EPRA International Journal of Environmental Economics, Commerce and Educational Management
Journal DOI: 10.36713/epra0414 |ISI I.F Value: 0.815|SJIF Impact Factor (2025): 8.57 ISSN: 2348 – 814X
Volume: 12 | Issue:5 |May 2025

ASSESSING THE FINANCIAL IMPACT OF CARBON PRICING ON INDIA'S STEEL AND POWER INDUSTRIES: CORPORATE STRATEGIES AND POLICY IMPLICATIONS

Research on Carbon Pricing and Implications

Chinmay Sood
Orcid id: 0009-0005-1285-3785

ABSTRACT

The global imperative to address climate change has led countries like India to implement innovative carbon pricing mechanisms, creating a complex regulatory landscape for high-pollution industries. This qualitative study examines the multifaceted impact of carbon pricing on corporate financial performance in sectors critical to India's economy. By analysing policy documents, corporate strategies, and industry reports, the research explores how carbon pricing shapes corporate profitability, investment decisions, and sustainability transformations. Drawing on data from government sources, industry analyses, and academic literature, the study reveals varied adaptation strategies among high-emission sectors, showing a nuanced relationship between emissions reduction and financial outcomes that challenges the notion of environmental regulation as merely a cost burden. It highlights strategic responses by leading Indian corporations, showcasing how regulatory challenges are being met with innovation and efficiency to preserve competitiveness. Ultimately, the research offers valuable insights into India's climate transition by linking policy with corporate finance, and provides actionable recommendations for policymakers, investors, and business leaders, emphasizing the role of carbon pricing as a driver of innovation, operational excellence, and sustainable growth.

KEY WORDS: *Carbon Pricing, Corporate Financial Performance, Emissions Trading*

INTRODUCTION

Climate change is one of the most pressing challenges of the 21st century, compelling nations to adopt policies that balance economic growth with environmental sustainability. Among industrial sectors, the **steel and power industries** are two of the largest contributors to global greenhouse gas (GHG) emissions. According to **Cornwall (Science.org)**, the steel industry accounts for **7% of global GHG emissions**, while the **power sector contributes approximately 34% (US Environmental Protection Agency)**. These industries play a crucial role in India's economy but are **heavily dependent on coal**, making them among the country's most carbon-intensive sectors. The **International Energy Agency (IEA)** reports that India's power sector alone contributes **53% of the nation's total GHG emissions**, with **72% of electricity** generated from coal. Similarly, the **steel industry accounts for 10-12% of India's total emissions** (Farhan et al., Climate Policy Initiative).

Beyond their environmental impact, these industries operate under **tight profit margins**. According to **RBSA Investment Advisors**, thermal power plants typically maintain a **Profit After Tax (PAT) margin of 10-15%**, while **CSI Market reports that the steel industry's average profit margin stands at 15.21%**. With the introduction of **carbon pricing mechanisms**, concerns arise over whether these policies impose an additional financial burden on companies or incentivize innovation and efficiency.

LITERATURE REVIEW

1.Carbon Markets and Pricing Mechanisms

Carbon pricing has emerged as a key policy tool for reducing greenhouse gas emissions. The World Bank reports provide insights into carbon market mechanisms worldwide, while India's Bureau of Energy Efficiency (BEE) outlines its national initiatives. Studies such as the one published in *Springer* analyse carbon pricing's economic impact, emphasizing cost efficiency and market stability.

Shakti Foundation's case study explores internal carbon pricing within companies, demonstrating its role in influencing investment decisions. Similarly, Columbia University's report on structuring India's carbon market highlights the challenges and opportunities of market-based solutions.

2. Impact of Carbon Pricing on Corporate Financial Performance

Several studies examine the financial effects of carbon pricing on corporations. Research published in *ResearchGate* finds a negative correlation between carbon emissions and financial performance in Indian firms.

A *ScienceDirect* article explores how carbon markets influence investment decisions in energy-intensive industries. The *Economic Times* discusses India's upcoming carbon trading initiatives, outlining expected financial impacts.

3. Regulatory and Policy Frameworks

Government and institutional reports provide critical insights into policy frameworks governing carbon markets. India's Ministry of Power outlines regulatory efforts, while the IMF examines policy reforms to support energy transitions in India.

The *Journal of Public Affairs* discusses corporate governance and policy alignment in carbon markets. Reports from the *World Bank* provide a global perspective on best practices.

4. Case Studies: Corporate Strategies and Carbon Compliance

A case study by *Reuters* explores Adani's response to environmental challenges, highlighting corporate strategies for regulatory compliance. The *Wiley Online Library* reviews corporate risk management in the context of carbon markets.

RESEARCH GAP

- Lack of sector-specific qualitative studies
- Few longitudinal and capital structure impact analyses
- Limited comparisons of India's mechanisms with global systems
- Underexplored role of digital technologies in compliance

METHODOLOGY

This study adopts a **qualitative research approach** to assess the impact of India's carbon pricing mechanisms on corporate financial performance, specifically in high-pollution industries such as steel, cement, oil & gas, and power generation. A **case study approach** will be employed to analyse financial and sustainability reports from selected companies operating under India's **Perform, Achieve, and Trade (PAT) scheme** and **Renewable Energy Certificates (RECs) market**. Additionally, policy documents, regulatory frameworks, and industry reports will be examined to understand how carbon pricing influences corporate financial decisions, profitability, and compliance costs. This will provide in-depth insights into corporate adaptation strategies and the financial implications of emissions trading.

Data will be collected from **corporate financial disclosures, government reports, and industry whitepapers** related to carbon pricing and climate finance. A **thematic analysis** will be conducted to identify recurring patterns in corporate responses to carbon regulations, highlighting challenges and best practices in managing environmental compliance costs. The study will also compare India's emissions trading framework with global benchmarks to assess its effectiveness. This qualitative approach will enable a deeper understanding of corporate strategies for navigating the transition to a **low-carbon economy**, offering valuable insights for policymakers, investors, and business leaders.

DATA COLLECTION AND SOURCES

This study relies on multiple data sources to assess the financial implications of India's carbon pricing mechanisms on high-pollution industries. Corporate financial and sustainability reports from companies such as Tata Steel, Adani, Reliance, and NTPC will be examined to understand how carbon pricing affects profitability, capital allocation, and compliance costs. Government reports from institutions like the Bureau of Energy Efficiency (BEE), the Ministry of Power, and the Securities and Exchange Board of India (SEBI) will provide insights into regulatory frameworks and market-based mechanisms such as the Perform, Achieve, and Trade (PAT) scheme and the Renewable Energy Certificate (REC) market. Industry whitepapers from organizations such as the World Bank, the International Monetary Fund (IMF), and the Carbon Disclosure Project (CDP) will offer comparative perspectives on global carbon pricing strategies. Additionally, academic journals and research papers from sources like Springer, ScienceDirect, and ResearchGate will be analyzed to identify empirical trends linking carbon pricing to corporate financial performance. Where possible, qualitative data from interviews with corporate finance executives, sustainability officers, and policy experts will be incorporated to capture industry perceptions and strategic responses. This multi-source approach ensures a comprehensive understanding of how firms navigate regulatory challenges, make financial adjustments, and capitalize on emerging opportunities in the transition to a low-carbon economy.

EPRA International Journal of Environmental Economics, Commerce and Educational Management
Journal DOI: 10.36713/epra0414 |ISI I.F Value: 0.815|SJIF Impact Factor (2025): 8.57 ISSN: 2348 – 814X
Volume: 12 | Issue:5 |May 2025

ANALYSIS FRAMEWORK

To comprehensively assess the impact of India's carbon pricing mechanisms on corporate financial performance within high-pollution industries, a robust analysis framework is essential. This framework encompasses several key components:

1. Thematic Analysis of Corporate Adaptation Strategies:

- **Operational Adjustments:** Investigate how companies modify their operations, supply chains, and product offerings to align with carbon pricing regulations. This includes the adoption of energy-efficient technologies and shifts towards renewable energy sources. For instance, a survey by Action Speaks Louder revealed that major steelmakers, including India's JSW Steel, have shown minimal or no renewable energy use, highlighting the challenges in transitioning to low-carbon production.
- **Risk Management Practices:** Evaluate the implementation of internal carbon pricing strategies and other risk mitigation measures. These practices can influence investment decisions and promote energy efficiency, thereby affecting financial performance.

2. Comparative Analysis with Global Benchmarks:

- **Policy Structure Comparison:** Contrast India's carbon pricing mechanisms, such as the Perform, Achieve, and Trade (PAT) Scheme and the proposed Carbon Credit Trading Scheme (CCTS), with international counterparts like the European Union Emission Trading Scheme (EU ETS) and China's carbon market. This comparison aims to assess the relative effectiveness and efficiency of these policies. Notably, India's Finance Minister has criticized the EU's planned Carbon Border Adjustment Mechanism (CBAM) as an arbitrary trade barrier that could impact India's economic growth and transition efforts.
- **Sectoral Performance Evaluation:** Analyse differences in financial outcomes and emission reductions across industries operating under various carbon pricing regimes. This includes examining how different sectors respond to carbon pricing in terms of compliance costs, profitability, and competitiveness.

3. Financial Metrics Evaluation:

- **Profitability Analysis:** Investigate the correlation between carbon productivity—defined as the ratio of output produced to carbon emissions—and financial performance indicators such as Return on Assets (ROA), Return on Equity (ROE), and Return on Sales (ROS). Studies have shown that carbon emissions reduction can increase ROA, ROE, and ROS, indicating a positive relationship between emission mitigation and financial performance.
- **Cost Structure Assessment:** Analyse how carbon pricing influences production costs, pricing strategies, and overall cost structures. This includes evaluating the direct costs of compliance and indirect costs such as changes in input prices. Research indicates that carbon trading markets can affect corporate capital structures by altering cash flow capacities and financing costs, impacting overall financial health.

4. Policy Effectiveness Assessment:

- **Emission Reduction Evaluation:** Assess the success of carbon pricing mechanisms in achieving targeted emission reductions. This involves analyzing emission trends before and after policy implementation to determine effectiveness.
- **Economic Impact Analysis:** Examine the broader economic implications of carbon pricing, including effects on sectoral output, employment, and competitiveness. This analysis helps in understanding the macroeconomic consequences of environmental regulations.

5. Integration of Digital Tools:

- **Technological Adoption:** Explore the role of digital technologies, such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT), in enhancing carbon management and reporting. These technologies can improve data accuracy, transparency, and compliance efficiency.
- **Data Analytics Utilization:** Assess the impact of advanced data analytics on compliance and strategic decision-making processes. The use of big data and predictive analytics can help companies anticipate regulatory changes and optimize their carbon management strategies.

FINDINGS AND DISCUSSION

The implementation of carbon pricing mechanisms in India has elicited varied responses from high-pollution industries, influencing corporate financial performance, operational strategies, and compliance behaviours. An in-depth analysis of recent studies, news articles, and industry reports reveals several key insights:

1. Financial Implications of Carbon Pricing

Research indicates a negative correlation between corporate carbon emissions and financial performance among Indian firms. A study analysing 57 Indian companies participating in the Science-Based Targets initiative and 74 non- companies from 2019–2020 to 2022–2023 found that reducing carbon emissions can enhance financial performance. This supports the "win-win" hypothesis, suggesting that emission mitigation efforts can lead to

profitability improvements. Furthermore, the adoption was observed to have a moderate relationship, highlighting the role of structured emission reduction commitments in financial outcomes.

2. Cost Efficiency through Carbon Markets

The introduction of carbon markets has demonstrated potential cost savings for Indian businesses. A simulation study conducted in 2020–2021, involving 21 large Indian enterprises representing approximately 10% of the nation's industrial emissions, revealed a 28% reduction in the total cost of emissions reductions. This finding underscores the economic viability of market-based mechanisms in facilitating cost-effective emission mitigation strategies.

3. Sectoral Adaptation Strategies

Steel Industry:

The steel industry, accounting for approximately 7% of global CO_2 emissions, faces substantial challenges in transitioning to low-carbon production. A survey by Action Speaks Louder revealed that major steelmakers, including India's JSW Steel, have shown minimal adoption of renewable energy sources. However, JSW Steel has initiated several measures to shift towards greener practices:

Renewable Energy Integration

JSW Steel plans to commission a total of 600 MW of additional hybrid renewable energy capacity by the fiscal year 2026-27, consisting of 200 MW of solar energy and 400 MW of wind energy at 60 MW at Salem, and 210 MW at JSW Steel Coated Products. This initiative will increase the company's total renewable energy generation capacity to 2,507 MW.

Decarbonization Targets

JSW Steel aims to reduce its CO_2 emission intensity by 42% by 2030, compared to a 2005 baseline. This commitment is part of the company's broader sustainability objectives, which also include achieving 100% recycling of all solid wastes generated and reducing freshwater consumption by over 39% by 2030.

Green Hydrogen Initiatives

JSW Energy has signed a seven-year contract with JSW Steel to supply green hydrogen and green oxygen for producing green steel. The pilot project has a capacity of 3,800 tonnes per year, utilizing 25 MW of renewable electricity. The hydrogen produced will be supplied to JSW Steel's manufacturing facilities through pipelines.

Carbon Capture Collaboration

In October 2024, JSW Steel entered into an agreement with BHP and Carbon Clean to explore the implementation of Carbon Clean modular technology. The joint studies aim to assess the feasibility of capturing up to 100,000 tonnes per year of CO_2 emissions—the largest scale Cyclone deployment in steelmaking to date. These studies are anticipated to be completed during 2026, after which the parties will consider installing at JSW Steel's Vijayanagar site.

Product Innovation for Renewable Sector

JSW Steel has introduced JSW Magsure, a coated steel product specifically designed to support the renewable energy sector, particularly in solar installations. This innovation underscores the company's commitment to aligning its product offerings with sustainable energy solutions.

Expansion into Copper Production

In March 2025, JSW Group announced plans to set up a 500,000 metric ton capacity copper smelter in Odisha by 2028/29, with feedstock sourced from Peru and Chile. This move aims to support JSW's electric vehicle and battery manufacturing plans, as copper is a critical mineral essential for India's green energy transition.

Power Industry

The power industry plays a pivotal role in India's transition towards sustainable energy, with companies like NTPC Limited at the forefront of this transformation. As India's largest power utility, NTPC has undertaken significant initiatives to expand its renewable energy portfolio and reduce its carbon footprint.

- **Renewable Energy Expansion**
  NTPC has set an ambitious target to achieve 60 GW of renewable energy capacity by 2032, aiming for renewables to constitute nearly 45% of its overall power generation capacity. To accelerate this growth, NTPC established NTPC Renewable Energy Limited (NTPCREL) in October 2020, a fully owned subsidiary dedicated to increasing the company's green footprint across the country and internationally.

- **Major Investments and Projects**
  In February 2025, NTPC announced plans to invest over ₹2 trillion (approximately $23 billion) in renewable energy projects in Madhya Pradesh. This investment includes the development of up to 20 GW of renewable energy capacity, an 800 MW pumped hydroelectric storage project, and other sustainable non-fossil fuel power plants.
- **Innovative Renewable Initiatives**
  NTPC has been a pioneer in adopting innovative renewable energy solutions. The company has developed several floating solar power plants, such as the 100 MW plant at Ramagundam, Telangana, and the 92 MW plant at Kayamkulam, Kerala. These projects utilize water surfaces for solar energy generation, conserving land and reducing water evaporation.
- **Collaborations and Joint Ventures**
  NTPC has entered into strategic partnerships to bolster its renewable energy initiatives. In February 2025, NTPC and its subsidiary NTPC Green Energy signed agreements with the Madhya Pradesh government to develop projects focusing on solar, wind, pumped hydro, and other carbon-neutral energy sources. **Current Renewable Portfolio**
  As of September 2021, NTPC had 6,173 MW of solar and wind capacity under operation, 3,784 MW under implementation, and 5,378 MW in the pipeline. The company's operational renewable projects span various states, including significant solar photovoltaic installations in Andhra Pradesh, Rajasthan, and Madhya Pradesh.

4. International Trade Considerations
Global carbon pricing policies, such as the European Union's Carbon Border Adjustment Mechanism (CBAM), have implications for Indian exporters. Companies like Meranti Green Steel in Thailand are positioning themselves to benefit from such mechanisms by investing in green steel production. Indian firms must adapt to these international policy shifts to maintain competitiveness in global markets. □cite□turn0news23□□

5. Macroeconomic Perspectives
Economists highlight the broader economic impacts of transitioning to a green economy, comparing the associated costs and pressures to historical events like the 1973–74 oil shock. Investments in clean energy, estimated at 2–3% of GDP over the coming decades, may lead to higher inflation and job displacement. However, long-term benefits include the adoption of more efficient technologies and potential economic gains from sustainable practices.

Conclusions and Recommendations for Carbon Pricing in India
For Corporates
- View carbon pricing as a driver of innovation
- Invest in renewables and digital tools
- Engage with global benchmarks

For Policymakers
- Design flexible, sector-sensitive carbon schemes
- Offer incentives for technological upgrades
- Anticipate international trade barriers

For Investors
- Integrate carbon metrics in risk models
- Reward ESG compliance and low-emission profiles

India’s climate policy journey is still unfolding. Firms that proactively embrace sustainability will not just survive—but lead—in the emerging green economy.

SOURCES

1. *Adani Group. (2024).* Sustainability Report 2024*. Retrieved from https://www.adani.com/sustainability-report-2024*
2. *Bureau of Energy Efficiency (BEE). (2023).* Perform, Achieve, and Trade (PAT) Scheme Guidelines*. Ministry of Power, Government of India. Retrieved from https://beeindia.gov.in/sites/default/files/PAT_Guidelines.pdf*
3. *Columbia University Center on Global Energy Policy. (2024).* India's Ambitious Green Steel Plan Hinges on Mitigating Coal*. Retrieved from https://www.energypolicy.columbia.edu/indias-ambitious-green-steel-plan-hinges-on-mitigating-coal/*

4. *European Commission. (2023).* Carbon Border Adjustment Mechanism: Questions and Answers. *Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3661*
5. *International Energy Agency (IEA). (2023).* India: Electricity. *Retrieved from https://www.iea.org/countries/india/electricity*
6. *International Energy Agency (IEA). (2023).* India: Emissions. *Retrieved from https://www.iea.org/countries/india/emissions*
7. *JSW Steel. (2024).* Climate Action Report 2024. *Retrieved from https://www.jswsteel.in/sites/default/files/assets/industry/steel/IR/CSR/Sustainability%20Reports/JSW-Climate-Action-Report-2024-23052024.pdf*
8. *Ministry of Power, Government of India. (2023).* Annual Report 2022-23. *Retrieved from https://powermin.gov.in/sites/default/files/uploads/MOP_Annual_Report_2022-23_English.pdf*
9. *NTPC Limited. (2024).* Renewable Energy Initiatives. *Retrieved from https://ntpc.co.in/power-generation/renewable-energy*
10. *Securities and Exchange Board of India (SEBI). (2023).* Business Responsibility and Sustainability Reporting by Listed Entities. *Retrieved from https://www.sebi.gov.in/legal/circulars/may-2023/business-responsibility-and-sustainability-reporting-by-listed-entities_60285.html*
11. *World Bank. (2023).* State and Trends of Carbon Pricing 2023. *Retrieved from https://openknowledge.worldbank.org/handle/10986/37455*
12. *World Steel Association. (2023).* World Steel in Figures 2023. *Retrieved from https://worldsteel.org/steel-topics/statistics/world-steel-in-figures-2023/*