at a practical level should start with governance, which determines how environmental, social and governance criteria are translated from declarations into daily decisions in procurement, operations, interactions with partners and work with customers. In trade logistics, the key pillar is the procurement and contract policy, where

requirements for energy efficiency, fuel composition, waste management, working conditions and personnel safety should often be recorded as formal performance indicators, as well as grounds for corrective actions and supplier reviews. In the tourism industry, the same trajectory is implemented through standards for hotels, tour operators, event organizers and destinations, where the management discipline includes ethical supply chains, reducing environmental impact and real benefits for local communities. That is why practical guidelines such as the Global Sustainable Tourism Council standards provide a common language for businesses and governments, allowing for comparisons and alignment of expectations between market participants. Then there is the issue of data, as without systematic impact accounting, a company will neither be able to honestly set priorities nor convincingly demonstrate progress to investors, partners and customers. For logistics, a consistent methodology for calculating emissions in transport chains is critical, where the International Organization for Standardization has proposed standard 14083 as a common basis for quantifying and reporting emissions related to passenger and freight transport in multimodal chains. The practical effect is enhanced by the approach of the Global Logistics Emissions Council, which directly addresses the application of standard 14083 and unifies calculations for companies measuring logistics emissions across different modes of transport. At the same time, for most companies, the largest share of emissions is in the value chain, so logistics calculations need to be compatible with the Greenhouse Gas Accounting Protocol approach for emissions in the value chain, which provides a methodology for accounting for indirect emissions in interaction with suppliers, contractors and consumers.

Once the database is formed, a set of management levers opens up in logistics that reduce environmental impact and at the same time increase the sustainability of supply chains. At the transportation level, this includes optimizing routes and loading, reducing empty runs, managing high-speed modes, switching to more energy-efficient modes of transport where economically justified, as well as updating the fleet of equipment and increasing data transparency from carriers. At the warehouse and distribution center level, energy efficiency of buildings, electrification of loading equipment, intelligent lighting and climate control, reducing losses in cold chains, as well as circular approaches to packaging, container return

and material recycling become important. For companies setting science-based climate targets, the Science-Based Targets Initiative's specific guidance materials, particularly for maritime transport, are of practical benefit, as they help link accounting to an emissions reduction trajectory and investment plan.

Table 3 is the measurement backbone, it shows which data domains must exist to make sustainability management real rather than symbolic. It covers transport activity and fuel, facilities energy and refrigerants, purchased goods and services, waste and water, social indicators, and customer and community impacts. The core message is that most organizations fail not because they lack good intentions but because they lack a defensible data system. In logistics, the biggest technical challenge is accurate, consistent attribution of emissions across modes and subcontracted legs, with clear boundaries that prevent double counting. In tourism, the biggest challenge is assembling a coherent picture from diverse suppliers and destinations, where data quality varies, definitions differ, and the line between direct operations and value chain impacts is blurry.

In the tourism industry, the implementation toolkit is broader, as the tourism product combines transport, accommodation, food, leisure, events and service procurement. Scientific estimates show that tourism-related emissions in 2019 reached 5.2 gigatonnes of carbon dioxide equivalent, or 8.8% of global emissions, so the sector cannot remain outside the trajectory of the green economy. At the same time, the United Nations World Tourism Organization emphasizes the role of climate action in tourism and the need for changes in transport and operations, since it is the transport component that determines a significant part of the impact. The practical action plan for business is complemented by the roadmap to net zero emissions published by the World Travel and Tourism Council, which details steps for aviation, accommodation, cruises, tour operators and digital intermediaries, and thus translates strategic slogans into a sequence of decisions and investments. A separate component of the full disclosure of the topic is related to transparency and traceability, since global supply chains consist of many suppliers, and data verification without common formats becomes prohibitively expensive. Therefore, solutions based on applied digital technologies should support single data directories, quality control of primary information, exchange of documents with partners, as

well as independent verification. In the context of the European Union market, the idea of a Digital Product Passport becomes important, which provides a digital identity of products, components and materials and the accumulation of information that supports sustainability, circularity and compliance. For logistics, this makes it possible to link product flows with data on materials, maintainability and recycling, and for tourism it opens the way to more transparent procurement in hotels and catering establishments, where the purchase is often guided by the confirmed characteristics of the supplier, and not only by price.

Table 3

Data and measurement system for sustainability across logistics and tourism supply chains

Data domain	What must be captured	Typical sources	How credibility is strengthened	Outputs that stakeholders actually use
1	2	3	4	5
Transport activity and fuel	Distances, loads, occupancy, fuel type and quantity, energy use per leg, operational parameters such as speed profiles where relevant	Telematics, carrier invoices, fuel cards, port call records, airline and rail reporting, booking and ticketing systems	Use standardized calculation methods, ensure traceable emissions factors, require supplier attestations, periodic third party checks	Emissions per shipment and per passenger, mode share reports, route emissions heatmaps, contract level performance
Facilities energy and refrigerants	Electricity and heat use, peak demand, on site generation, renewable procurement evidence, refrigerant type and leakage	Utility bills, meter data, building management systems, maintenance logs, procurement contracts	Metering upgrades, data reconciliation routines, audit trails, independent assurance for key claims	Energy intensity dashboards, project savings tracking, decarbonization roadmap progress, compliance reporting

1	2	3	4	5
Purchased goods and services, value chain impacts	Spend, volumes, supplier specific emissions data where available, risk indicators, labor practices, environmental compliance	Enterprise resource planning systems, supplier portals, audit reports, certifications, procurement records	Tier mapping, supplier verification, sampling audits, consistent questionnaires, documented corrective actions	Supplier scorecards, risk registers, corrective action status, scope three emissions estimates with methodology notes
Waste, water, and circular flows	Waste types and destinations, reuse and recycling rates, food waste, packaging flows, water withdrawal and discharge where relevant	Waste contractor reports, inventory systems, hotel operations systems, site logs, procurement data	Require weight based reporting, align categories across sites, verify contractor documentation, track diversion evidence	Waste reduction performance, circularity indicators, compliance evidence for regulated waste, customer disclosures
Social indicators and labor conditions	Injury rates, working hours, training, turnover, seasonal workforce conditions, grievance outcomes, subcontractor practices	Human resources systems, safety systems, audit reports, hotline records, contractor management tools	Confidential channels, independent audits, root cause analysis, corrective actions with deadlines and owners	Health and safety dashboards, training compliance reports, social risk assessments, buyer due diligence packs
Customer and community impacts	Destination carrying capacity indicators, community benefit programs, local procurement shares, visitor behavior impacts	Destination management data, surveys, procurement records, stakeholder meetings, incident logs	Transparent methodologies, stakeholder validation, periodic impact assessments, documented engagement	Destination sustainability reports, community benefit reporting, responsible tourism product documentation

Source: Formed by the author

A transformation that cannot be demonstrated with credible evidence will not survive regulatory scrutiny, investor reviews, or commercial procurement audits, especially in sectors as networked as trade logistics and tourism. This is why performance management becomes the practical core of ESG aligned supply chains, because it converts broad commitments into measurable outcomes, assigns ownership, and creates routines that expose underperformance early. In logistics, performance management must operate at shipment, lane, facility, and supplier levels, since emissions intensity and social risk are heavily shaped by routing, load factors, subcontracted legs, and working conditions across multiple operators. In tourism, performance management must connect mobility, accommodation, food and beverage, excursions, and destination relations into one coherent picture, because the customer experiences the package as a single product, while impacts occur across many suppliers. A robust system therefore treats sustainability indicators as operational indicators, meaning they appear in weekly or monthly steering meetings, they are linked to budgets and incentives, and they trigger corrective actions in the same way that service failures or safety incidents do. A practical starting point is to define a small set of key indicators that are decision relevant, auditable, and comparable over time, rather than attempting to track everything at once. For trade logistics, priority indicators usually include emissions intensity per tonne kilometre and per shipment, load factor and empty kilometres, fuel mix and electrification share, energy intensity per square metre in warehouses, refrigeration leakage performance where relevant, safety indicators such as total recordable incident rate and severe incident frequency, and supplier compliance rates for labor and environmental requirements. For the tourism industry, the equivalent set typically includes emissions intensity per guest night and per trip, mobility mix and low impact share, energy and water intensity per room night, waste per guest and diversion rates, local procurement share, workforce turnover and training coverage for seasonal staff, and incident and grievance response metrics that demonstrate effective social safeguards. The strategic benefit of a focused indicator set is that it enables clear accountability, it supports investment prioritization, and it allows organizations to communicate progress without exaggeration. Over time, the indicator system can expand into more granular sub metrics, but early success depends on

selecting indicators that actually change decisions, not indicators that only fill reports.

Once indicators are selected, the next challenge is to build an evidence chain that makes every number defensible. In practice, that evidence chain links each indicator to primary activity data, to a documented method, to a clear boundary definition, and to an approval workflow that prevents uncontrolled adjustments. For logistics, an evidence chain typically starts with telematics, transport management systems, fuel and electricity records, carrier invoices, and subcontractor declarations, then it moves through calculation routines that allocate emissions to shipments and lanes, and it ends with a controlled reporting layer that records methodology versions and data quality flags. For tourism, the evidence chain must also integrate property utility data, procurement records, waste contractor documentation, booking and itinerary information, and supplier evidence for excursions and services. The key design principle is that the organization should be able to answer the same questions repeatedly and consistently, including what is counted, what is estimated, what is measured, and why a method changed. This reduces audit friction, protects credibility, and makes performance management useful for operations rather than a once a year compliance task. Assurance readiness becomes a competitive advantage because it lowers the risk of disputes with customers, reduces the likelihood of regulatory penalties, and builds investor confidence. Assurance readiness is not only about external audits, it is about internal controls that prevent accidental errors and intentional manipulation. A strong system includes role based access to data, separation of duties between data entry and approval, automated checks for outliers, documented procedures for recalculations when methods change, and a clear policy for how estimates are used and labeled. It also includes controls for sustainability claims in marketing and sales, so that statements about low carbon services, responsible tourism, or community benefits are backed by evidence that is current and traceable. This is especially important because both logistics and tourism operate in environments where greenwashing risk is material, and where reputational damage spreads quickly. A credible organization therefore treats claim governance as part of risk management, meaning claims are approved through a process, they have owners, they are supported by evidence

packs, and they are withdrawn or revised when evidence no longer meets the standard.

Continuous improvement requires a link between performance indicators and operational levers, otherwise measurement becomes passive. In trade logistics, the main levers include network redesign, modal shift where feasible, consolidation and load planning, carrier selection and contract incentives, fleet and equipment upgrades, warehouse energy management, packaging and reverse logistics programs, and workforce safety programs that reduce incidents and improve retention. In the tourism industry, levers include accommodation retrofits and energy procurement, water and waste systems, changes in food sourcing and menu design to reduce waste and emissions, mobility options that shift demand toward lower impact modes, and product design choices such as encouraging longer stays with fewer trips, improving seasonality balance, and managing visitor flows in sensitive destinations. The most effective organizations run improvement cycles where baseline performance is reviewed, the highest impact levers are selected, pilots are executed with clear success criteria, and results are integrated into standard operating procedures and procurement requirements. This cycle creates learning, and learning becomes an advantage because it reduces cost over time and improves service reliability, not only sustainability outcomes.

Finally, performance management must include resilience and adaptation, because climate related disruptions increasingly determine whether supply chains and tourism services can operate reliably. A mature approach integrates climate risk screening into asset management, corridor planning, destination strategy, insurance decisions, and business continuity playbooks. For logistics, this includes heat and flood impacts on warehouses, ports, and road corridors, as well as contingency routing, inventory buffers, and redundancy in critical suppliers. For tourism, it includes destination heat stress, water scarcity, wildfire risk, storm patterns, and safety protocols that protect guests and staff, while also shaping product design and capacity management. When resilience indicators are linked to sustainability indicators, organizations can steer toward solutions that deliver both mitigation and adaptation, such as electrification combined with robust energy management, circularity programs that reduce dependence on fragile supply lines, and destination partnerships that align visitor growth with local environmental limits. In this way, Section 4 completes the logic

of transformation by showing that credibility, auditability, operational levers, and resilience form one integrated performance system that keeps global supply chains competitive in a green economy.

A sustainable transition in global supply chains cannot be delivered by individual firms alone, because the biggest levers sit in shared infrastructure, public regulation, and ecosystem coordination. Trade logistics depends on ports, rail corridors, roads, customs processes, electricity grids, and fuel availability, while the tourism industry depends on airports, local transport, destination infrastructure, water systems, waste systems, and public safety services. These are collective systems with high fixed costs, long investment cycles, and strong spillover effects, which means that policy and ecosystem governance largely determine whether ESG aligned strategies become scalable or remain limited to pilots. Public authorities influence the pace of change through regulatory certainty, permitting, standards, procurement rules, and targeted investment programs that lower the cost of transition technologies. In parallel, standard setters and market institutions influence comparability and trust, for example through measurement standards, certification schemes, disclosure frameworks, and assurance practices that reduce confusion and prevent a race to the bottom in credibility. A core policy function is to create a predictable trajectory for decarbonization and to connect that trajectory to infrastructure readiness. In trade logistics, the transition depends on electrification of warehousing and material handling, charging infrastructure for road transport, rail capacity upgrades, port electrification and shore power, and availability of lower carbon fuels for shipping and aviation related freight. In tourism, decarbonization depends on similar energy and mobility infrastructure, plus building renovation pipelines for accommodation, credible renewable energy procurement, and waste and water systems that can handle seasonal surges without environmental harm. Policy coherence is critical because fragmented rules can create perverse incentives, such as shifting emissions from one part of the chain to another or discouraging long term investments due to uncertainty about future requirements. Effective governance therefore aims to align energy policy, transport policy, industrial policy, and land use planning so that businesses can plan investments across a 5 to 15 year horizon. It also creates mechanisms that reduce first mover disadvantages, for example through investment grants, tax incentives, concessional

financing, or contracts for difference that help bridge the cost gap for low carbon fuels and electrification.

A second policy function is to build the measurement and transparency infrastructure that makes sustainability comparable across firms and prevents greenwashing. This includes standardized rules for calculating transport emissions, consistent treatment of indirect emissions in value chains, clear requirements for evidence behind public claims, and accessible verification mechanisms that do not impose excessive burden on smaller suppliers. For logistics, this is essential because supply chains often include multiple subcontractors and cross border legs, and without common standards the same shipment can be reported with different numbers depending on who calculates it. For tourism, consistent measurement matters because destinations and products compete for trust, and because many service providers are small and lack technical capacity. A practical governance approach therefore includes public guidance, shared tools, and capacity building programs, such as training for suppliers, templates for data collection, and digital platforms that support reporting with low friction. When this ecosystem layer exists, organizations can focus on improving performance rather than arguing about methods, and consumers receive clearer information that supports responsible choices. Destination governance must balance economic benefits with issues such as housing pressure, congestion, water stress, waste generation, cultural integrity, and fair distribution of value to local businesses and workers. In logistics, local legitimacy relates to safety, noise, traffic, land use, labor conditions, and the relationship between industrial activity and surrounding communities. Public authorities can support legitimacy through clear labor enforcement, safety regulations, fair competition policies that reduce incentives for low road subcontracting practices, and participatory planning processes that give communities visibility into decisions. They can also deploy smart demand management tools, such as visitor caps in sensitive areas, differentiated pricing, timed entry systems, and mobility planning that reduces congestion and emissions. The strategic point is that social legitimacy is not a soft issue, it is a constraint that can stop projects, trigger legal challenges, and damage brand trust, so ecosystem governance must treat it as a core dimension of sustainability, alongside emissions and resource efficiency.

A fourth policy function is to enable cross sector collaboration, because many high impact solutions require coordination across multiple actors who do not share the same incentives. Examples include shared freight consolidation hubs that reduce empty runs, interoperable data exchange between shippers, carriers, and ports, joint procurement of renewable electricity for clusters of warehouses and hotels, coordinated charging and hydrogen corridors, and destination wide waste and water solutions that individual hotels cannot deliver alone. Public authorities can catalyze collaboration by convening stakeholders, funding shared feasibility studies, creating regulatory sandboxes for digital traceability and data sharing, and setting open standards that prevent lock in to proprietary systems. In addition, public procurement can shift markets by demanding low carbon logistics services and sustainable tourism services, providing stable demand that supports investment and innovation. When collaboration is designed well, it reduces the total cost of transition and increases resilience, because systems become more integrated, more redundant, and better able to respond to shocks.

Finally, ecosystem governance must incorporate resilience and adaptation, because climate impacts and geopolitical disruptions increasingly threaten both logistics corridors and tourism destinations. Policy can support resilience through climate risk mapping, infrastructure hardening investments, updated building codes, emergency response systems, and insurance and financing frameworks that reward risk reduction. For logistics, this includes protecting critical corridors and nodes, improving flood defenses for ports and warehouses, and ensuring energy system resilience to heat waves. For tourism, it includes destination adaptation plans, water management, wildfire prevention, and safety protocols for extreme weather, together with economic diversification strategies for regions that face declining seasonal viability. In an integrated view, Section 5 shows that sustainable global supply chains emerge from a shared governance environment where rules are predictable, measurement is comparable, infrastructure is prepared, community legitimacy is protected, and collaboration is enabled. When these conditions are present, private sector ESG strategies can scale, costs decline over time, and both trade logistics and tourism can compete and grow in line with the trajectory of the green economy.

Conclusions

Thus, the transformation of trade logistics and the tourism industry in the context of environmental, social and governance (ESG) criteria and the green economy is not an isolated trend, but a systemic change in the rules of competition in global supply chains. The gradual strengthening of reporting, due diligence and climate regulation shifts the focus from declarations to impact management, where data, procedures, responsibility and evidence become key. Therefore, the focus is on the ability of companies to explain how they reduce emissions, how they manage social risks in the external environment of suppliers, and how they ensure the integrity of management decisions. In such a position, the sustainability of the supply chain often becomes more important than short-term cheapness, because failures, sanctions, loss of trust and legal risks quickly convert into financial consequences. At the same time, trade logistics is the basic infrastructure of global trade, so any changes in the rules on emissions, fuel, energy efficiency and transparency automatically change the parameters of routes, warehouse networks and contract models. At the same time, the tourism industry concentrates demand, increases seasonal peaks, forms loads on transport nodes and energy systems, and therefore requires the same impact management as industrial supply chains. For both areas, the ability to combine economic efficiency with decarbonization, as well as with social responsibility in interaction with personnel, communities and small suppliers, is becoming decisive. Thus, a sustainable development strategy acquires practical meaning only when it is integrated into planning, procurement, risk management and operational discipline.

A key result of fully disclosing the topic is the understanding that without standardized accounting and agreed assessment methodologies, companies will not be able to manage the transformation systematically. For logistics, this means comparable emissions calculations in multimodal transport, quality control of primary data, supplier audits, and transparent rules for including the carbon component in the price of the service. For tourism, this means managing impacts across the entire range of services, from transport and accommodation to food and events, where both direct operational emissions and impacts along the value chain matter. At the same time, digital solutions are becoming a tool not only for automation, but also

for trust, as they provide traceability, documentation, format agreement and verification, without which the scaling of sustainable practices is hampered.

Therefore, successful transformation requires a coordinated portfolio of actions, where technological, organizational and behavioral levers work simultaneously. At the logistics level, this includes optimizing loading and routes, increasing the energy efficiency of warehouses, electrifying equipment, changing packaging approaches, and stricter selection criteria for carriers and contractors. At the tourism level, this includes modernizing energy consumption in hotels, responsible purchasing, waste management, reducing pressure on natural areas, and working with customer demand through changing product, seasonality and transport solutions. At the same time, resilience to climate risks, such as floods, fires or storms, is emerging as a separate management task, because it affects both the continuity of supply, the security of tourist flows, and the quality of service. Thus, the scientific and practical importance of the topic lies in the formation of a holistic vision, where global supply chains are evaluated simultaneously by efficiency, sustainability and responsibility, and not by a single indicator of price or speed. For businesses, this provides a basis for reducing regulatory and reputational risks, maintaining access to financing and partnerships, and increasing competitiveness in markets where transparency has already become the norm. For public authorities, it provides an opportunity to fine-tune policies to support infrastructure, energy efficiency, and destination development, taking into account both economic effects and environmental and social impacts. Ultimately, a sustainable global supply chain strategy provides a practical path to a green economy, where accountability is supported by data and long-term value is created through managed, transparent, and sustainable operations.

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