

Ownership, Compliance, and Climate Responsibility: Investigating the Role of Foreign versus Local Ownership in Carbon-Intensive Industries in India

Trisha Pandit
pandittrisha1604@gmail.com

ABSTRACT

Climate change has intensified debates over who should bear responsibility for the environmental impacts of carbon-intensive industries, particularly when production is increasingly spread across national borders.

The paper examines whether ownership structure influences environmental compliance in India by comparing six companies across the steel, cement, and thermal power sectors, including both Indian firms and foreign-owned subsidiaries or joint ventures. The analysis brings together evidence from corporate sustainability reports, government records, National Green Tribunal proceedings, environmental disclosures, and other publicly available sources to compare emissions intensity, renewable energy use, production or generation capacity, and regulatory compliance. While the foreign-owned firms in the steel and cement sectors generally show fewer recorded regulatory actions than their domestic counterparts, the overall picture is more nuanced. Differences in technology, regulatory capacity, and sector-specific conditions also play an important role in shaping environmental performance. Rather than presenting ownership as a single explanation for compliance outcomes, this study argues that it is one part of a broader institutional and political landscape.

By approaching ownership through the lens of global climate responsibility, the paper highlights how transnational investment can complicate questions of accountability for emissions produced within carbon-intensive industries

INTRODUCTION

As the world confronts an accelerating climate crisis, the question of who bears responsibility for rising emissions has become heavily disputable. We have noticed that the Global North often tout their progress in reducing domestic greenhouse emissions, when much of this success rests on the relocation of

carbon-intensive production to semi-peripheral economies¹. A prominent real life example is the United Kingdom, which has reduced its domestic greenhouse gas emissions by about 50% since 1990. It is often cited as a leading achievement in climate progress (UK Government, 2024). Still, this success is mainly due to outsourcing energy-intensive industries like steel and cement production to countries in the Global South, like China and India.

Through Foreign Direct Investment (FDI)² and transnational supply chains, core nations like the United States, Germany and Japan outsource energy-intensive industries abroad. With this, they retain economic benefits and reputational credit for cleaner domestic records. As a result, India being a semi-periphery, becomes both a host of these industries and the bearer of major ecological burdens.

In this context, foreign versus local ownership structures offer a critical lens for analyzing environmental compliance³ in carbon-intensive industries. Ownership matters not only for firm behavior but also for global climate justice. Foreign firms, i.e. subsidiaries or affiliates of multinational corporations headquartered abroad that have established operations in host countries through FDI, can usually face unique incentives to obey regulations, because of global scrutiny, liability concerns, and home-country expectations. On the other hand, domestic firms may end up exploiting regulatory gaps, showing weak enforcement and political ties, and lobbying power to minimize compliance costs. That is why the comparative study of ownership is essential for understanding if the outsourcing of emissions exacerbates inequities in global climate governance⁴ or whether transnational ownership may elevate compliance standards in host countries at times.

For examining these dynamics, India has a large advantage. As a semi-peripheral country with one of the fastest-growing economies and among the world's largest emitters (though its per capita emissions are much lower than those of core nations like the United States), India hosts both large domestic

¹ **Semi-peripheral economies** are middle-tier countries in global capitalist structures, characterized by intermediate levels of industrialization, dependence on core nations for capital and technology, and vulnerability to ecological burdens from outsourced production.

² **Foreign Direct Investment (FDI)** refers to an investment made by a firm or individual in one country into business interests located in another country, typically involving a significant degree of control or ownership (e.g., establishing operations or acquiring at least 10% of a foreign company's assets), as defined by the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD).

³ **Environmental compliance** refers to the adherence of industries, firms, or entities to environmental laws, regulations, and standards established by national or international authorities to mitigate ecological harm. In India, this includes compliance with the Environment (Protection) Act, 1986, which governs emission standards (e.g., SO₂, NO_x, PM), waste disposal, and mandatory environmental clearances (ECs).

⁴ **Global climate governance** encompasses international systems, agreements, and institutions designed to manage and mitigate climate change through coordinated global action. Key frameworks include the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement (2015), which set targets for greenhouse gas reductions and promote principles like "common but differentiated responsibilities" (CBDR). These systems involve national commitments (e.g., Nationally Determined Contributions), monitoring mechanisms, and accountability measures to ensure compliance, while addressing inequities between developed and developing nations in tackling climate impacts.

conglomerates like Tata Steel, NTPC, and UltraTech Cement, and foreign subsidiaries like ArcelorMittal Nippon Steel (*Joint Venture; Luxembourg and Japan*), Heidelberg Materials (*Germany*), and AES (*United States*). Even after the presence of environmental regulations and institutions such as the Central Pollution Control Board (CPCB) and the National Green Tribunal, compliance still remains highly uneven here (Basu, 2024). This imbalance raises questions about ownership type: whether it systematically shapes compliance patterns in industries such as cement, steel, and thermal power, which collectively account for a huge chunk of share in India's industrial emissions.

The paper hence asks: How does foreign versus local ownership⁵ Carbon-intensive industries in India impact compliance with environmental regulations, and what does this reveal about the countries' shared climate responsibility in the cross border outsourcing of emissions?

This research adds to existing scholarship in three ways. First, it advances academic debates on environmental political economy by situating ownership within global structures of responsibility. The existing literature has already said a lot about how foreign direct investment (FDI) influences environmental outcomes in host countries through pollution halo effects in emerging economies or the scale and technique impacts of trade openness. But ownership itself has rarely been treated as a proxy for transnational accountability, particularly in semi-peripheral settings like India. Most studies either generalize about FDI's environmental spillovers or discuss firm-level governance in developed markets, and very few integrate ownership structures to the larger North-South debate over who bears responsibility for global resource use and environmental harm. By deciding to address this gap, I'm focusing on pairing political economy theories of uneven development with empirical firm-level analysis, along with showing how foreign ownership can simultaneously entrench and unsettle existing asymmetries in climate-related power.

Second, this offers useful insights for Indian regulators trying to target enforcement more effectively. In India, carbon-intensive sectors like cement, steel, and thermal power pull in significant FDI, yet compliance stays uneven because institutional capacity is weak and Special Economic Zone (SEZ)⁶ exemptions create loopholes. Sector-specific, ownership-disaggregated data is still thin on the ground here. A few studies look at corporate governance's importance in emissions disclosure or performance (e.g., Ezhilarasi & Kabra, 2017), but almost none of them turn that into something regulators can actually use, like prioritizing audits in FDI-heavy zones or using home-country norms as compliance leverage.

Third, it speaks to global climate governance on how emissions outsourcing quietly undermines "common

⁵ **Local ownership** refers to companies that are headquartered, registered, and primarily operate within India. These firms are predominantly governed by Indian environmental and industrial regulations, like the Environment (Protection) Act, 1986, and are influenced by domestic institutional frameworks, including State Pollution Control Boards (SPCBs) and local political ties, which can affect compliance through lobbying or regulatory leniency.

⁶ **Special Economic Zones (SEZs)** are designated areas in India offering tax incentives and relaxed regulations to attract FDI, but they often include environmental exemptions that enable regulatory arbitrage.

but differentiated responsibilities” (CBDR)⁷. The CBDR principle, enshrined in the UNFCCC and Paris Agreement, is meant to balance shared obligations against historical emissions and capability. But a lot of the literature critiques how consumption-based outsourcing erodes this in practice, where core nations push emissions out through supply chains while still claiming mitigation wins. Such outsourcing is often made possible by Foreign Direct Investment (FDI). It also complicates how climate considerations get mainstreamed into development cooperation, especially for semi-peripheral economies like India that end up carrying a disproportionate environmental burden (Gupta & van der Grijp, 2010). CBDR has been studied plenty in the context of NDCs and trade-climate tensions, though only a few empirically link it to firm ownership, such as how FDI-driven outsourcing masks developed countries' footprints and pushes the burden onto hosts like India. By tracing ownership's role in this obfuscation, this paper contributes to calls for corporate-level accountability in global inventories, strengthening CBDR's implementation amid rising border carbon adjustments.

By the end of this paper, it is evident that ownership not only influences compliance outcomes but also reveals the inequities embedded in transnational climate responsibility.

India's Role in the Global Climate Economy

India exemplifies the tensions of a semi-peripheral economy. On one hand, it attracts foreign capital by offering cheap labor and lax enforcement of environmental standards, with OECD (2023) reporting inward FDI to India's manufacturing and energy sectors (including cement, steel, and thermal power) exceeding \$20 billion annually in 2022-23, driven by infrastructure demand. On the other, it suffers disproportionately from the ecological costs of industrial growth, including air pollution, water contamination, and greenhouse gas emissions. Cement, steel, and thermal power industries are among the largest contributors to India's emissions (Zhang et al., 2025). India's core industries driving the economy include **manufacturing** (e.g., automobiles, chemicals, pharmaceuticals, and electronics), **agriculture**, **services** (IT and financial sectors), and **energy** (oil, gas, and power). These are the four pillars keeping India's economy running. Together they account for over 70% of GDP, and support a projected 6.5% growth for FY 2025-26 (Reserve Bank of India, 2025).

What's fascinating is the scale of employment underneath these numbers: more than 600 million people work across these sectors (MoSPI, 2025), and manufacturing alone employs around 60 million as of 2025 (Goldar, 2024), a number the PLI scheme has been pushing higher. Break it down further and the picture gets sharper. Cement supports over a million jobs, direct and indirect combined (IBEF, 2025). Steel carries roughly 2.5 million people across production and mining (IBEF, 2022). Thermal power, sitting

⁷ **Common But Differentiated Responsibilities (CBDR)** is a principle of international environmental law, notably enshrined in the Paris Agreement and Rio Declaration, stating that all countries share a common duty to address global environmental issues like climate change, but their responsibilities are differentiated based on their different contributions to the problem and varying economic and technical capacities to respond. Developed countries, historically responsible for more pollution and possessing more resources, are expected to lead the way by providing financial and technological support to developing countries.

within the wider coal and energy sector, sustains close to 3 million jobs in generation and distribution (Ministry of Coal, 2026). None of this is incidental; it's exactly why these industries matter so much to India's employment story as urbanization and infrastructure spending are accelerating.

But there's a harder truth sitting underneath the job numbers. This is what global asymmetry actually looks like on the ground: core nations get to outsource the dirty part of production and still hold onto their climate credentials, while countries like India absorb all the ecological fallout. Which is really the whole argument for why ownership can't be studied in a vacuum. It sits at the intersection of global pressure (home-country standards, what investors expect) and local weakness (loopholes in regulation, enforcement that doesn't quite reach).

Literature Review

Foreign Firms and Environmental Compliance: The evidence on foreign ownership and compliance is mixed, but it leans positive. Multinationals tend to carry home-country standards into host-country operations with them, mostly when those standards are stricter (Christmann & Taylor, 2001). There is also a different mechanism: stakeholder pressure and reputational risk, which push foreign firms toward cleaner practices almost regardless of where they're operating (Kolk & Pinkse, 2008). This claim is backed up with numbers: institutional ownership in the UK and US correlates with lower greenhouse gas emissions (Benlemlih et al., 2022). When we put these together, a pattern emerges. Foreign firms often perform better environmentally because they're more exposed to liability and more embedded in international disclosure frameworks (Christmann & Taylor, 2001). India fits this pattern too. Foreign ownership here is likewise associated with stricter environmental standards (Gupta et al., 2019). But I'd push back a little on how far this literature goes. Most of it stops at establishing that ownership matters in general, without specifying how much the effect depends on everything else surrounding it.

Local Firms and Regulatory Arbitrage: Domestic firms, meanwhile, are good at finding the gaps. SEZs in particular become spaces where firms can delay or dodge compliance altogether (Sahu, 2020). There's also similar reporting from a different angle: outdated licenses that let industries keep operating without ever meeting updated norms (MoEFCC, 2018). It has also been documented that Indian companies underreport emissions, or simply withhold data when it suits them (Centre for Science and Environment, 2019). Political ties make this even worse. Legal affidavits from the National Green Tribunal (NGT) provide direct evidence that large domestic corporations — NTPC being one of them — have repeatedly delayed implementing emissions-control technologies, openly acknowledging non-compliance in some cases (National Green Tribunal, 2020, 2022). In one case, NTPC confirmed that certain units at its Tanda and Unchahar plants were not meeting environmental norms. At Shaktinagar, the company pushed its FGD plant's commissioning date to December 2024, a date that only got set because of ongoing litigation over the delays. What this shows, I think, is less about individual bad actors and more about a structural problem. Weak enforcement combined with political economy constraints creates room for local firms to prioritise profit over compliance, and they take it.

Contradictions in Foreign Firm Behavior: Foreign ownership isn't really a guarantee, though. Even when headquartered in stricter environments, they sometimes adapt downward once they're operating somewhere enforcement is weak. For example, AES India has run on outdated permits for years, which tells us that whatever compliance advantage comes with foreign ownership can vanish fast if local institutions aren't holding the line. Ownership thus interacts with regulatory capacity, and global norms only carry weight when someone local is actually enforcing them.

Climate Responsibility and Outsourcing: We also have a bigger accounting problem here. Davis and Caldeira (2010) argue that outsourced emissions distort national carbon inventories, successfully hiding the real carbon footprint of developed countries. Mbanyele (2023) traces a related mechanism: foreign institutional investors shaping emissions across global supply chains. India is arguably one of the clearest examples of this dynamic in practice. Its rise as a manufacturing hub has come with real economic gains, but also rising emissions, and the split is unjust: foreign firms extract the profit, while the local communities live with the ecological cost.

Analytical Gap and Framework

Even with all these insights, firm-level studies that actually compare ownership types within India are still scarce. Most existing work either generalizes about ownership broadly or zeroes in on a single industry. Through this paper, I try to close that gap by comparing foreign and domestic firms across cement, steel, and thermal power directly, using both quantitative and qualitative methods together.

My analysis is derived from two lenses: political economy and environmental justice.

From a political economy angle, ownership is actually about economic and regulatory powers being distributed across borders (Strange, 1996). Foreign firms answer to two masters simultaneously: home-country standards and host-country enforcement, while domestic firms are driven primarily by local institutions and political ties. That dual accountability makes ownership a useful tool for understanding how regulatory incentives are distributed and manipulated. It exists because foreign firms, usually subsidiaries of larger multinationals, cannot ignore the strict environmental rules back home. To understand this better, let's look at the EU's Industrial Emissions Directive (European Commission, 2010) or U.S. SEC disclosure requirements on ESG risk (SEC, 2022): They both carry legal and reputational weight that follows a company overseas. Or, take a German-owned firm like Thyssenkrupp India. It might adopt higher-grade abatement technology just to satisfy their parent-company audits, even if the Indian enforcement wouldn't require it, simply to avoid liability under something like the OECD Guidelines for Multinational Enterprises (OECD, 2011). On the contrary; host-country enforcement, such as India's CPCB inspections or NGT orders, although supposed to have the floor, is chronically under-resourced and inconsistently applied, which lets foreign firms lean on their home-country reputation as a kind of halo effect (Greenstone et al., 2022).

This duality cuts both ways. On one hand, it creates real pressure for firms, as they can face lawsuits in their home countries for harms caused abroad, like the way France's Duty of Vigilance Law holds parent companies liable for subsidiary pollution (Loi n° 2017-399, 2017), which pushes firms toward things like ISO 14001 certification. On the other hand, it opens room for strategic adaptation. A firm can exploit host-country gaps, like SEZ exemptions (Ministry of Commerce and Industry, 2005), while keeping up misleading appearances at home through selective reporting. What this basically shows is that ownership redistributes regulatory power in a very crooked way: it can push the standards high up through their imported best practice, but it can just as easily let firms externalize costs onto countries that can't hold them accountable, because of their weak and politically schemed mandates.

The environmental justice side of this focuses on who carries the burden. Carbon-intensive industries in India don't just generate local harm, namely polluted air, waste, degraded ecosystems; they also add on to the global emissions in ways that fall hardest on people who have no say at all in the matter. Ownership carries weight here because it decides who profits, who pollutes, and who's left holding the aftermath. Studying compliance patterns through this lens is what lets the analysis get into the unfair practice running through transnational climate governance.

Together, these two lenses are what let us move past firm-level compliance and toward something more systemic; that is, how ownership structures really reflect and reinforce global asymmetries in responsibility.

Hypotheses

Based on the literature review, following patterns are expected:

Foreign Firms from Strict-Regulation Contexts Will Show Higher Compliance:

Firms headquartered in the EU or Japan should perform better, driven by reputational concerns, tougher home-country norms, and liability risks.

Domestic Firms Will Exploit Regulatory Gaps:

Local firms, mostly those in SEZs, are likely to delay or dodge compliance by leaning on political connections and weak enforcement.

Ownership Interacts with Enforcement Capacity:

Even foreign firms that intend to comply may lower standards when enforcement by Indian regulators is inconsistent.

Carbon Responsibility is Unequally Distributed:

Ownership structures will highlight how emissions are outsourced to India while profits are exported, reinforcing inequities in climate responsibility.

METHODS

The analysis includes six companies across three of India's most carbon-intensive industries: steel, cement, and thermal power. These sectors were selected because each of them combines substantial production or generation capacity with significant emissions and regulatory exposure, while allowing us to compare across different ownership structures. Assessing all three sectors maximises the scope of analysis beyond a single industrial process and makes it possible to check if ownership-related compliance patterns recur under distinct sectoral technologies, emissions metrics, and enforcement challenges.

Compliance will be assessed using violation records from the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs), records from Ministry of Environment, Forest and Climate Change (MoEFCC), Environmental Impact Assessments and corporate ESG reports, Comptroller and Auditor General (CAG) reports, National Green Tribunal court case documents, reports from NGOs and journalists like Centre for Science and Environment and Human Rights Watch, and Company Disclosures and Sustainability Reports, for Self-Reported Compliance and Records.

Data Analysis

To test whether foreign-owned firms actually do comply more with environmental regulation than locally owned ones, we compare six companies across steel, cement, and thermal power, as previously mentioned. The analysis is centered around three dimensions reported in the existing evidence: production capacity, CO₂ intensity and renewable energy share in Table 1; regulatory records and judicial profiles in Table 2; and company-level environmental disclosure. Because these sectors log capacity and emissions intensity in different units, comparisons are drawn within sectors. Cross-sector interpretation targets patterns of ownership, compliance, and transparency rather than a blended numerical ranking.

- Steel Sector: ArcelorMittal Nippon Steel (AM/NS) India (Foreign Joint Venture, Luxembourg/Japan) versus Tata Steel (Local Conglomerate).
- Cement Sector: Heidelberg Materials India (Foreign Subsidiary, Germany) versus UltraTech Cement (Local Conglomerate).
- Thermal Power Sector: NTPC Limited (Local State-Owned Enterprise) versus Odisha Power Generation Corporation (OPGC: Local State Enterprise, formerly a foreign-local joint venture with AES Corporation, USA).

Within each sector, the firms were chosen to allow a direct foreign-versus-local comparison rather than a broad sectoral survey. AM/NS India was paired with Tata Steel, and Heidelberg Materials India with UltraTech Cement, because each firm operates at meaningful production scale within its sector and each publishes enough compliance-adjacent data; such as, CPCB/SPCB notices, NGT case records, ESG or integrated reports, to support a like-for-like comparison. Tata Steel and UltraTech Cement are also among the largest domestic producers in their respective industries, which makes them reasonable benchmarks for how large local conglomerates operate under Indian regulatory oversight. Thermal power doesn't offer an equivalent foreign-local pair today, so NTPC was included as India's largest state-owned generator, and OPGC was included because its ownership shifted from a foreign-local joint venture with AES Corporation to a fully local state enterprise in late 2020. That shift lets OPGC be measured against its own earlier record rather than against a separate company, giving the analysis a within-firm test of the ownership question that a cross-firm pairing alone couldn't provide. Across all three sectors, the firms were selected as much for the traceability of their compliance and disclosure history as for their size, since the comparisons depend on being able to check claims against independent regulatory and judicial sources rather than corporate reporting alone.

Emissions Performance

Table 1: Comparative Emissions and Energy Mix (FY 2023- 2026)

Company	Ownership Type	Crude Steel/ Cement Production/ Power Capacity	CO₂ Intensity	Renewable Share of Energy	Future Target
AM/NS India	Foreign Joint Venture (Luxembourg / Japan)	9.6 MTPA (expanding to 15)	2.30–2.40 tCO_2/t crude steel	~12% (higher scrap usage)	20% CO ₂ intensity reduction by 2030.
Tata Steel	Local Conglomerate	21.6 MTPA	2.32 tCO_2/t crude steel	~8%	40% renewables by 2030
Heidelberg Materials India	Foreign Subsidiary (Germany)	5.4 MTPA	~495–507 $kg CO_2/t$	>40% (utilizing)	Reduce net CO ₂ emissions to 400 kg/t by 2030

Company	Ownership Type	Crude Steel/ Cement Production/ Power Capacity	CO ₂ Intensity	Renewable Share of Energy	Future Target
			cementitious material	wind-solar hybrids and WHRS)	
UltraTech Cement	Local Conglomerate	147.3 MTPA	~539- 557 <i>kg CO₂/t</i> cementitious material	~17.6% of total energy consumption	27% reduction in greenhouse gas intensity by 2032 (2017 baseline)
NTPC Limited	Local State-Owned Enterprise (PSU)	~76 GW (total capacity); ~50 GW (thermal)	0.75–0.78 <i>kg CO₂/kWh</i>	~15% active green/non-fossil capacity	35% reduction in emissions intensity by 2030; build 60 GW of renewables by 2032.
OPGC	Local State Enterprise (Formerly Foreign JV with AES Corp, USA until late-2020)	1.74 GW	0.95- 1.05 <i>kg CO₂/kWh</i> (subcritical)	<1% (relying primarily on 5.07 MW mini-hydel demo)	Supercritical Stage-III expansion (2x660 MW) with zero-liquid discharge limits.

Table 1 shows substantial differences in scale and in the form of emissions reporting across the six companies. In steel, Tata Steel reports more crude-steel capacity than AM/NS India. The two firms land in a similar place on carbon intensity, which makes sense since both still rely heavily on blast furnace and basic oxygen furnace routes.

In cement, UltraTech reports a much larger capacity value than Heidelberg Materials India, while Heidelberg reports a lower CO₂-intensity range compared with UltraTech. Heidelberg also reports a higher renewable-energy share than UltraTech.

In thermal power, NTPC reports much higher total capacity but slightly lower CO₂ intensity than OPGC. These values are presented in their original sector-specific forms in Figures 1 and 2 and are not converted into a common cross-sector metric.

Regulatory Compliance and Judicial Records

The violation history narrates a much sharper story. An analysis of legal actions, National Green Tribunal (NGT) rulings, and State Pollution Control Board (SPCB) directives shows a paradigm of compliance issues among local and state enterprises, clashing with the smoother regulatory profiles of foreign-owned facilities.

Table 2: Compliance and Violation Records (2017–2025, 2020–2026)

Company (F: foreign owned, L: Local)	Approx. CPCB/ SPCB Notices (2017–25)	Approx. NGT/Legal Cases (2020–26)	Major Issues Reported
AM/NS India (F)	0	2	Gujarat High Court PIL flagged localized wastewater discharge at Hazira into Tapi River; statutory filings show corrective monitoring.
Tata Steel (L)	4	3	Recurrent CPCB/SPCB notices for particulate matter (PM) exceedances, industrial dust, and untreated water discharge in Jharkhand and Odisha.
Heidelberg Materials India (F)	0	0	High standard adherence to SPCB clearance norms; zero active high-profile NGT litigations
UltraTech Cement (L)	Periodic SPCB warning reviews	1	Occasional issues regarding alternative fuel co-processing stack emissions and fugitive dust near mining sites
NTPC Limited (L)	Multiple regulatory warnings	High / Active Caseload	Systemic, documented delays in Flue Gas Desulphurization (FGD) retrofits across thermal plants (e.g., <i>Rashmi Singh v. NTPC Ltd.</i>); ash dyke breach litigations.

Company (F: foreign owned, L: Local)	Approx. CPCB/ SPCB Notices (2017–25)	Approx. NGT/Legal Cases (2020–26)	Major Issues Reported
OPGC (L)	Periodic SPCB/MoEFCC reviews	Active local NGT filings	Chronic delays in completing FGD installations for Units 3 & 4; ash pond management and slurry spill disputes near local reservoirs.

Table 2 gives crisp quantified contrasts in steel and cement; thermal power is a different case, since most of what's recorded there is qualitative rather than numerical. The table does point toward a stronger compliance profile for the two foreign-owned firms in their respective sector comparisons, but being upfront, it doesn't give uniform numerical counts across all six companies, and it shouldn't be read as if it does.

The thermal-power records in particular show why reducing "compliance" to a single number doesn't really work:

NTPC Limited: Table 2 shows multiple regulatory warnings and a high or active caseload, tied to delayed Flue Gas Desulphurization (FGD) retrofits and ongoing ash-dyke litigation.

OPGC: Table 2 shows periodic SPCB/MoEFCC reviews and active local NGT filings around FGD delays, ash-pond management, and slurry-spill disputes.

Transparency and Self- Reporting

Disclosure adds another layer here, one that isn't captured by the compliance counts alone. AM/NS India and Heidelberg Materials India both report under parent-company or international frameworks, with company-specific decarbonization and operational metrics attached. Tata Steel and UltraTech Cement also put out extensive sustainability or integrated reports, but the external records I pulled show localized compliance issues that never show up in those headline corporate numbers. For NTPC and OPGC, most of what is there comes from regulatory and judicial records around FGD implementation, ash management, and related operational problems. So the study treats transparency as something to read alongside Tables 1 and 2, not as a stand-in for actual measured compliance.

Across the whole sample, disclosure quality and compliance outcomes don't sort neatly into foreign-versus-local. The two foreign firms have the strongest quantified compliance records in Table 2, sure. But the domestic conglomerates and state enterprises somewhat vary a bit in both how much they report and how exposed they are to regulatory action. If anything, that variation is the argument for comparing within sectors rather than across ownership types broadly, and for keeping self-reported commitments separate from independently recorded notices, cases, and reviews.

RESULTS

Looking across all six companies, there's a valid association between ownership and compliance, but it's not a clean one. Sector, technology, reporting units, and how complete the regulatory records are all shape what we're actually seeing. The two foreign-owned firms, AM/NS India and Heidelberg Materials India, do have fewer quantified regulatory actions in Table 2 than their domestic counterparts in the same sector. Nonetheless, the evidence does not permit ownership to be isolated as an independent causal factor. Differences in capacity, emissions denominators, technology, and sectoral context prevent a direct numerical ranking across all three sectors.

In steel, Tata Steel is operating at a larger scale, with 21.6 MTPA of crude-steel capacity, against 9.6 MTPA for AM/NS India (expanding toward 15 MTPA). Their carbon intensity figures sit close together: 2.32 per unit of crude steel for Tata Steel, 2.30–2.40 for AM/NS India. Where the gap really opens up is in compliance: four CPCB/SPCB notices and three NGT or legal cases for Tata Steel, versus zero notices and two legal cases for AM/NS India. So steel shows a stronger quantified compliance profile for the foreign joint venture, but not really a decisive edge in carbon intensity.

In cement, UltraTech is far larger on the capacity measure in Table 1: 147.3 MTPA against Heidelberg's 5.4 MTPA. Further, Heidelberg reports the lower CO₂-intensity range, roughly 495–507 per unit of cementitious material compared with UltraTech's approximately 539–557. Heidelberg also reports a renewable-energy share above 40%, against UltraTech's roughly 17.6% of total energy consumption. And on compliance, Heidelberg shows zero CPCB/SPCB notices and zero legal cases, while UltraTech has periodic SPCB warning reviews and one legal case. Of the three sector comparisons, cement is honestly the one where the ownership hypothesis lines up most cleanly with lower intensity, higher renewable integration, fewer compliance actions, all pointing the same direction.

Thermal power doesn't allow for the same kind of paired comparison, and OPGC's case actually adds an important wrinkle to the ownership argument rather than complicating it randomly. NTPC reports about 76 GW of total capacity, around 50 GW thermal, a CO₂ intensity of 0.75–0.78 kg CO₂/kWh, and roughly 15% active green or non-fossil capacity. OPGC reports a capacity value of 1,740, high coal intensity, renewable integration under 1%, and a CO₂ intensity of 0.95–1.05 kg CO₂/kWh. Both companies carry real compliance concerns: NTPC with multiple regulatory warnings and a high or active caseload, OPGC with periodic SPCB/MoEFCC reviews and active local NGT filings. What's worth pulling out separately is OPGC's own trajectory over time. Until late 2020, it ran as a joint venture with the US-based AES Corporation holding a 49% stake, and its record then was solid, with supercritical units coming online without much friction, and compliance broadly held. After OHPC bought out AES's share and OPGC became fully state-owned, things shifted. A 2023 ash-dyke breach at Banharipalli, Odisha sent fly ash slurry into nearby farmland, triggering an NGT-ordered damage assessment. Around the same time, Odisha SPCB issued a show-cause notice over contractors illegally dumping ash near Sambalpur and Rengali without proper clearances, and expansion hearings drew real pushback from villagers who felt earlier promises on jobs and pollution control had quietly been dropped. What makes this useful isn't just

that OPGC struggled; it's that the struggles started once the foreign stake left. That's a within-firm comparison, not a cross-firm one, and it makes the ownership argument harder to dismiss as coincidence.

Taken together, I think the findings offer qualified support for the idea that firms operating inside stronger transnational accountability systems tend toward more consistent compliance. That case is strongest in cement and in the quantified steel compliance data. But the thermal-power comparison, the qualitative entries, and the different emissions denominators across sectors all push back against treating ownership as a sufficient explanation on its own. Figure 1 lays out the production and capacity entries from Table 1 using sector-specific scales, and Figure 2 shows the reported CO₂-intensity values in their original units without converting across incompatible measures. All compliance findings stay tied strictly to Table 2.

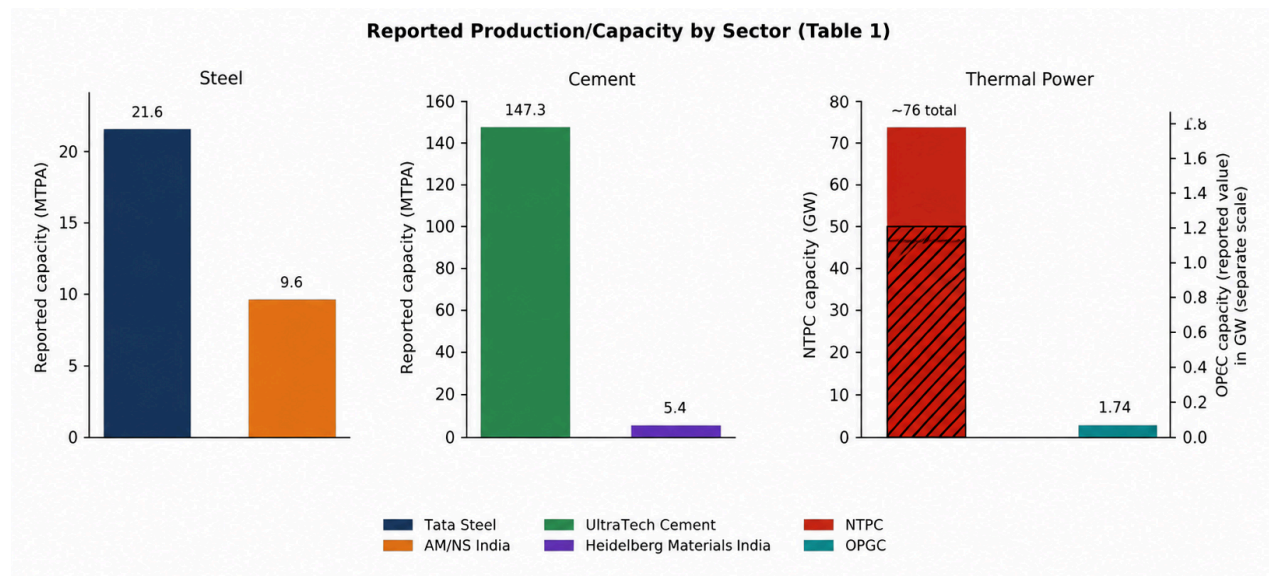


Figure 1. Reported production and capacity values for all six companies in Table 1, grouped by sector. Steel and cement values are shown in MTPA as reported. NTPC is approximately 76 GW total and approximately 50 GW thermal. OPGC is 1.74 GW.

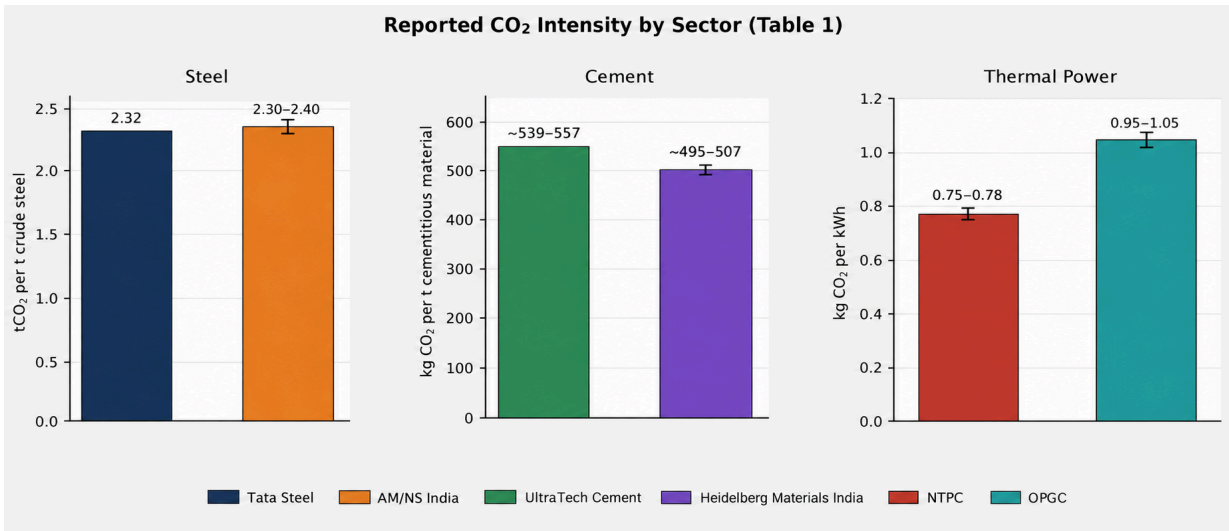


Figure 2. Reported CO₂-intensity values for all six companies in Table 1, grouped by sector and retained in their original units. Steel is reported per unit of crude steel, cement per unit of cementitious material, and thermal per kWh.

Limitations

This study uses a small, purposively selected, non-random sample of six firms; relies substantially on secondary and company-reported data; and does not conduct inferential statistical testing. Certain constraints in the study's scope and data framework warrant attention. The analysis centers on a deliberate sample of six major enterprises rather than a broad statistical survey, meaning the findings highlight specific structural patterns rather than universally generalizable trends across all Indian manufacturing. Additionally, the reliance on public regulatory archives, court dockets, and corporate sustainability disclosures introduces potential variations in reporting consistency, as state-level enforcement and self-reporting criteria are rarely uniform. Lastly, because each sector operates on distinct production metrics—measuring output in tonnes of crude steel, cementitious material, or kilowatt-hours—the data does not lend itself to standardized cross-industry statistical testing or a single causal metric for ownership.

DISCUSSION

These findings carry implications at both the national and global level. For Indian regulators, I think the best lesson is that enforcement mechanisms need strengthening so compliance holds steady across ownership types, not just where it's convenient. Closing SEZ loopholes and going after firms with a documented history of political protection would meaningfully cut down on regulatory evasion.

Globally, I'd argue policymakers need to get past nation-based carbon accounting and start building in corporate-level responsibility for outsourced emissions. Frameworks that track emissions across transnational supply chains would let accountability actually be shared between host and home countries, instead of quietly falling through the cracks between them. ESG reporting should also be required to reflect foreign subsidiaries' real environmental performance. Theoretically, what I'm arguing is that ownership itself is a marker of global inequality in climate responsibility, with economies like India negotiating their climate obligations from a position that's still structurally shaped by dependence on foreign investment.

CONCLUSION

What I decided to do in this paper was gain a basic understanding of how ownership alters environmental compliance across India's carbon-intensive industries, and what that, in turn, says about climate responsibility more broadly. The literature suggests ownership does matter, and that firms from stricter home-country contexts tend to raise their compliance bar, while domestic firms more often find ways around local rules. But it's not a clean or uniform predictor; foreign firms adapt downward too, whenever weak enforcement lets them.

The bigger point, I think, is that ownership exposes just how lopsided climate governance really is. Emissions get pushed onto economies like India, while accountability stays scattered and hard to trace back to its source. Getting anywhere close to climate justice is going to require stronger enforcement at home, real corporate-level responsibility frameworks, and a clearer-eyed recognition of how much ownership structures actually shape environmental outcomes.

Going forward, I want to take this same comparative approach to other semi-peripheral economies across the Global South, and to other carbon-intensive sectors beyond the three covered here, to build a more complete picture of how ownership patterns mediate compliance and responsibility in an economy built on outsourced emissions.

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