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International trade dynamics and environmental degradation in the global south a critical review of linkages and policy pathways

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Abstract

International trade has become a central driver of economic growth in the Global South, yet its environmental consequences remain contested. This review examines the relationship between trade dynamics and environmental degradation, focusing on how export-oriented growth strategies shape ecological outcomes. Three theoretical perspectives frame the discussion: the pollution haven hypothesis, which emphasizes regulatory disparities; ecological unequal exchange, which highlights the transfer of environmental costs to developing regions; and the environmental Kuznets curve, which considers income-related transitions in environmental quality. Empirical evidence from agriculture, mining, and industrial sectors demonstrates that trade liberalization often accelerates deforestation, soil degradation, and pollution, while embedding Southern economies in low-value segments of global value chains. At the same time, opportunities exist to integrate sustainability into trade through technology transfer, green standards, and South–South cooperation. Persistent challenges include weak governance, uneven bargaining power, and limited capacity to manage ecological risks. The review identifies research gaps, such as insufficient attention to informal trade and climate–trade interactions, and underscores the need for harmonized policies linking trade and environmental governance. Aligning economic integration with ecological sustainability is essential to ensure that trade supports both development and environmental resilience in the Global South.

Keywords: International trade, global south, economic growth

Introduction

International trade has emerged as one of the most influential forces shaping the economic trajectories of nations across the Global South. Since the latter half of the twentieth century, developing economies have increasingly turned to export-oriented growth strategies, liberalized trade regimes, and integration into global markets as pathways to industrialization and development. While these processes have spurred foreign investment, increased gross domestic product (GDP), and enhanced access to global value chains, they have also generated profound ecological consequences. The relationship between trade and the environment in the Global South is therefore deeply complex, simultaneously presenting opportunities for economic advancement and risks of environmental degradation [1-3].

The Global South, encompassing regions in Latin America, Africa, and much of Asia, is endowed with abundant natural resources and ecological diversity. These resources-ranging from tropical forests and mineral reserves to fertile soils and biodiversity hotspots-form the foundation of the region's trade competitiveness. Yet the same resource base also renders these countries vulnerable to environmental degradation when trade dynamics prioritize extraction and export without adequate safeguards. Deforestation for agricultural exports, overexploitation of fisheries, pollution from mining operations, and carbon emissions from manufacturing hubs illustrate how trade can exacerbate ecological vulnerabilities [4-6].

A central tension emerges between the pursuit of economic growth through trade and the preservation of environmental integrity. Scholars have debated this relationship using three dominant theoretical frameworks. The pollution haven hypothesis posits that lax environmental regulations in developing countries attract polluting industries from the Global North, effectively transferring environmental burdens southward. The ecological unequal exchange perspective emphasizes structural inequalities in trade relations, where the Global South exports resource-intensive, low-value goods while importing high-value manufactured products, effectively externalizing ecological costs. Conversely, the environmental Kuznets curve hypothesis suggests that environmental degradation initially increases with income growth but eventually declines as societies demand cleaner technologies and stricter regulations. Together, these perspectives highlight the contested and multifaceted links between trade and the environment [7].

Empirical evidence supports aspects of each framework, though outcomes vary across sectors and regions. For example, agricultural trade liberalization has been linked to

deforestation in the Amazon and Southeast Asia, where global demand for soybeans, palm oil, and beef drives land-use change. Similarly, mineral exports from Sub-Saharan Africa and Latin America often lead to soil contamination, water pollution, and biodiversity loss. In manufacturing hubs such as South Asia, trade-related industrial growth has contributed to severe air and water pollution. However, there are also cases where trade has facilitated access to environmentally friendly technologies, green production standards, and renewable energy markets, suggesting that the relationship is not uniformly negative [8-9].

The political economy of trade in the Global South further complicates this relationship. Developing countries often face asymmetric bargaining power in trade negotiations, leading to terms that prioritize immediate export revenue over long-term ecological sustainability. Additionally, weak governance structures, limited enforcement of environmental regulations, and dependence on foreign markets reduce the capacity of these nations to manage ecological risks effectively. Informal and unregulated trade flows, particularly in timber, wildlife, and artisanal mining, add further layers of complexity by contributing to environmental degradation outside formal governance structures [10].

The climate crisis intensifies the urgency of addressing trade–environment linkages. The Global South is disproportionately vulnerable to climate impacts such as rising sea levels, desertification, and extreme weather events. Yet trade-related activities, particularly deforestation and fossil fuel dependence, exacerbate greenhouse gas emissions [11]. This raises pressing questions about the compatibility of current trade models with global climate goals and the capacity of developing economies to pursue sustainable pathways.

Despite these challenges, opportunities exist for aligning trade with environmental sustainability. Green trade policies, certification schemes, and eco-labeling initiatives can create incentives for sustainable production and consumption. Technology transfer through trade agreements has the potential to support cleaner production methods in developing countries. Moreover, South–South cooperation and regional trade agreements are increasingly being explored as mechanisms to promote sustainable development without reproducing the structural inequalities of North–South trade relations [12].

This review article seeks to synthesize theoretical debates, empirical findings, and policy perspectives on the relationship between international trade dynamics and environmental degradation in the Global South. Specifically, it examines how trade liberalization, resource dependence, and global value chain integration shape environmental outcomes. It also explores pathways through which trade could be reoriented to support ecological resilience and sustainable development [13]. By bridging economic, ecological, and governance perspectives, the review aims to provide a holistic understanding of the trade–environment nexus in developing regions.

The central argument advanced here is that trade dynamics in the Global South cannot be understood solely through economic indicators such as GDP growth or export volume. Instead, a comprehensive assessment requires attention to ecological costs, distributional inequalities, and governance structures that mediate trade–environment interactions [14]. Addressing these issues is critical not only for environmental sustainability but also for the long-term viability of development strategies in the Global South.

Theoretical Perspectives on Trade and Environment

The relationship between trade and environmental outcomes in the Global South has been widely debated through several theoretical frameworks. These perspectives provide different lenses for understanding how economic globalization influences ecological processes and help explain the divergent outcomes observed across sectors and regions [15]. Three prominent frameworks-the Pollution Haven Hypothesis, Ecological Unequal Exchange, and the Environmental Kuznets Curve-form the foundation of much of the scholarly debate.

Pollution Haven Hypothesis (PHH)

The Pollution Haven Hypothesis argues that multinational corporations and firms relocate pollution-intensive industries to countries with weaker environmental regulations and lower compliance costs. This relocation allows firms to maintain competitiveness while externalizing environmental costs onto host countries. In the Global South, evidence for this hypothesis is mixed but partially supported in sectors such as textiles, chemicals, tanning, and low-cost manufacturing. For example, dyeing and textile industries in South Asia have attracted investment from firms seeking to avoid stricter environmental controls in Europe or North America. Similarly, the chemical and electronics recycling industries in parts of Africa and Southeast Asia reveal patterns of industrial relocation linked to regulatory gaps [16].

However, not all trade-related pollution in the Global South can be attributed to PHH. Domestic demand, governance weaknesses, and the prioritization of rapid industrialization also play significant roles. Furthermore, recent evidence suggests that in some cases, firms may adopt cleaner technologies to meet international standards, especially when exports target markets with stringent environmental regulations. Thus, while PHH captures part of the reality, it does not fully explain the diversity of trade–environment outcomes [17].

Ecological Unequal Exchange

The theory of Ecological Unequal Exchange focuses on structural imbalances in the global economy, arguing that trade systematically transfers ecological costs from the Global North to the Global South. Under this framework, developing economies become suppliers of resource-intensive, low-value primary commodities-such as agricultural goods, timber, and minerals-while importing higher-value manufactured products from industrialized countries [18]. This creates a situation in which the Global South bears the brunt of resource depletion, land degradation, and pollution while capturing only a fraction of the economic gains.

Latin America's reliance on soybean and beef exports to meet global demand, or Africa's dependence on mineral exports, exemplifies this unequal dynamic. The environmental consequences include deforestation, soil

degradation, and water contamination, while profits are often captured by global corporations or concentrated elites. Moreover, ecological unequal exchange highlights the asymmetry in trade negotiations, where developing countries often lack bargaining power to secure terms that adequately account for environmental costs [19-20]. This perspective underscores the systemic nature of environmental degradation linked to trade, suggesting that sustainability challenges are embedded in the very structure of the global trading system.

Environmental Kuznets Curve (EKC)

The Environmental Kuznets Curve hypothesis proposes an inverted U-shaped relationship between income levels and environmental degradation. At low levels of income, economic growth is associated with rising pollution and resource use. After reaching a certain threshold of income, however, societies demand cleaner environments, invest in greener technologies, and strengthen regulations, leading to improved environmental quality [21]. In the context of the Global South, the EKC framework has generated mixed findings. Middle-income countries such as China, Brazil, and South Africa show signs of decoupling certain pollutants from income growth, with investments in renewable energy, stricter regulations, and technological adoption. However, most low- and lower-middle-income countries remain in the early stages of the curve, where environmental degradation continues to rise as economies prioritize growth and trade expansion [22-23]. Additionally, the EKC does not account for globalized trade flows, where cleaner consumption patterns in the North may be sustained through environmentally intensive production outsourced to the South. This limits the explanatory power of the EKC when applied to highly interconnected global economies.

Together, these three perspectives offer complementary yet incomplete insights. The Pollution Haven Hypothesis highlights firm-level relocation strategies, Ecological Unequal Exchange exposes systemic inequalities in trade structures, and the Environmental Kuznets Curve suggests possible pathways toward sustainability. A comprehensive understanding of trade and environment in the Global South requires integrating these frameworks while also considering governance capacity, technology transfer, and the broader political economy of global trade [24].

Trade-Driven Environmental Pressures

International trade has reshaped economic opportunities in the Global South, but it has also intensified environmental pressures across multiple sectors. These pressures stem from the expansion of agricultural frontiers, intensified resource extraction, industrial production for export markets, and participation in global value chains (GVCs). Examining these pathways provides insight into how global trade dynamics contribute to ecological stress in developing regions [25].

Agricultural Exports

Agriculture remains a cornerstone of many economies in the Global South, particularly through the cultivation of export-oriented cash crops such as soy, palm oil, coffee, and cocoa. The global demand for these commodities has driven rapid expansion of monocultures, particularly in Latin America, Southeast Asia, and sub-Saharan Africa. This expansion often comes at the expense of forests and other ecologically sensitive areas, contributing to biodiversity loss, carbon emissions, and altered hydrological cycles. For instance, soybean cultivation in Brazil and Argentina has been linked to extensive deforestation in the Amazon and Cerrado biomes, while palm oil plantations in Indonesia and Malaysia have transformed tropical landscapes. Beyond deforestation, monocultures deplete soil fertility and reduce ecosystem resilience, leaving agricultural systems more vulnerable to pests, diseases, and climate variability [26].

Resource Extraction

Resource exports-including minerals, oil, and gas-remain central to many Southern economies. These sectors are particularly prone to environmental degradation due to the scale and intensity of extraction. Mining operations often generate toxic waste, contaminate water sources, and degrade land. Oil and gas extraction contributes not only to local pollution but also to global greenhouse gas emissions. For example, cobalt mining in the Democratic Republic of Congo supplies global demand for batteries, yet it has been associated with severe soil and water contamination as well as social displacement. Similarly, oil extraction in the Niger Delta has produced chronic pollution, undermining both ecological systems and livelihoods [27]. These examples highlight how export-oriented extraction frequently externalizes environmental costs onto local ecosystems and communities.

Industrialization and Manufacturing

Export-led industrialization has positioned several regions of the Global South as global manufacturing hubs. While this model has created employment and infrastructure growth, it has also left substantial ecological footprints. Textile industries in South Asia, for example, rely heavily on water-intensive dyeing processes that discharge untreated effluents into rivers, affecting aquatic ecosystems and public health. In West Africa, the growth of informal electronic waste recycling has generated localized pollution through open burning and acid leaching, exposing workers and surrounding communities to hazardous substances [28]. These cases illustrate how integration into global production networks can amplify industrial pollution, particularly where regulatory oversight and enforcement remain limited.

Global Value Chains (GVCs)

Participation in global value chains represents a double-edged sword for economies in the Global South. While GVCs facilitate market access and export growth, they often lock producers into low-value segments characterized by resource exploitation and pollution-intensive processes [29]. For instance, countries may specialize in raw material extraction or basic assembly while higher-value activities-such as advanced manufacturing, research, and environmental services-remain concentrated in the Global North. This unequal distribution of roles perpetuates environmental burdens in developing economies while limiting opportunities for technological upgrading and sustainability-oriented transitions. The structure of GVCs thus reinforces the ecological imbalance between North and South, with environmental costs borne disproportionately by

exporting countries [30].

Opportunities, Research Gaps, and Policy Pathways for Sustainable Trade

The trade–environment nexus in the Global South is often framed through its environmental costs, yet trade also offers important opportunities for sustainability transitions. At the same time, significant research gaps constrain a comprehensive understanding of these dynamics. Policy pathways that integrate ecological resilience into trade strategies remain essential to realign economic growth with environmental integrity [31].

Opportunities for Sustainability in Trade

Several opportunities exist to mitigate trade-related environmental pressures while promoting sustainable development. Green trade policies are increasingly considered within multilateral and bilateral trade agreements, offering mechanisms to embed environmental safeguards and standards in cross-border exchanges. Provisions such as deforestation-free commodity standards or carbon-border adjustments can help shift incentives toward more sustainable production systems [32]. Technology transfer represents another critical avenue. Through trade partnerships, the Global South can gain access to cleaner production methods, renewable energy technologies, and advanced monitoring systems. For example, the diffusion of water-efficient irrigation systems or cleaner textile dyeing techniques can reduce the environmental footprint of export-oriented industries. South–South cooperation further enhances the potential for sustainable trade by enabling knowledge-sharing and regional resilience-building. Initiatives that focus on sustainable agricultural practices, low-carbon technologies, or ecological restoration can reduce dependence on models imported from the Global North, tailoring strategies to local ecological and social contexts.

Diversification strategies also hold promise. Economies that reduce overdependence on resource-intensive exports can minimize vulnerability to both ecological degradation and market volatility. Shifting toward higher-value and lower-impact sectors-such as sustainable tourism, organic agriculture, or digital services-may provide pathways for ecological and economic resilience [32-33].

Research Gaps

Despite these opportunities, current research leaves critical blind spots. First, integrated analyses combining trade flows with ecological and social justice indicators remain underdeveloped. This gap limits the capacity to capture the multidimensional impacts of trade, particularly on marginalized communities [34]. Second, most scholarship focuses on North–South trade dynamics, with limited attention to South–South flows. As intra-regional trade expands in Asia, Africa, and Latin America, its environmental implications warrant closer scrutiny.

Third, informal trade represents a substantial yet poorly understood dimension. From smallholder cross-border food exchanges to informal electronic waste markets, these flows often carry significant ecological consequences that remain unrecorded in formal trade data. Robust methodologies are needed to assess their scope and impacts.

Finally, the intersection between trade and climate adaptation is insufficiently explored. Given that many economies in the Global South are highly vulnerable to climate change, understanding how trade can support or hinder adaptive capacity is crucial for policy design.

Policy Pathways

Addressing trade-related environmental pressures requires aligning trade policy with ecological integrity. Strengthening environmental governance is foundational, particularly through enforcement of pollution controls and land-use regulations in export sectors. Trade agreements should be explicitly aligned with climate commitments, ensuring that liberalization does not undermine emission reduction targets or biodiversity conservation goals [35-37]. Policies that incentivize sustainable production-such as eco-certifications, carbon labeling, or preferential tariffs for green products-can create market rewards for environmentally responsible producers. At the same time, penalizing the externalization of ecological costs through pollution taxes or import restrictions can discourage unsustainable practices. Inclusive approaches that empower local communities must also be central. Trade policies that integrate local knowledge, secure land rights, and provide equitable access to markets can prevent ecological costs from being disproportionately borne by vulnerable groups. In sum, while international trade continues to generate environmental pressures in the Global South, it also provides leverage points for ecological sustainability [38-39]. Seizing these opportunities requires bridging research gaps and adopting policies that foreground environmental governance, equity, and resilience.

Conclusion

International trade has been a major driver of economic transformation in the Global South, yet it has also amplified environmental degradation through deforestation, resource extraction, and industrial pollution. The disproportionate burden of ecological costs borne by these regions reflects deep structural asymmetries in global trade relations. Moving forward, a shift toward sustainable trade requires coordinated governance mechanisms that integrate environmental safeguards into trade agreements and align them with climate and biodiversity commitments. Strengthening technological innovation and facilitating equitable access to cleaner production systems will be central to reducing ecological footprints. Moreover, fostering South–South cooperation and regional resilience can help diversify economies and reduce overdependence on resource-intensive exports. For trade to contribute to long-term sustainability, policies must ensure that economic gains do not come at the expense of ecological integrity, while empowering local communities to participate in shaping sustainable trade futures.

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