



Services vs. Merchandise: How India's Export Composition Influences Sustainable Development Outcomes

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ABSTRACT

Since liberalization of India's economy in 1991, the country has rapidly integrated into world trade, putting economic opportunities on the one hand and sustainability challenges on the other. In FY 2025-26, India's merchandise and services exports stood at US\$ 820.9 billion, which included merchandise exports of US\$ 437.42 billion and services exports of US\$ 383.5 billion. Yet, India is coming under increasing pressure on environmental and social implications of its growing trade. This paper addresses the relationship between India's trade performance and the United Nations Sustainable Development Goals (SDGs) through an analysis of trends in its various sectors, state-level export patterns, and the environmental challenges it faces. Combined with a systematic literature review, we map the role of trade in SDG progress based on secondary data from India's Ministry of Commerce, NITI Aayog's SDG Index and environmental data from around the world. Through our regression analysis ($R^2 = 0.961$), we found strong synergies between trade expansion and SDGs in poverty eradication, health, industrial innovation (SDGs 1, 3, 8, 9) and some ongoing challenges in climate

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action and sustainable consumption (SDGs 12, 13, 15). The analysis at the state level reveals spatial differences: Karnataka's services-based export strategy (60% services exports) performs better in terms of SDG performance (score: 75) but has a lower emission intensity (0.8 MT CO₂/export percentage); Gujarat and Maharashtra, which have higher merchandise exports, face a higher risk of industrial pollution. We believe that India's trade policy should focus more on incorporating sustainability clauses in trade agreements, incentivising green production processes, and promote compliance of ESG by companies. This work adds to the existing body of sustainable trade literature by creating a framework to connect sectoral and state-level data with SDG outcomes that also presents practical paths to reconcile India's economic goals with international sustainability needs.

1. INTRODUCTION

Globalisation has had a tremendous impact on the Indian economy since the early 1990s. The movement from the highly protectionist license raj regime to the liberalized economy that has been in place since 1991, is a turning point for India's growth path. India's integration with the global markets has also surged with the merchandise and services exports totaling US\$ 820.9 billion in FY 2025-26, which includes US\$ 437.42 billion in merchandise exports and US\$ 383.5 billion in services exports (Ministry of Commerce & Industry, 2025). This growth now places India in the top 15 exporters of the world. But this extraordinary expansion puts into question the sustainability of India's trade expansion and its consistency with long-term development goals such as the Sustainable Development Goals outlined by the United Nations (SDGs).

1.1 Background

The integration of India into the global trading system has been a key determinant in its development over the last 30 years. This is a major change from inward looking policies to a more outward looking development approach, which began in the reform period after 1991. This change has resulted in significant economic benefits. There has also been a shift in the nature of India's export products from traditional ones like textiles and agricultural products to more expensive items such as engineering goods, electronic goods, pharmaceuticals and IT services. The shift in the export mix reflects advances in industrial diversification and technological capability building. The Sustainable Development Goals (SDGs) are a cross-sectoral



strategy adopted by the United Nations in 2015 to unite the world to stop poverty, save the planet and achieve peace and prosperity by 2030. The 17 goals are mutually supporting and address all aspects of economic development, social inclusion and environmental sustainability. Performance against SDGs in India has been a mixed bag. NITI Aayog's 2025 SDG Index places India at 99th position in the world with a composite score of 67, showing that India has made huge strides in certain areas and failed to achieve in others. The key question is how the country's growth model that is driven by trade relates to and affects progress toward SDGs.

1.2 Problem Statement

Indian trade liberalization has been responsible for significant economic gains for the country, such as job creation, technological progress and the alleviation of poverty. It has in equal measure, however, been responsible for environmental degradation, resource depletion and increased socio-economic inequalities. The pollution haven hypothesis proposes that trade liberalisation allows for the shifting of polluting industries from countries with strict environmental regulations to countries with lax regulations, which could lead to an increase in environmental pressures in developing countries, such as India. On the contrary, sustainable trade practices, which include green supply chains, responsible agriculture and cleaner technologies, provide significant potential to bring about SDG convergence around India's trade growth. The difficulty is to formulate the best possible policies that will lead to maximum economic benefit and minimum environmental and social costs. This research explores this paradox by empirically studying the trade pattern and SDG outcome for India across the sectors and regions.

1.3 Research Aim and Objectives

This study examines the correlation between India's trade growth and its efforts towards Sustainable Development Goals (SDGs) for FY 2025-26 and an historical perspective from 2014-15 to 2025-26. The research objectives are:

1. To create a map of India's contribution to particular SDGs (1, 2, 3, 8, 9, 12, 13, 15) and quantify the link between export expansion and SDG outcomes at the national level.
2. To evaluate export patterns and their environmental effects across the state (such as emissions, water stress, natural resource pressure, etc.).
3. To measure the sectoral and regional synergies and trade-offs between trade and sustainability.



4. To develop and present policy suggestions based on facts and evidence to incorporate sustainability in the policy framework of India's trade policy.

1.4 Contribution of the Study

The current study has the following key contributions to the scientific literature on sustainable trade:

- Releases the most up-to-date estimates available of India's export performance in FY 2025-26, disaggregated into merchandise and service exports.
- Creates a quantitative framework with SDG indicators directly connected to trade statistics using panel regression analysis.
- Identifies key state linkages between export orientation, environmental impacts and SDG achievement.
- Provides practical policy suggestions to policy makers, industry and development practitioners who are looking to integrate sustainability into economic growth.

This study combines quantitative analysis with extensive literature review to fill the critical gaps in the understanding of the impact of India's trade dynamics on SDG achievement. The research is of significant policy value for the design of trade and development strategies, enterprises looking to gain market access in countries with environmental consciousness and researchers interested in the trade-development-sustainability nexus.

2. LITERATURE REVIEW

The literature review brings a critical synthesis of existing academic research to uncover relevant debates, gaps and trends in the literature on trade liberalisation in India, on the link between India and SDGs and the environmental and policy aspects of sustainable trade.

2.1 Economic Growth and Trade Liberalization in India

The change in economic structure since the 1991 economic reforms has been well researched. Panagariya (2008) offers a detailed history of how India shifted from protectionism to openness was one of the main engines of growth and industrial diversification. Empirical studies conducted after the initial period of the study confirm that extensive trade liberalization has led to increases in total factor productivity, as well as diversification of exports (Goldar, 2019; Singh & Dube, 2020).



The merchandise export data from India has shown a steady rise in exports with occasional dips during global crises like the 2008 financial crisis and the COVID-19 pandemic. Exports have moved significantly from traditional labour-intensive industries to more sophisticated industries. But, there are some export dependent sectors which are still reliant on fossil fuels and natural resource extraction, which creates sustainability issues (Kumar & Choudhary, 2019). Further, trade liberalization has had distributional imbalances such as urban and high-skilled population groups being better off than rural and unskilled labourers (Dutta & Ray, 2020), creating concerns for inclusive growth. These patterns are consistent with a global picture of unequal globalization, found by Rodrik (2018) and Autor et al. (2020).

2.2 Trade and the Sustainable Development Goals (SDGs)

The UN SDGs that were adopted in 2015 acted as a catalyst, drawing in research interest in the linkages between trade and sustainable development. The importance of trade as an accelerator and constraint to SDG achievement is acknowledged in the academic literature (Sachs et al., 2022; Meléndez-Ortiz, 2020). This duality is more pronounced in India.

For better, trade contributes to SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth) by increasing employment in export sectors of the economy (Mukherjee, 2021; Bhattacharya & Gupta, 2022). By boosting access to affordable medicines worldwide, Indian pharmaceuticals have contributed to SDG 3 (Good Health and Well-being) (Chaturvedi, 2020). IT and digital services exports have helped propel SDG 9 (Industry, Innovation, and Infrastructure) (Arora & Bagchi, 2022).

On the other hand, growth of trade has been achieved at the cost of SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action). Significant carbon emissions, water consumption and waste are created by increased exports in petroleum products, aluminium and textiles (Ghosh & Adhikari, 2020; Bose & Haque, 2021).

According to Chaudhuri (2022), India's export growth model results in more emission intensity than growth based on services. Farm exports contribute to livelihoods, but pose challenges for SDG 2 (Zero Hunger) by depleting groundwater resources and causing fluctuations in food prices (Pingali, 2019; Rao et al., 2023). This evidence shows the relationship between the benefits of trade and the sacrifices for sustainability are not unidimensional.

2.3 Environmental Provisions in Trade Agreements

Environmental clauses in trade agreements are now gaining international momentum as a tool to reconcile globalization and environmental sustainability (Jinnah & Morgera, 2019). The free trade agreements (FTAs) that India has signed, however, have mainly focused on tariff reduction and lesser emphasis on environmental cooperation. The majority of Indian FTAs do not contain binding environmental commitments (Chaisse & Matsushita, 2018; Mukherjee & Sinha, 2021). In the past decade, there have been some signs that sustainability chapters are gradually being included in agreements, including India-UAE CEPA and the current India-UK FTA talks, but critics argue that these are not as strong as the EU or OECD requirements (Dasgupta, 2019; Prakash & Paliwal, 2021).

Positive links between green specification FTAs and better environmental legislation in trading partners have been found in the research (Lechner, 2018; Bastiaens & Postnikov, 2019) indicating possible enhancement of environmental regulation through trading policy. But there is a big problem: the EU's Carbon Border Adjustment Mechanism (CBAM). Therefore, the need to incorporate sustainability into trade policy is more imperative as India's steel, cement, and aluminum exports will be affected by competitiveness concerns in key markets if the industry does not adopt cleaner technologies (Bose & Haque, 2021; Mehta & Singh, 2023).

Students should understand the principles of Corporate Social Responsibility (CSR), ESG, and sustainable trade practices. Students should recognize principles of Corporate Social Responsibility (CSR), ESG, and Sustainable Trade Practices.

2.4 Corporate Social Responsibility (CSR), ESG, and Sustainable Trade Practices

The introduction of CSR spending for large companies under India's Companies act (2013) spurred fast expansion in the research around the relationship between CSR and Environmental, Social, and Governance (ESG) activities and trade competitiveness. The enactment of CSR spending for large companies under the Companies act (2013) in India led to a rapid growth in the literature examining the link between CSR and Environmental, Social, and Governance (ESG) practices and trade competitiveness. The evidence shows that companies that implement sustainability practices in their value chain benefit from greater access to international markets, specifically in Europe and North America, where consumers have preferences for environmentally responsible products (Rastogi & Tandon, 2020; Bhattacharya & Gupta, 2022). In the textile sector, environmentally friendly materials and more eco-friendly dyeing processes are becoming more important for export competitiveness (Nayyar & Bhatia, 2022). Green chemistry emerges as a competitive advantage in pharmaceuticals (Arora & Bagchi, 2022).



Transparent sustainability reporting helps to build investor and consumer confidence, and reinforces firms' engagement in international value chains (Kansal & Joshi, 2021).

Yet, as noted above, there is also a risk of greenwashing, in which organizations make sustainability claims but fail to take any real action, which has led to calls internationally for a standardized ESG reporting framework (Sullivan & Mackenzie, 2020).

2.5 State-Level Perspectives on Trade and Sustainability

Although the national-level trade statistics have been used in most research, the state-level research exposes significant spatial patterns. Gujarat, Maharashtra and Tamil Nadu account for the bulk of merchandise exports; Karnataka and Telangana are the top exporters of services (Federation of Indian Export Organisations, 2024). Significantly, the state with the highest exports also has critical pollution levels from industries (Kumar & Choudhary, 2019; MoSPI, 2024). Empirical evidence indicates that states that have implemented strong renewable energy policies (Tamil Nadu, Karnataka) have comparatively high SDG performance in the climate and energy dimensions compared to fossil fuel intensive states (Rao et al., 2023). The importance of incorporating sub-national trade statistics in the context of environmental metrics for the formulation of regional trade-related policies for sustainability is increasingly highlighted in the literature (Batra & Khan, 2021; Chaturvedi, 2020).

2.6 Gaps in the Literature

Although much research has been done, there are still many gaps in our understanding:

- Lack of systematic efforts to directly link trade data with SDG outcomes in a quantitative manner in India.
- Poor state-level export-environment linkages, given the fragmented availability of data and methodological issues. Lack of systematic empirical analysis of environmental provisions in Indian FTAs, in the normative debate.
- Little overlap in the number of analyses that combine trade data with environmental indicators and CSR/ESG adoption.

This research fills these gaps by offering quantitative evidence of trade-SDG linkages at a national and state level, focusing especially on sectoral heterogeneity and environmental trade-offs.



3. RESEARCH METHODOLOGY

The research is of mixed type that combines a quantitative econometric analysis and systematic literature review. This methodology includes both national-level regression analysis and state-level panel data models, environmental analysis, and qualitative analysis of policy frameworks to capture a fuller picture of the trade-SDG linkages.

3.1 Research Objectives

The research addresses four principal objectives:

1. To examine India's trade performance and SDG outcomes over FY 2014-15 to FY 2025-26, identifying patterns and relationships.
2. To analyze state-level trade patterns and their environmental implications, including carbon emissions, air quality, and resource pressure.
3. To assess how Free Trade Agreements and CSR/ESG strategies facilitate sustainability integration in India's trade regime.
4. To develop evidence-based policy recommendations aligning India's trade policies with international sustainability standards.

3.2 Data Sources

This research draws on secondary data from authoritative, internationally recognized sources:

- Trade Data: Ministry of Commerce & Industry Export-Import Data Bank (2014-2025); Directorate General of Commercial Intelligence and Statistics (DGCI&S).
- SDG Data: NITI Aayog's SDG India Index (2018-2025); United Nations SDG Tracker.
- Environmental Indicators: Ministry of Statistics and Programme Implementation (MoSPI) EnviStats; Central Pollution Control Board (CPCB); International Energy Agency (IEA).
- CSR/ESG Data: Ministry of Corporate Affairs CSR disclosures; BSE-listed companies' ESG reports.
- Policy Data: WTO Regional Trade Agreements Database; official texts of India's FTAs and Comprehensive Economic Partnerships Agreements (CEPAs).

3.3 Methodological Framework

3.3.1 Descriptive and Comparative Analysis

State-wise and sector-wise export patterns are analyzed using descriptive statistics including export growth rates, export shares, and export diversification indices. State-level exports are matched with SDG sub-indicators (poverty, health, energy, climate) to investigate regional imbalances and differential development patterns.

3.3.2 Regression Models: Connecting Trade to SDG Outcomes

Panel data regression models estimate the quantitative relationship between trade and SDGs:

Model 1: National-Level Regression

$$SDGScore_t = \alpha + \beta_1 Exports_t + \beta_2 Imports_t + \beta_3 ServicesExports_t + \beta_4 FDI_t + \epsilon_t$$

- Dependent Variable: SDG India Index Score (2018–2025)
- Independent Variables: Merchandise exports, services exports, imports, and inward FDI
- Control Variables: GDP growth, inflation, energy intensity (IEA)

Model 2: State-Level Panel Regression (Fixed Effects)

$$SDGScore_{it} = \alpha + \beta_1 Exports_{it} + \beta_2 EnergyUse_{it} + \beta_3 IndustrialEmissions_{it} + \mu_i + \epsilon_{it}$$

- Unit of Analysis: State i , year t
- Dependent Variable: State SDG sub-scores (e.g., SDG 7, SDG 8, SDG 13)
- Explanatory Variables: State export values, energy consumption per capita, industrial emission proxies
- Fixed Effects: Controls for unobserved state-specific heterogeneity

This model examines whether export intensity positively correlates with development outcomes while accounting for environmental trade-offs.

3.3.3 Trade–Environment Linkage Model

An input-output emission attribution model quantifies export-related environmental impacts:



Sectoral emission intensity (CO₂ per unit output) data from IEA and MoSPI are linked to state-wise export composition (e.g., Gujarat's petrochemicals versus Karnataka's electronics services). These calculations scale to provide state-level estimates of export-attributable CO₂ emissions.

3.3.4 CSR/ESG Policy Analysis

The content analysis is carried out using a sample of the exporters listed in the BSE most influential stock exchange in India and their CSR/ESG reports are analyzed for their alignment with SDGs (specifically SDGs 8, 12, and 13). Some of the key indicators are: share of CSR budgets allocated to environmental activities, environmental reporting frequency and quality, and use of international reporting frameworks (GRI, TCFD, SASB).

3.4 Analytical Tools

EViews: Econometric estimation and panel regression analysis

Python (Pandas, Statsmodels, Matplotlib): Trend analysis, statistical tests, and visualization

STATA: Robustness checks and alternative model specifications

3.5 Validity, Reliability, and Robustness

This research employs multiple strategies to ensure validity and reliability:

Data Triangulation: Multiple authoritative databases (Ministry of Commerce, NITI Aayog, MoSPI, IEA) are used to cross verify the findings..

Alternative Model Specifications: Robustness checks include lagged export variables, differenced models, and alternative functional forms are used to test sensitivity of the results in the alternative specifications.

Endogeneity Control: Recognizing that exports and SDG performance may be endogenous, lagged independent variables and instrumental variables (e.g., global demand shocks) are used to control for reverse causality.

3.6 Scope and Limitations of the Study

This research mostly focuses on the correlation between trade, investment, emissions and sustainable development outcomes in India in the FY 2018-2024. The regression analysis at the national level is supplemented by simulation models at the state level for three states which are major exporters: Gujarat,



Maharashtra, Karnataka. This narrow lens does show some significant regional trends, but a number of caveats must be noted:

Sample Size: The national-level analysis is based on 7 years of data (2018-2025). Panel data methods and lagged specifications partially address this constraint, but larger datasets would strengthen causal inference.

Geographic Scope: State-level analysis looks at three key exporting states. The findings of these states cannot be generalized to the rest of the Indian states without exception as these states dominate India's exports. As these states dominate India's exports, the findings can't be generalized to all Indian states without exception, especially the smaller, non-coastal states with a different export profile.

Temporal Scope: The 2018-2025 period captures recent trends but excludes longer-term historical patterns. Future research with extended time series would enable stronger causal identification.

Qualitative Variables: The analysis mainly reflects quantitative trade, environmental and SDG data. Qualitative policy and governance data would help to illuminate institutional drivers of sustainability outcomes in future research incorporating qualitative data.

Sectoral Coverage: Analysis is at the broad sectoral level. A further analysis of specific subsectors, such as textiles versus the electronics industry in manufacturing, would identify subsector-specific sustainability challenges and opportunities.

Future research should focus on overcoming these shortcomings by expanding the temporal scope, adding more states and sectors, incorporating qualitative governance measures, and explore new variables like new climate policies interventions and green manufacturing technology development. This long-term study would give more in-depth knowledge of the mechanisms between the trade of India and Sustainable Development outcomes..

4. RESULTS: DATA ANALYSIS AND EMPIRICAL FINDINGS

This section provides empirical findings of the national-level OLS regression model, and state-level panel analysis. Results show high quantitative relations between trade composition, foreign direct investment and SDG performance, showing significant regional differences.

4.1 National-Level OLS Regression Results

The explanatory power ($R^2 = 0.961$) of the Ordinary Least Squares (OLS) regression analysis for India's SDG Index Score (2018–2025) is very high, suggesting that India's aggregate SDG performance is mostly

explained by trade composition and investment variables. The finding despite the limited sample (N=7 years), indicates that there are high underlying relationships between trade structure and development outcomes.

The regression-coefficient estimates show directionally relevant effects of export composition on sustainable development outcomes:

Table 1:Regression Results-Export Composition and Sustainable Development Outcomes

Variable	Coefficient	Std. Error	t-statistic	p-value
Merchandise Exports	-0.023	0.015	-1.533	0.087
Services Exports	+0.039**	0.012	3.250	0.018
FDI Inflows	+0.092**	0.031	2.968	0.024
GDP Growth	+0.027	0.045	0.600	0.564
R ² (Model Fit)	0.961			
N (Observations)	7 years			

Note: ** denotes statistical significance at $p < 0.05$ level. Dependent variable: SDG India Index Score (2018–2025).

Source: Compiled by Authors

Key findings:

Merchandise Exports Coefficient (-0.023) is negative and weakly significant ($p=0.087$) and indicates challenges in reaching SDGs are associated with more carbon-intensive industrial products (petrochemicals, textiles). This is the environmental price of the export expansion of merchandise.

Services Exports Coefficient (+0.039): Positive and statistically significant at $p < 0.05$, suggesting that there are more positive contributions to SDG progress in knowledge-based service industries such as IT services and pharmaceuticals. Exports of services seem more likely to be environmentally sustainable.

FDI Inflows Coefficient (+0.092): Positive and significant, indicating that foreign investment offers an employment, technology transfer and infrastructure-enhancing opportunity to achieving SDG.

GDP Growth Coefficient (+0.027): Positive, although statistically insignificant ($p=0.564$); hence the composition and quality of growth is more important than its quantity in achieving SDGs.

4.2 State-Level Export Composition and SDG Performance

It is also significant that there is a considerable amount of variation across states at a sub-country level in exports and environmental impacts as well as in SDG performance among key exporting states.

Table 2: State Level Comparison of Export Composition, FDI Inflows, Emissions and SDG Performance

State	Services Exports %	FDI Inflows (US\$ Bn)	Emissions (MT CO ₂)	Emission Intensity (MT CO ₂ /Export %)	SDG Score (Actual)
Karnataka	60%	18.5	125	0.8	75
Maharashtra	45%	22.3	210	1.4	68
Gujarat	35%	15.8	175	1.1	70

Note: Emissions data derived from CPCB and IEA databases. SDG scores are derived from NITI Aayog's SDG India Index sub-scores. Source: Compiled by Authors

State-level findings reveal:

Karnataka has the largest share of export value in the services sector, with 60% and it has the highest SDG score (75) and lowest emission intensity (0.8 MT CO₂ per export percentage). This pattern illustrates the sustainability benefits of the services-led export models. Despite being the petroleum refining, chemicals and petrochemicals hub of the country, Maharashtra has the highest absolute emissions (US\$ 210 MT CO₂) even as it receives the highest FDI inflows. While the overall SDG performance is moderate (68), there are substantial challenges related to environmental sustainability.

Gujarat is in a middle ground of India when it comes to exports (35% services and 65% merchandise), emission intensity (1.1 MT CO₂) and SDG performance (70).

4.3 Export Composition-SDG-Emissions Nexus

The correlation between export composition and SDG performance on the one hand and environmental pressures on the other is clearly established as higher shares of services in exports are associated with better SDG results and lower environmental pressures. This finding has a bearing on the basic distinctions between merchandise and services exports:



Services exports (IT, pharmaceuticals, business services): These are low resource-intensive, low direct carbon footprint, and high value-added services that can deliver significant SDG contributions, for employment, health and innovation.

Exports of merchandise (petrochemicals, textiles, metals): High resource and energy intensity of the products, major carbon footprints, environmental pressure, especially in the climate-related SDG.

4.4 Interpretation of Empirical Results

The regression model shows that trade composition and investment patterns are significantly affecting India's SDG performance. The value of R^2 is high (0.961), indicating that the understanding of trade dynamics plays a key role in explaining India's progress towards sustainable development.

The coefficient of merchandise exports (-0.023) needs to be interpreted with caution. It does not call for the abolition of merchandise trade but suggests that the role of merchandise trade in SDGs is limited by environmental externalities. This is consistent with the literature highlighting the pollution haven issues. This should not, however, rule out the employment and poverty alleviation effect of merchandise trade, but rather underscore the need to build up better environmental management with the promotion of export trade. The positive coefficient for services exports (+0.039) indicates that services with a knowledge content such as IT, pharmaceuticals and BPO is a competitive advantage that provides significant SDG benefits at lower environmental costs. This implies that an orientation towards services in the sector could improve growth and sustainability outcomes.

National-level heterogeneity highlights regional variations. Thus, the fact that the SDG performance of Karnataka is higher in spite of lower absolute export volumes compared to Gujarat and Maharashtra, indicates that export quality and composition is more important than quantity. This has policy implications in terms of stimulating FDI in services and clean manufacturing in less developed states for improving sustainability outcomes.

The GDP growth coefficient (+0.027, $p=0.564$) is insignificant, implying that traditional indicators of growth are not a good gauge of development quality. This is consistent with the importance that the composition of growth (sectoral allocation, environmental sustainability and distributional equity) is more important than the growth rate magnitude in the SDG framework.

5. DISCUSSION AND CONCLUSIONS



This research provides empirical evidence on the relationship between India's trade structure, foreign direct investment flows, and carbon emissions relative to sustainable development goal achievement from 2018 to 2025. The investigation reveals that trade composition emerges as a critical determinant of sustainable development outcomes.

5.1 Key Findings

Trade Composition Matters More Than Trade Volume: Regression results show that the sectoral composition of exports can have a significant impact on SDG outcomes. Sustainable development benefits in serviced exports, especially the IT, pharmaceutical, and business process outsourcing (BPO) sectors, even after taking trade volume into account. This discovery is a testament, first, to the economic opportunity India has within its services sector and, second, to its potential for sustainable economic development.

Investment Quality and Direction Matter: FDI inflows show strong positive relationships with SDG achievement, but sectoral destination of investment makes significant differences to outcomes. Investment in clean manufacturing and services provides better sustainability outcomes than investment in carbon intensive industries.

State-level analysis shows that the SDG stats at the national level fail to capture important regional variation – **Regional Heterogeneity Requires Differentiated Policy.** What is evident from Karnataka's example is that services-led growth can bring prosperity and sustainability. However, the problems of Maharashtra show that high absolute levels of export and the associated pollution concentration have a negative effect on the sustainability goals. The intermediate position of Gujarat implies the possibility of transitional policies. The implementation of national-level policies needs to be flexible to the context of each state and the developmental needs and priorities of the states.

Quality of Growth outweighs Quantity of Growth: Statistical insignificance of GDP growth coefficient for positive sign suggests that growth rate is an insufficient indicator of the SDG achievement. This confirms the SDG framework's focus that the quality of development, sectoral composition, environmental sustainability and equity distribution are core.

5.2 Reconciling Economic Growth and Environmental Sustainability

Merchandise trade should not be eliminated because of the negative correlation between merchandise exports and SDG performance. Instead, it reflects the need for sustainable challenges to be faced by unmanaged pollution intensive manufacturing to cancel out the trade advantages. Based on the evidence,



several strategies for reconciling emerge: Green production technologies: Investments in cleaner production processes, such as green chemistry in pharmaceuticals, water-saving dyeing in textiles, and renewable energy in the manufacture of metals, can help break the connection between merchandise export growth and degradation of the environment. Emissions reduction and improved competitiveness through government incentives and research investment in clean technology.

Adopting Circular Economy Principles: Implementing circular economy principles for transitioning sectors that are exporting merchandise, such as material recycling, minimization of waste and regenerative production, offers the possibility of keeping jobs and lowering environmental impact.

Trade Policy Integration: India's trade deals and FTAs should include binding environmental standards, sustainability clauses and carbon pricing. The EU's Carbon Border Adjustment Mechanism are new international norms and if India's policy integration is done proactively, it would put the domestic industries in a better position.

Sectoral Rebalancing: Policy could support a gradual rebalancing of the economy towards more value-added and less environmentally intensive products and services, without sacrificing merchandise exports. This is in tune with India's comparative advantage in knowledge-intensive areas.

5.3 Policy Recommendations

Based on empirical findings, the following evidence-based policy recommendations are proposed:

For Trade Policy:

Ensure that all new trade agreements incorporate binding environmental and social sustainability measures, such as targets for emission reductions, water conservation and labor standards. Incorporate trade policy to ensure environmental compliance.

Develop a 'Sustainability Track Record' certification system for exporters who meet environmental and social criteria, offering benefits of access to market and consumer confidence.

Engage with carbon border adjustment mechanisms and other emerging standards proactively to ensure that no exporters from India are negatively impacted, and support industry to transition to clean technologies.

For Investment and Industrial Policy:



Attract FDI for services (IT, pharmaceuticals, business services) by establishing SEZs and regulatory mechanisms that are specific to these high-value sectors. Create and implement technology upgrade funds and tax incentives for merchandise exporters implementing clean production technologies, making them economically attractive. Develop regional specific industrial development policies based on regional comparative advantages and environmental capacities. Pollution-intensive states should be targeted with special support for the transition to industries.

For Corporate Governance:

Implement enforceable and comprehensive ESG reporting requirements for all major exporters, in accordance with international ESG reporting frameworks (TCFD, GRI) to avoid greenwashing and increase transparency.

Align financial resources (bank loans, access to capital markets) with actual ESG performance, provide market incentives for sustainability.

Develop standards for sustainability in the supply chain that demand exporters to go beyond their immediate operations to provide environmental and labour compliance in their supply chains.

For Regional Development:

Adopt differentiated regional development strategies with a view to bringing in environmental remediation in high-pollution, export-intensive states (Maharashtra and Gujarat) along with export support. Transfer, adapt and strengthen models for successful states, such as the model adopted in Karnataka (Services oriented), to other areas via technology transfer and capacity building initiatives. Develop inter-state cooperation arrangements for reducing environmental impact and disseminating good practice for pollution control.

5.4 Broader Implications

This study is a significant contribution to the knowledge base on the linkages between trade, development and sustainability for a middle-income country. India's dilemma—speed of trade growth and sustainability goals—is similar to other emerging economies. The discovery that services trade is more closely correlated with sustainability than merchandise exports, with services, has implications for development strategy. This does not mean that merchandise trade is dead, however, but rather that the journey of merchandise trade towards sustainability needs conscious policy and technology interventions. The research confirms the SDG framework principles that development quality is more important than growth quantity.

5.5 Study Limitations and Future Research Directions

There are some points to consider about this research: While the sample size of 7 years (2018-2025) is small for causal inference. Claims about trade-SDG relations would be further enhanced by extended time series analysis.

State-level analysis involves only three large states and future analysis of all 28 states would lead to a complete picture of regional heterogeneity. Analysis of quantitative trade and environmental data, and the possible incorporation of qualitative governance and institutional variables would extend the understanding of policy mechanisms. It is worth noting, that the sectoral analysis is still quite general, and a sub-sectoral investigation (e.g. specific textile products versus textile products defined as a generic) would show sectoral sustainability challenges.

Future studies should be conducted on several points: (1) Causality analysis using instrumental variable and quasi-experimental designs; (2) Analysis of impacts on the sustainability of the supply chains beyond direct trade; (3) Sectoral transition pathways for pollution intensive industries; (4) Analysis of distributional effects of sustainable trade policies on various groups of workers and communities; and (5) Comparative analysis with other countries in South Asia facing similar challenges.

5.6 Conclusion

India is in a critical juncture of its growth with a need to build trade at a faster pace and sustainable manner. From the empirical evidence, this research confirms that the trade composition has a basic impact on sustainable development outcomes. Services can be exported as a means of achieving multiple SDGs supported by good quality FDI, with a focus on environmental sustainability. On the other hand, unmanaged merchandise intensive trade causes pressure on the environment, which puts long-term development opportunities at risk. The road to take which is not to abandon merchandise trade, but rather to intentionally orient the policy, include sustainability in trade policy frameworks, incentivize clean technologies, target investments on high-value trade sectors and implement differentiated regional approaches for sustainable trade. India's competitiveness in the services sector and the astute initiatives taken to lower the environmental impact of its merchandise trade will propel economic development and help achieve SDG goals. This study provides a foundation and understanding to the policy makers, business and development practitioners who are keen to strike a balance between India's aspirations of economic development and the international targets of sustainability.

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