Implications Of China's Green Finance Framework for Foreign Manufacturing Enterprises: A Case Study of Tesla's Gigafactory Shanghai

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Abstract. The paper examines how China's green finance framework affects the sustainable development of manufacturing enterprises, using Tesla's Gigafactory Shanghai as a representative foreign case. Mainly drawing on Tesla's official disclosures, such as Impact Reports, Form 10-K, and Investor Day presentations, alongside China's evolving green finance policies, the study examines how policy-driven incentives, ESG disclosure reforms, and environmental governance mechanisms have indirectly shaped Tesla's financial performance, compliance practice, supply chain localization and innovation. However, several challenges still exist, including the limited participation of foreign enterprises in domestic green bond markets, fragmented ESG disclosure standards, and uneven green upgrading among local suppliers. To better engage with China's green finance system, Tesla could consider adopting customized financing strategies, improve the compatibility of its ESG reporting with local standards, and actively support the green upgrading of small and medium-sized suppliers in its supply chain. The findings provide insights into how China's green finance framework influence the behavior of foreign manufacturing enterprises in emerging economies directly and indirectly.

Keywords: China's green finance; Tesla's gigafactory Shanghai; ESG; Sustainability.

1. Introduction

In global, manufacturing serves as a cornerstone of economic development, particularly in developing countries, where it remains central to long-term growth and employment [1]. In the post-pandemic era, the industrial development is reshaped by new imperatives: digital transformation, environmental sustainability, and resilience. According to UNIDO's Industrial Development Report 2022, countries with strong manufacturing bases demonstrated greater resilience in the face of COVID-19-related shocks [2]. Meanwhile, the pandemic accelerated structural shifts, most notably the adoption of advanced digital technologies and the global promotion of green industrial practices.

Traditional manufacturing industries, characterized by high energy consumption and inefficient resource utilization, are now under increasing pressure to enhance productivity through automation and digitization and align with low-carbon development goals. Various strategies have been explored to curb carbon emissions, including advancements in renewable energy, establishing carbon markets, and broader green technological innovation. Within these efforts, green finance has attracted increasing scholarly and policy interest since the early 2000s, and it emerged as a pivotal financial paradigm that aligns environmental sustainability with economic development goals [3].

China continually positions green finance as a strategic tool to coordinate economic development and environmental sustainability. As the world's fastest-growing major economy since 1980, China has undergone a profound industrial and urban transformation. Whereas, the rapid development has come with significant environmental costs, as China also became the world's largest emitter of greenhouse gases, accounting for about one-third of global carbon dioxide (CO2) emissions [4]. Recognizing the urgent need for change, in 2020, China announced its dual carbon goals, aiming to peak CO2 emissions before 2030 and achieve carbon neutrality by 2060 [4]. Within the strategic framework, green finance has become a critical instrument to mobilize capital for sustainable development, particularly to support the sustainable transformation of manufacturing.

The paper uses Tesla Shanghai as a case study to explore the implication of China's green finance framework on a foreign manufacturing enterprise. While Tesla is already a sustainability-oriented firm with a strong global environmental profile, its operations in China still reflect important adaptive behaviors in response to local financial, regulatory, and institutional conditions. The study analyzes three main areas: improving financing mechanisms, enhancing ESG compliance, and locating green supply chain innovation. At the same time, the study identifies key challenges such as inconsistent financing access, regulatory fragmentation, and supply chain gaps. The goal is to assess how green finance has shaped enterprise behavior and to provide insights into how enterprises can better integrate into China's green finance frameworks.

2. Background

2.1. Overview of Green Finance in China

China is integrating green financial services into constructing a modern financial system with its characteristics, which aligns with the national strategies outlined in the 20th CPC National Congress and the Central Financial Work Conference [5-6]. One of the goals is to enhance resource allocation, risk management, and market pricing through green finance, thus supporting the Beautiful China Initiative and promoting high-quality financial development [7]. Since the People's Bank of China (PBOC) released the 2016 Guidelines for Establishing the Green Financial System, China has rapidly developed a comprehensive green finance architecture. The PBOC defines green finance as "financial services provided for economic activities that support environmental improvement, climate change mitigation, and more efficient resource utilization" [8]. Built on a strong policy foundation, the system comprises a range of financial instruments, including but not limited to green credit, green bonds, green stock indices, green development funds, and green insurance [8].

China has introduced targeted policy instruments that lower entry barriers and guild enterprise engagement to encourage more enterprise participation in green finance. One example is the Shanghai Green Finance Pilot Zone, launched under the Action Plan for Accelerating the Development of Emerging Financial Industries (2022–2025) by the Lin-gang Administrative Committee [9]. The initiative simplifies green bond approvals, provides fiscal incentives, and diversifies green financial products [9]. At the industry level, the new energy vehicle (NEV) sector has received targeted support under the 2020 development plan, with accelerated bond approvals and interest subsidies from the People's Bank of China. These initiatives reflect how China's top-down green finance model shapes enterprise behavior through regulatory coordination and industrial alignment with national development goals [10]. This topic will be further elaborate in the following sections.

2.2. Overview of Tesla's Gigafactory Shanghai

Founded in 2003, Tesla, Inc. is a multinational company headquartered in the United States. The company operates a global network of Gigafactories, strategically located to support the production of electric vehicles (EVs) and battery energy storage systems. As of 2024, Tesla's major Gigafactories include facilities in Nevada, New York, Shanghai, Berlin, and Texas, each serving critical roles in advancing the company's mission of accelerating the world's transition to sustainable energy [11].

Tesla's Gigafactory Shanghai, also known as Gigafactory 3, represents a landmark achievement in China's foreign direct investment and green industrialization. Established in 2019 as Tesla's first manufacturing facility outside the United States, the Gigafactory was a significant breakthrough. It was also China's first wholly foreign-owned automotive plant after allowing full foreign ownership in the new energy vehicle sector [12].

Strategically located in the Lingang area of Shanghai, Gigafactory Shanghai was constructed in 9.5 months, at such a remarkable speed [13]. Tesla's investment in Gigafactory Shanghai aimed to facilitate the affordability of its vehicles for local customers by reducing manufacturing costs and mitigating the impact of adverse tariffs [14]. The facility's design incorporates critical production

processes--stamping, body welding, painting, assembly, and battery pack production-into a single streamlined operation, enhancing operational efficiency and lowering energy consumption [11].

Nowadays, Gigafactory Shanghai serves as a central hub for Tesla's operations in Asia, producing Model 3 and Model Y vehicles for both domestic and international markets. According to Tesla's Q2 2024 update, Gigafactory Shanghai holds the most extensive installed annual vehicle production capacity among Tesla's global facilities, with an output capability exceeding 950,000 vehicles [15].

3. Analysis of Impact

3.1. Enabling Sustainable Investment through Policy-Driven Financial Incentives

China's green finance framework has increasingly played a supportive role in facilitating the growth of manufacturing enterprises by improving access to low-cost capital through policy-driven financial mechanisms. Among them, Tesla's development in Shanghai offers an apt example. The company initially benefited from a range of economic incentives granted by the Shanghai government. These included favorable land-use rights arrangements, tax incentives tied to capital investment performance, and a reduced corporate income tax rate of 15% for the years 2019 through 2023, compared to the standard 25% statutory rate in China [14]. Although these financial arrangements were not formally classified as "green finance", they were closely aligned with China's broader green finance objectives. By supporting EV adoption and carbon reduction, these policy-driven incentives reflect the basic logic of green finance in mobilizing capital for sustainable industrial development.

Besides these indirect policy incentives, China's formal green finance system also creates pathways for deeper financial engagement through green bonds, a channel of growing relevance for foreign manufacturers. Tesla's operations in China also align with the 2021 version of the Green Bond Endorsed Project Catalogue, which identifies projects eligible for green bond financing under Chinese regulatory frameworks [16]. While Tesla has not yet issued green bonds in China, the classification increases its eligibility for future issuance. Also, the designation may enable Tesla to access more simplified approval processes, interest subsidies, and preferential refinancing channels. By contrast, domestic new energy vehicle manufacturers BYD have already actively leveraged China's green finance instruments. Using the difference-in-difference (DID) model and the parallel trend test, Khurram et al. found that the issuance of green bonds significantly improves corporate innovation performance and corporate value [17]. Given these demonstrated benefits, and as Tesla continues to expand within China's green industrial framework, green bond financing may be a strategic tool to reinforce its long-term sustainable investment objectives.

3.2. Strengthening ESG Compliance and Corporate Governance

One of the key channels through which China's green finance framework promotes industrial transformation is strengthening corporate Environmental, Social, and Governance (ESG) compliance. In recent years, regulatory institutions such as the China Securities Regulatory Commission (CSRC) and the Shanghai and Shenzhen stock exchanges have introduced ESG disclosure guidelines requiring listed firms to report key sustainability metrics. These metrics measure carbon and pollutant emissions, circular economy practices, and alignment with national development strategies [18]. Although these requirements primarily apply to domestic listed companies, they are reshaping normative expectations and exerting indirect pressures on the broader enterprise landscape.

Rather than publishing localized ESG disclosures in China, Tesla has released annual Impact Reports from 2018 to 2023, outlining its global performance across environmental, social, and governance dimensions. The 2023 Impact Report highlights key environmental initiatives like battery material traceability, water conservation, and an effort to reduce carbon emissions [11]. However, the report is global in scope and does not explicitly display the ESG performance of Gigafactory Shanghai. Nonetheless, Tesla's Gigafactory Shanghai partially aligns with China's evolving ESG expectations. For example, in 2024, the facility was recognized by the Ministry of Industry and Information Technology (MIIT) as the "Green Supply Chain Management Company of the Year" [19].

Specifically, the MIIT praised Tesla's advanced water recycling system, which achieves a 98% reuse rate and recycles over 400,000 tons of water annually [19]. Tesla's response to China's ESG expectations remains partial and indirect in this context. Green finance has influenced its behavior more through soft policy instruments than formal compliance mechanisms.

3.3. Driving Supply Chain Localization and Sustainable Innovation

China's green finance policies have fostered an enabling environment for manufacturing localization and corporate innovation. Empirical studies using quarterly panel data from Chinese non-financial listed companies between 2016 and 2020 show that green finance instruments-particularly green bond issuance--significantly enhance innovation performance and firm value [15]. While Tesla's technologies, such as full-self driving and battery recycling, reflect global innovation strength, China's green finance ecosystem has also indirectly influenced the sustainable and innovative practices of its local supply chain [11].

By the fourth quarter of 2020, Gigafactory Shanghai had achieved a localization rate of approximately 86% for non-Tesla Model 3 and Model Y components, and the rate continued to rise in subsequent years [20]. In 2025, Tesla launched production at its Shanghai Megapack Factory, the company's first energy storage facility outside the United States [21]. Compared to the Gigafactory, the Mega-factory was completed within nearly seven months, at a speed that probably reflects government support due to its alignment with the Action Plan for Accelerating the Development of Emerging Financial Industries [9]. With an initial annual capacity of 10,000 units, equivalent to roughly 40 gigawatt-hours of storage, the factory enhances Tesla's role in supporting China's renewable energy transition [21].

Green finance has also indirectly supported Tesla's supply chain localization by encouraging upstream suppliers to adopt more sustainable production practices. In 2020, Tesla signed a battery supply agreement with Contemporary Amperex Technology Co. Limited (CATL), a global leader in new energy technology, to support EV production at Gigafactory Shanghai [22]. The strategic partnership helped reduce costs and improve supply chain efficiency. At the same time, CATL has leveraged China's green finance environment to expand low-carbon capacity and drive innovations in electrochemical technology, facilitated by a proactive ESG disclosure strategy that enhance investor confidence and strengthens innovation incentives [23].

4. Challenges in Green Finance Landscape

4.1. Uncertainties and Constraints in Utilizing Green Financial Instruments

Tesla is already listed in the Green Bond Endorsed Project Catalogue, indicating that it meets the necessary requirement to issue green bond, but it has not issued any such bonds in China so far. This may be partly because of the growing procedural complexity and intensified compliance expectations within regulatory system.

Additionally, for foreign enterprises like Tesla, these obligations may not pose fundamental eligibility concerns, but they could cause frictions when coordinating local requirements with the global compliance framework. Furthermore, the inconsistent interpretations of green project standards by Chinese financial institutions have further increased the uncertainty of regulation [10]. While domestic banks such as China Development Bank (CDB) and Industrial and Commercial Bank of China (ICBC) actively promote green loans, foreign enterprises possibly consider China's green finance channels less attractive due to the lack of coordination and higher administrative burdens.

4.2. Mismatch Between Tesla's Global ESG Reports and China's Local Rules

Tesla's global ESG report is relies on centralized Impact Reports, instead of localized disclosures that comply with China's regulatory framework. The lack of localized ESG disclosure reflects broader challenges in coordinating global and domestic governance expectations. China's ESG framework increasingly emphasizes dual importance, industry-specific benchmarks, and carbon tracking

obligations, which is quite different from Tesla's current reporting standard [24]. Furthermore, Tesla was removed from the S&P 500 ESG Index in 2022, reflecting concerns over its lack of a formal low-carbon strategy, governance issues, and unresolved social controversies [25]. As the requirements for ESG information disclosure become increasingly strict, these shortcomings may hinder its deeper integration into China's standardized green financial system.

4.3. Uneven Progress Among Tesla's Local Suppliers

China's green finance policy aim to support sustainable development across industrial supply chains, but progress among Tesla's local suppliers is uneven. Access to green loans and technological innovation funding remains inconsistent, particularly for SMEs. While leading firms like CATL possess the financial and technical capacity to meet increasingly stringent ESG requirements, smaller component suppliers often face resource constraints and limited implementation capabilities.

The fragmented ESG disclosure pattern--such as ESG, CSR, sustainability, climate reporting--has further exacerbated this disparity [10]. The ESG guidelines issued by multiple departments often overlap and lack consistency, creating a significant compliance burden for suppliers. These regulatory inconsistencies can hinder equitable access to green finance and further exacerbate disparities in ESG performance across Tesla's broader supply chain network.

5. Strategic Suggestions

5.1. Improving Tesla's Participation in China's Green Finance System

At the corporate level, Tesla may consider issuing green bonds in China to reinforce its long-term commitment to sustainable manufacturing. However, given the company's strong profitability and sufficient operating cash flow in recent years, reliance on bond financing is unnecessary. Moreover, regulatory complexities, such as disclosure requirements and fund allocation tracking, pose additional barriers. Tesla could establish a dedicated China green finance team to address these challenges while maintaining global standards to navigate local compliance frameworks and policy expectations. At the same time, Tesla might leverage Shanghai's pilot green supply chain notes program, which offers simplified procedures designed to reduce administrative burdens [9].

5.2. Adapting ESG Disclosures to Meet China's Local Standards

To better align with China's evolving ESG expectations, Tesla could improve its disclosure by supplementing its global reports with localized ESG reports for each factory. These site-specific reports could follow a consistent structure and include standardized metrics--such as emissions, water use, and supply chain sustainability--and also reflecting operational differences across facilities. However, this approach may require considerable time and effort, and excessive variation between sites could complicate the company's overall ESG narrative. In parallel, Tesla can engage certified third-party ESG advisory firms, particularly bilingual consulting providers, to help reduce adaptation costs and improve the credibility of its localized disclosures. This strategy allows Tesla to respond to domestic regulatory expectations without overhauling its global reporting framework.

5.3. Helping Local Suppliers Improve ESG through Targeted Support

Tesla can promote supply chain sustainability by providing local suppliers with technical support, standardized ESG reporting templates, and compliance training. By reducing participation barriers, Tesla could encourage broader supplier alignment with its sustainability targets. To address fragmented ESG disclosure requirements, Tesla can engage third-party consultants to develop streamlined reporting systems and avoid duplication. In partnership with financial institutions and local policy initiatives, Tesla can also expand access to green finance for smaller suppliers through credit guarantees and performance-based incentives. These actions enable Tesla to close ESG

performance gaps across its supply chain and demonstrate leadership in building an inclusive and low-carbon manufacturing ecosystem in China.

6. Conclusion

Overall, this study demonstrate that China's green finance framework has contributed to shaping a favorable environment for Tesla's sustainable development in Shanghai, mainly through indirect approaches. Rather than relying on formal instruments like green bonds, Tesla has benefited from policy-driven incentives that aligned with national green industrial policy goals. Secondly, evolving ESG disclosure norms and soft regulatory signals have encouraged Tesla to partially adjust its governance practices, despite the absence of localized ESG reporting. Thirdly, green finance has indirectly influenced Tesla's supply chain development by fostering manufacturing localization and sustainable innovation. However, challenges remain: enterprise's limited participation in green capital markets, fragmented ESG disclosure standards and uneven progress in supply chain. By analyzing Tesla's case, this paper illustrates how a foreign enterprise adapts to China's green finance framework. Further research is needed to examine how the framework directly affects corporate behavior under different regulatory and market environments.

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