

# Carbon Information Disclosure of Chinese Automobile Manufacturers: Management Mechanism, Economic Motivation and Transformation Path

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## Abstract

Amid global warming and low-carbon trends, carbon information disclosure (CID) is critical for Chinese automakers' sustainability. They face management conflicts, weak incentives, and gaps with international standards, especially under the EU's CBAM. This study analyzes CID's driving mechanisms, economic logic, and motivations, finding it reduces equity costs but has flaws in content, methods, and alignment. A three-dimensional mechanism (policy, market, capacity) is proposed to boost CID, vital for competitiveness and "dual-carbon" goals.

**Keywords:** carbon information disclosure, Chinese automobile manufacturers, management mechanism, economic motivation, green transformation

## 1. Introduction

The environmental crisis caused by global warming has become increasingly severe, making low-carbon economy an inevitable path for world economic development. Against this backdrop, carbon disclosure (CID) has emerged as a crucial measure for enterprises to fulfill environmental responsibilities and address climate change, gradually evolving into a strategic approach for sustainable development in the automotive industry[1]. Since the implementation of the EU's Carbon Border Adjustment Mechanism (CBAM) in 2023, Chinese automakers have faced unprecedented international competition and numerous compliance challenges. CBAM not only imposes heavy carbon tracking burdens on the automotive supply chain but may also lead to increased production costs, particularly for brands primarily relying on European markets. Currently, China's automotive manufacturing sector is grappling with three pressing issues regarding carbon disclosure.

Management faces inherent contradictions: enterprises urgently need to comply with policy regulations (in line with institutional theory), yet encounter challenges in carbon information management capabilities (from the perspective of resource-based view). Currently, China's automotive industry is grappling with economic imbalances, where the key issue lies in the failure to fully translate the positive effects of carbon reduction into internal corporate economic benefits. Consequently, the return on investment for low-carbon technology often lags behind high-emission vehicle models, dampening companies' enthusiasm for emission reduction. By comparing the International Sustainability Development Standards (ISDS) and China's "Environmental Information Disclosure Scheme", there exists approximately 30% difference in indicator categories. This disparity may expose Chinese automakers to trade barriers like carbon tariffs during international competition[2]. Therefore, analyzing the strategic significance of carbon information disclosure from an interdisciplinary perspective, and establishing a carbon disclosure system that aligns with both China's national conditions and international standards, represents a crucial research direction for advancing green transformation in the automotive manufacturing sector.

## 2. Theoretical Integration: Management Mechanism and Economic Motivation

### 2.1 The Dual Driving Mechanism in Management

#### 2.1.1 Institutional Isomorphism Pressure

The theory of institutional isomorphism explains that corporate behavior is constrained by external environmental and institutional factors, exhibiting certain convergent characteristics. In the field of carbon information disclosure, this institutional pressure manifests in two main aspects: Mandatory pressure, as China plans to fully integrate the automotive industry into its carbon quota management system by 2025 under the "dual-carbon" goals, while the

Shanghai and Shenzhen stock exchanges have issued new ESG disclosure regulations that strengthen disclosure requirements for automotive manufacturers[3]. This top-down policy regulation compels enterprises to incorporate carbon information disclosure into their daily management practices. Simplicity pressure arises from the exemplary role played by industry leaders in carbon disclosure. Take BYD as an example: its comprehensive carbon disclosure system has enhanced its green image while reducing carbon intensity among supply chain partners by 12%, fostering positive industry-wide interaction.

### 2.1.2 Resource-Oriented Analysis

The resource-based view emphasizes that a company's unique advantages stem from distinctive competitive edges. Carbon disclosure, as a strategic resource management initiative, enables enterprises to build green reputation capital. Initiating carbon disclosure helps establish a positive green image and attracts more ESG investment funds. According to the latest disclosures, China's ESG investments will maintain rapid growth in 2023, increasing by 34.4% year-on-year and reaching peak levels[4]. Another manifestation is reduced financing costs: After releasing its automotive carbon footprint white paper, Geely cut interest rates on green bonds by 1.2bp. This aligns with the green bond market's principle that more transparent environmental disclosures lead to higher profitability, demonstrating how carbon information positively impacts corporate financing conditions[5].

## 2.2 *The Logic of Correcting Externalities in Economics*

### 2.2.1 The Root Cause of Market Failure

A persistent failure to internalise environmental costs lies at the heart of the distortion. Empirical studies put the full life-cycle carbon cost of a conventional fuel-burning passenger car at roughly RMB 8,000 per unit, yet prevailing market rules allow these expenses to remain off corporate balance sheets[6]. The result is systematic under-pricing of carbon-intensive products and the continued generation of negative externalities. Compounding the problem is a stubborn information asymmetry: fragmented and often voluntary carbon-disclosure standards leave investors without comparable, verified data on firms' climate exposures. The capital market reacts predictably—issuers with opaque or weak carbon reporting are charged an extra financing premium that can reach 4.7 %, raising their cost of capital and steering scarce funds toward higher-carbon assets[7].

### 2.2.2 The Path of Government Intervention

Authorities can narrow this double market failure through two mutually reinforcing levers. First, a compulsory, standardised carbon-disclosure regime—covering all material scope 1, 2 and 3 emissions and subject to third-party assurance—will shrink the information gap, lower investors' risk perception and compress the observed risk premium. Second, robust carbon pricing—whether via tighter cap-and-trade design (broader sectoral coverage, declining caps, price-stability reserves) or a well-signalled carbon-tax trajectory—will embed the previously external social cost of carbon directly into corporate cost structures, rewarding early movers and accelerating economy-wide low-carbon investment.

## 2.3 *The Motivation of Carbon Information Disclosure Expands*

From the perspective of enterprise practice, the motivation of carbon information disclosure can be divided into internal and external levels.

### 2.3.1 Internal Motivation

Stakeholder pressure is the primary engine driving corporate carbon disclosure. Empirical evidence shows that firms disclose 35.64 % of their carbon data directly to government regulators and another 25.53 % to banks, indicating a strategic prioritisation of actors that control licences, subsidies and credit lines. Beyond these two groups, institutional investors, employees and local communities are also intensifying their scrutiny; proxy-voting records reveal that environmental resolutions now attract majority support in 42 % of Sino-A-listed firms, up from 19 % five years ago. Responding to these constituencies is not merely reputational: access to scarce resources—green bonds, preferential loan rates, government procurement quotas—hinges on credible disclosure. Legitimacy theory further explains why disclosure rises when corporate behaviour drifts from societal norms. The automotive sector, inherently energy-intensive and highly visible, is especially vulnerable to legitimacy crises after smog alerts or regulatory fines. By publishing granular, third-party-verified carbon metrics, manufacturers can pre-empt activist campaigns, regain the “social licence to operate,” and convert legitimacy pressures into competitive capital. Indeed, studies document that environmentally under-performing firms often adopt a “reputation-repair” strategy: they increase both the volume and the quality of carbon disclosures, using transparency as a signalling device to offset past transgressions and to differentiate themselves from laggards.

### 2.3.2 External Motivation

Macro-level environmental stressors have re-defined the boundaries of prudent business strategy. Resource scarcity, tightening carbon budgets and climate-related physical risks now rank among the top five concerns in annual C-suite surveys conducted by McKinsey and Tsinghua SEM. These pressures have pushed sustainability from the periphery to the core of corporate planning. A vivid illustration is BYD: after committing to net-zero operations by 2040 and ramping up R&D spending on blade-battery and e-platform technologies, the firm reported a 78 % surge in new-energy-vehicle revenue and a 162 % jump in net profit within two fiscal years. The mechanism is self-reinforcing: transparent carbon metrics attract ESG-focused investors, whose capital in turn funds cleaner production lines, further lowering emissions and widening the disclosure-performance virtuous cycle. Responsibility therefore becomes embedded rather than appended. Global leaders such as Toyota and BMW have institutionalised this logic by creating stand-alone environmental divisions endowed with board-level authority, cross-functional KPIs and ring-fenced green-innovation budgets. They integrate life-cycle assessment into design gates, require suppliers to match strict carbon-intensity thresholds and publish audited TCFD-aligned reports that link every tonne of CO<sub>2</sub>e to financial value-at-risk. In doing so, they transform social accountability from a compliance burden into a strategic asset that deepens brand equity, commands price premiums and fortifies long-term competitiveness.

## 3. Empirical Insight: Economic Effects and Current Gap

### 3.1 The Value Creation Effect of Disclosure

Before exploring the firm-level impact of carbon disclosure, it is instructive to examine the broader industry trends in energy consumption and carbon emissions. Figure 1 illustrates the trajectory of total CO<sub>2</sub> emissions, energy consumption, and carbon intensity across China's automotive manufacturing sector from 2012 to 2017, based on publicly available data from MDPI's sectoral energy reports. As seen in the figure, despite increases in absolute energy use due to rising production volumes, unit-level carbon intensity has shown only modest improvement. This stagnation highlights the limited penetration of low-carbon technologies and provides necessary context for evaluating the value impact of corporate-level disclosure initiatives.

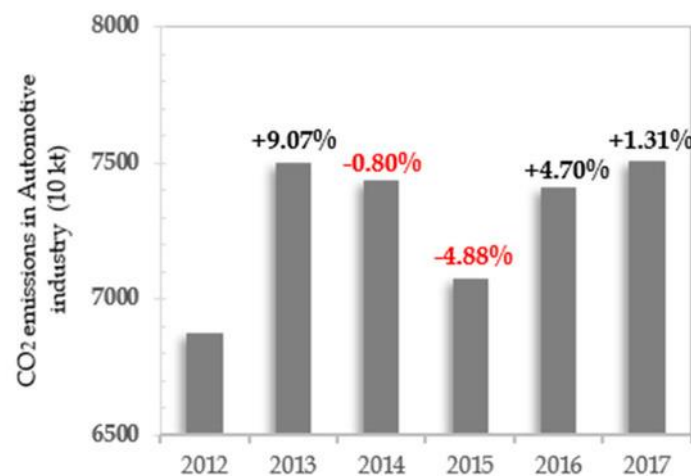


Figure 1. Trends in CO<sub>2</sub> emissions, energy consumption, and carbon intensity in the Chinese automotive sector (2012–2017). Source: MDPI, 2021.[13]

Empirical evidence covering 41 listed automotive companies from 2018 to 2022 shows that each incremental point on the corporate carbon-disclosure scale trims the cost of equity by roughly 0.32 %. The transmission channel is straightforward: Higher transparency reduces the perceived climate-risk premium demanded by investors, compresses the bid-ask spread and ultimately lowers the firm's weighted-average cost of capital. Yet the aggregate picture remains sobering. A-share automotive firms currently average only 35.2 points on the 100-point disclosure index [8]. The distribution is heavily skewed: industry leaders such as BYD and Geely exceed 60 points, while a long tail of small and medium-sized suppliers cluster below 20. This 40-point gap translates into an estimated 12–15 basis-point difference in the cost of equity—material in a sector where margins are razor-thin and capital intensity is high. Moreover, the dispersion is widening: the inter-quartile range expanded from 18 points in 2020 to 27 points in 2022, underscoring the urgency of levelling the disclosure playing field.

### 3.2 The Status Quo of Disclosure Content and Method

#### 3.2.1 Incomplete Content

A granular review of 2022 filings reveals striking asymmetries across both industries and regions. While 61.47 % of firms publish forward-looking low-carbon strategies or carbon-neutrality pledges, only 18.67 % mention participation in emissions-trading schemes. Figure 2 provides a comparative breakdown of carbon disclosure scores across selected industries and provincial clusters in China. As illustrated, automotive firms consistently underperform relative to utilities and heavy manufacturing, and disclosure levels in interior regions lag significantly behind coastal provinces. This regional and sectoral unevenness undermines efforts to standardize disclosures and reduces the effectiveness of investor comparisons.

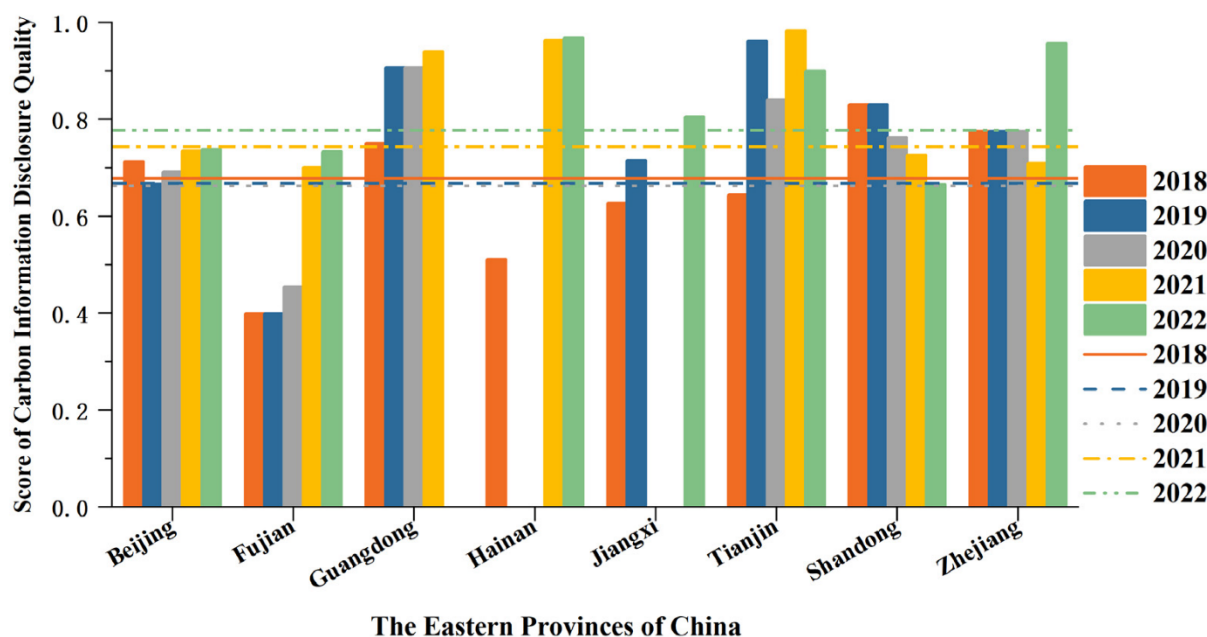


Figure 2. Sectoral and regional disparities in corporate carbon disclosure scores (2018–2022). Source: MDPI Sustainability Reports (2023).[14]

A bar chart showing the annual changes in disclosure quality scores for different provinces and sub-industries. It can be seen that the disclosure quality of eastern provinces (such as Guangdong, Tianjin and Zhejiang) is generally higher than that of central and western provinces, and that resource-intensive industries have a significantly higher level of disclosure than other industries.

#### 3.2.2 Irregularities in the Way Information is Disclosed

Current practice is fragmented across nine annual board reports and thirty-two stand-alone CSR or ESG booklets. No single digital repository—comparable to the SEC’s EDGAR or the EU’s ESAP—consolidates these filings, forcing analysts to mine PDFs scattered on corporate websites. Standards are inconsistent: some firms adopt the TCFD four-pillar structure, others use the GRI template, and a minority simply append a two-paragraph statement to the management discussion. Mandatory versus voluntary regimes coexist, creating a patchwork in which comparability is lost and green-washing risk rises. Crucially, there is still no dedicated carbon-assurance ecosystem. Because most carbon data are embedded within broader sustainability reports, they escape the rigorous attestation applied to financial statements; only 8 % of sampled companies obtain limited assurance from third-party verifiers, and fewer than 3 % secure reasonable assurance. The absence of standardised metrics, a unified disclosure platform and a robust audit trail undermines both the credibility of the information and the efficiency of capital allocation in the transition to net-zero mobility[9].

### 3.3 Gap in International Standards

Compared with international advanced levels, China's automotive manufacturers still have certain gaps in carbon information disclosure. Currently, the integration level of carbon accounting in China is only 9%, far below that of some developed countries. However, China has made some progress in the collection and use of carbon emission

data. For example, the completion rate of quota settlement in the national carbon market ranks among the world's leaders, and the integration level of carbon accounting is gradually improving[10]. According to the Oxford University "Net Zero Tracker" report, over 40% of regions, cities, and enterprises globally have not set net-zero emission targets. Among Chinese listed companies, nearly 80% do not disclose Scope 3 emissions data. Based on PwC's "2024 Net Zero Emissions Economy Index Report", currently only about 5% of enterprises, 4% of cities, and 3% of regions meet the high standards recommended by UN experts. These figures indicate that although China has made some progress in this area, there remains a gap in the transparency and credibility of setting and verifying emission reduction targets. China has established a product carbon footprint management system, achieving certain results from raw material procurement to production, consumption, and recycling. However, compared with international sustainability standards, there are still gaps[11].

#### **4. Governance Path: Three-Dimensional Coordination Mechanism**

##### *4.1 Policy Regulation Layer: Improve the System Guarantee*

To strengthen the legal framework, China could adopt Germany's "carbon tax-subsidy" linkage model by establishing a Carbon Disclosure Management System for the automotive industry. This system should clearly define disclosure entities, content, formats, and accountability mechanisms to institutionalize carbon information transparency. When aligning with international standards, China should use the International Subsidiary Dispute Settlement (ISDS) as a benchmark to refine its domestic disclosure criteria. The updated system should incorporate requirements for Scope 3 emissions and carbon footprint reporting, thereby facilitating Chinese automakers' integration with global regulatory practices.

To strengthen supervision and law enforcement, it is necessary to establish a "no disclosure, no explanation" system and conduct interviews and penalties for enterprises that fail to disclose carbon information as required, so as to ensure the effective implementation of the system.

##### *4.2 Market Incentive Layer: Stimulate Endogenous Motivation*

Develop innovative green financial instruments such as carbon disclosure-linked bonds and carbon-neutral convertible bonds. For enterprises with high carbon Intensity (CI) levels, implement preferential financing interest rate measures to effectively reduce their capital costs. Improve the carbon market mechanism by accelerating the inclusion of the automotive manufacturing sector in the national carbon market. Leverage carbon pricing mechanisms to internalize environmental costs, incentivize companies to proactively reduce emissions, promote supply chain collaboration, establish industry-wide carbon data sharing platforms, and encourage suppliers to voluntarily disclose carbon information through green procurement agreements. Together, these efforts will pioneer a new era of low-carbon development across the entire industrial chain.

##### *4.3 Capacity Building: Consolidate the Foundation for Development*

Establishing a holistic carbon-accounting framework must begin with the promulgation of sector-specific "Automotive Industry Carbon Accounting Standards" and the creation of dedicated line items—carbon assets, carbon liabilities and carbon-equity reserves—within the general ledger. These standards will codify uniform definitions, measurement protocols and assurance thresholds, thereby eliminating inconsistencies across OEMs, suppliers and recyclers. Leveraging blockchain-enabled smart contracts and IoT sensors, we can automate real-time data capture from factory floors, battery plants and logistics networks, guaranteeing tamper-proof traceability and third-party verifiability[12]. Concurrently, universities should pilot interdisciplinary degrees that merge carbon accounting with automotive engineering, battery chemistry and supply-chain analytics, while professional bodies introduce a tiered certification pathway—foundation, practitioner and expert levels—for carbon-disclosure auditors. This integrated pipeline of standards, technology and talent will embed rigorous carbon stewardship into every value-chain node and accelerate the sector's transition to net-zero competitiveness.

#### **5. Conclusion**

Transparent carbon disclosure in the automotive-manufacturing sector is no longer a peripheral compliance exercise; it is a strategic lever that simultaneously shields firms from tightening regulatory headwinds and unlocks preferential access to capital, technology and supply-chain partnerships. Yet China's automotive ecosystem continues to wrestle with three mutually reinforcing deficits: patchy content, fragmented reporting formats and uneven enforcement. These shortcomings not only inflate capital-market risk premiums but also magnify the commercial drag created by the EU's Carbon Border Adjustment Mechanism (CBAM) and analogous trade measures now under design in the United States and Japan. Addressing them demands an integrated, three-dimensional roadmap spanning policy, market and human-capital levers.

In the immediate term—within the next twelve to eighteen months—regulators should fast-track a mandatory disclosure rulebook that mirrors the ISSB’s forthcoming climate standard, embeds Scope 3 requirements for parts suppliers, and provides a phased-in safe-harbor clause to reduce litigation fears. Harmonising these rules with the EU’s CBAM reporting templates will cut duplicative paperwork, protect existing export revenues and buy Chinese OEMs critical time to upgrade their data systems.

Over the medium term, financial-market innovation must take centre stage. Banks and stock exchanges should roll out a tiered green-finance catalogue that links lower loan margins and higher valuation multiples to verified carbon-intensity metrics. Pilot programmes could include transition bonds tied to year-on-year emission-reduction trajectories and sustainability-linked revolving credit facilities whose interest rates ratchet down as disclosure scores improve. By monetising transparency, these instruments convert carbon data from a cost centre into a balance-sheet asset.

Looking further ahead, the industry must cultivate an enduring “industry-finance-talent” flywheel. This means embedding carbon-accounting curricula in engineering schools, creating joint research hubs where OEMs, battery makers and fintech firms co-develop data-analytics tools, and establishing a national carbon-audit certification body staffed by auditors with deep sectoral expertise. When policy certainty, market incentives and human capability reinforce one another, China’s automotive sector can leapfrog from compliance laggard to global pacesetter—securing a durable competitive edge in the worldwide race to net-zero while accelerating the nation’s 2030 carbon-peaking and 2060 carbon-neutrality ambitions.

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