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Policy Proposal to Reduce Inequality and Enhance Effectiveness

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Yunzhe Nie
Master in Public Policy (2025)

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This report reflects the views of the author and should not be viewed as representing the views of the National Economics Foundation, Peking University, nor those of Harvard University or any of its faculty.

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Note on Terminology and Sources

This report uses specialized terms related to industrial policy and economic analysis. Key terms are **bolded** and briefly explained upon first use, with full definitions in **Appendix E**.

All external sources are cited in footnotes with the author's name, year, and a hyperlink (when available). Full references are listed in **Appendix F**.

Word Count

14,812 words (excluding Appendices)

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Executive Summary

China’s municipal industrial policies have played a crucial role in shaping the country's economic landscape, driving industrial growth and technological upgrades. However, questions remain regarding the distributional effects of these policies, particularly their impact on household income inequality. While existing research highlights industrial policy’s role in productivity and innovation, there is less attention on how these policies interact with market forces and inter-city competition, and how they influence income disparities.

This report, prepared for Professor Yao Yang, President of the **National Economics Foundation (NEF)** and Director of the **China Center for Economic Research at Peking University**, aims to address two key gaps in the literature:

1. A case study on the role of state support in China’s electric vehicle (EV) industry, showing how industrial policies have facilitated sectoral growth and internal competition.
2. An empirical analysis of the effect of city-level industrial policies on household-level economic inequality, offering recommendations for enhancing policy effectiveness and inclusiveness.

To this end, the report addresses four central questions:

1. How does China's industrial policy operate at the municipal level?
2. What are the key empirical patterns of city-level industrial policy in China?
3. What is the impact of city-level industrial policy on household-level inequality in China? How does it differ by demographics, sectors, and regions?
4. How can industrial policies be improved to better enhance their effectiveness while mitigating its potential effect on inequalities?

Chapter 1 provides an overview of China's industrial policy, positioning municipal policies within the broader framework of national economic planning and their role in market facilitation. It explores the impact of industrial policy on productivity and sector growth, while highlighting challenges like regional competition, policy duplication, and inefficiencies in subsidy allocation. The chapter also examines recent trends in inequality, identifying key drivers, and links industrial policies to rising income disparities through theoretical analysis.

Chapter 2 provides a case study of China's EV industry, showing how state support—especially at the local level—has driven rapid growth and innovation. The policy emphasized industry-wide competition over firm-level winner-picking, combining subsidies, regulation, and strategic market opening (e.g., Tesla's entry). This fostered growth and a market shakeout, with top firms like BYD emerging through competition. However, benefits were uneven, creating regional wage disparities. Cities like Shenzhen and Hefei succeeded with strong local execution, while Shiyan faltered due to coordination failures and weak technological foundations.

Chapter 3 delivers empirical analysis, documenting city-level industrial policy patterns from 2000 to 2018, with a shift in policy focus from coastal to inland regions and evidence of inter-city competition, especially in high-tech sectors. It also analyzes the impact on household-level inequality using data from city policy records and the China Family Panel Studies (CFPS). The analysis shows that industrial policies raise employment and household incomes, especially for less-educated workers in high-tech sectors, though the effects are uneven across industries, and inequality persists across industries.

Chapter 4 outlines a policy framework to enhance the equity and effectiveness of municipal industrial policies. It proposes seven recommendations under three broad strategic priorities:

Invest in Local Skill Development Programs

1. Expand targeted workforce training for low- and mid-skilled workers to align labor supply with policy-supported sectors and promote broader earnings growth.
2. Strengthen vocational education and certification systems in inland and underdeveloped regions to support labor mobility and inclusive participation in high-tech industries.

Focus on Vertical Quality Upgrading

3. Reform industrial subsidy criteria to prioritize technological innovation, productivity gains, and value-added output over pure output expansion.
4. Integrate labor market outcomes—including wages, skill composition, and job quality—into the design, approval, and evaluation of industrial support programs.

Improve Improve Targeting and Accountability

5. Mandate ex-ante distributional impact assessments to ensure that subsidies contribute to inclusive growth and do not exacerbate inequality.
6. Enhance inter-regional coordination to reduce policy duplication, improve industrial specialization, and avoid wasteful subsidy competition between cities.
7. Enforce performance-based accountability by linking subsidies to firm-reported outcomes such as employment, wage levels, and innovation metrics.

Introduction

Industrial policy has long served as a key tool for economic development, enabling governments to guide structural transformation through strategic interventions. Defined as government-led initiatives aimed at selectively supporting industries and sectors to promote economic growth,[1] industrial policy has played a pivotal role in global economic transformations. Historically, it has been central to the post-World War II growth of East Asian economies like Japan and South Korea, and more recently, its resurgence in countries like the United States reflects new challenges related to green transitions and technology competition.[2]

While these policies aim to address market failures and fosters growth and innovation, their implementation often faces informational shortcomings and susceptibility to political capture. [3] Increasingly, attention is being paid to the distributional consequences of these policies—particularly their impact on **income inequality** across sectors, regions, and worker groups.[4]

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[1] Alternative definitions of industrial policy exist in the literature. For example, Lin (2012) describes it as "effective government in support of a market economy"; Rodrick et al. (2024) emphasizes "government policies that explicitly target the transformation of the structure of economic activity in pursuit of some public goal"; and Naughton (2021) defines it as "an intentional effort [of] policy-makers to change the sectoral structure of the economy."
[2] Oqubay et al. 2020.; Irwin 2023
[3] Rodrick et al. 2024
[4] This report uses equality (inequality) and equity (inequity) interchangeably.

Problem Statement and Key Questions

In China, industrial policy has been central to economic strategy, fueling rapid industrialization and innovation. Since 2006, the Chinese government has intensified its focus on industrial upgrading, particularly in strategically important industries such as **semiconductors**, **artificial intelligence (AI)**, **5G**, **Electric Vehicles (EV)**, and **renewable energy technologies**.[5,6] While these efforts have driven innovation and economic growth, their effects on income inequality, especially at the municipal and household level, remain underexplored.

This study seeks to answer a central question:

How can city-level industrial policy in China be improved to reduce economic inequality and enhance policy effectiveness?

To address this, the report analyzes four interrelated questions:

1. How does China's industrial policy system operate, particularly at the municipal level?
2. What are some key empirical patterns of city-level industrial policy in China?
3. What is the impact of city-level industrial policy on household-level inequality in China? How does it differ by demographics, sectors, and regions?
4. How can industrial policies be improved to better enhance their effectiveness while mitigating its potential effect on inequalities?

Methodology

This study employs a three-pronged approach: an extensive literature review, quantitative econometric analysis, and qualitative case studies.

- **Literature Review:** The review draws from Chinese and English-language sources,

[5] García-Herrero & Schindowski 2024
[6] This is the year the *Medium-to-Long-Term Program for Science and Technology Development (2006–2020)* (MLP) was adopted. See Chen and Naughton (2016) for the importance of this program to China's industrial policy.

covering government reports, academic research, economic journal articles, expert commentary, and news articles on industrial policy, inequality, and innovation.

- **Case Study:** The study presents a case study of China's EV industry to illustrate how municipal policy is implemented in practice. The EV industry is selected based on its level of policy support and regional diversity. By comparing cities such as Shenzhen and Shiyan, the study explores the uneven distribution of policy benefits and the role of local governance and execution capacity. The analysis is enriched by interviews with national policymakers, researchers, and industry experts (See **Appendices C and D** for details).
- **Quantitative Analysis**: The core quantitative analysis uses two datasets: a **city-industry policy indicator** derived from municipal government work reports across 284 cities (2000-2018), and microdata from the **China Family Panel Studies (CFPS)**, a longitudinal survey of household income, employment, education, and demographics. This allows for econometric analysis of the relationship between industrial policy and income inequality across sectors, regions, and education levels (See **Appendices A and B** for details).

This report is strcutured as follows. **Chapter 1** provides an overview of China's industrial policy system, focusing on municipal governments' role in implementing national strategies and the challenges they face. **Chapter 2** presents the EV industry case study, illustrating how policy execution impacts both sector efficiency and inequality. **Chapter 3** delivers the quantitative analysis, examining the relationship between city-level industrial policy and household-level inequality across demographic groups. **Chapter 4** offers policy recommendations to improve industrial policy effectiveness and equity, focusing on local skill development, **vertical upgrading**, and better targeting of subsidies.

While the broader impacts of productivity and innovation are acknowledged, this report primarily focuses on the **distributional effects** of industrial policy, particularly its impact on income inequality at the household level. Though national and provincial policies are referenced, the analysis centers on the **city level**, where the majority of industrial targeting, subsidy allocation, and policy execution occur. This local focus is essential for understanding how these policies are implemented and their real-world effects.

Chapter 1: Background

1.1 Overview of Industrial Policy in China

In 2019, China's industrial policy spending exceeded 1.7% of its GDP, far surpassing the 0.3-0.7% range of other major economies like France, Germany, Japan, South Korea, Taiwan, and the U.S.[7] Industrial policy has been a key economic instrument for the Chinese government, evolving from sporadic sectoral interventions in the early reform era to a more structured and systematic approach since 2006.[8] Although industrial policy is often associated with top-down state planning, in practice, China's approach to governance operates through a multi-layered, market-facilitating system, where national, provincial, and municipal governments all play distinct but interconnected roles.[9] As illustrated in **Figure 1** (on the next page), the central government sets strategic priorities, provincial governments coordinate and allocate resources, and municipal governments execute concrete programs, while firms and market actors provide feedback upward through the system—creating a dynamic loop of vertical guidance and market facilitation.

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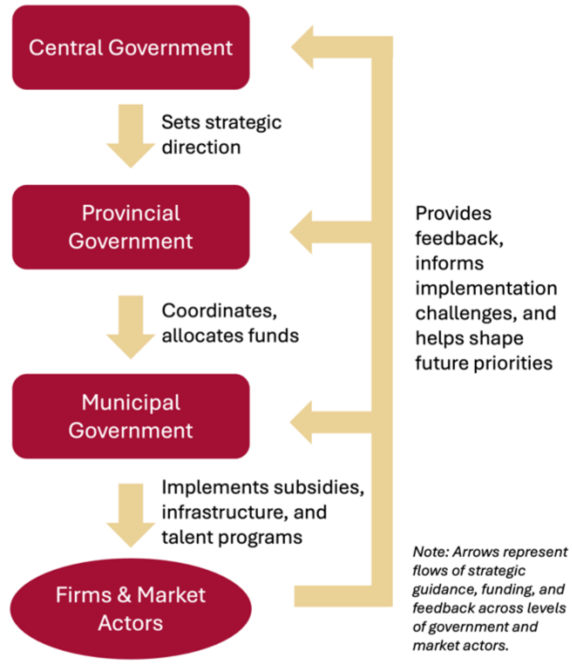
[7] See DiPippo et al. 2022 for measurement and calculation details.
[8] Naughton 2021.
[9] See Xu (2011) for more discussion on political centralization and economic regional decentralization in China.



Source: Author's illustration based on interviews and review of official policy documents.

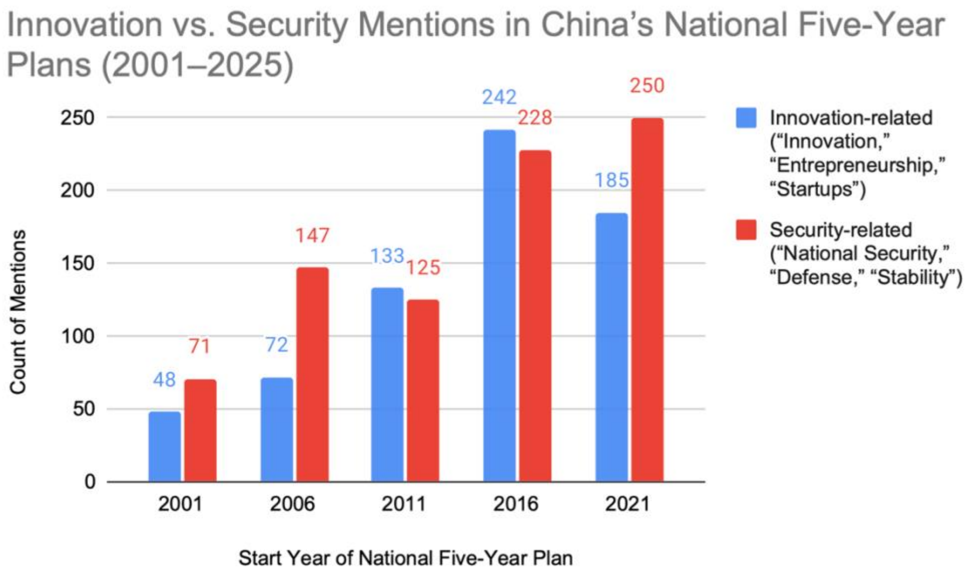
Figure 1. *China's Multi-Level Industrial Policy Implementation System*

At the national level, the central government sets broad strategic priorities, such as those outlined in the **"Made in China 2025" initiative** adopted in 2015.[10] These policies emphasize technological self-sufficiency, indigenous innovation and industrial upgrading, particularly in high-tech sectors like 5G, semiconductors, EV, and solar panels. Since the 2008 **Global Financial Crisis (GFC)**, industrial policy has been dramatically expanded in order to support the perceived slowdown of the Chinese economy and to avoid the consequence of "leaving the market alone" as evidenced by the GFC. More recently, since 2021, government documents have increasingly emphasized "science and technology self-reliance" as a central development objective, reflecting growing geopolitical tensions and economic security.

Figure 2 below illustrates this strategic shift by comparing the frequency of innovation-related and security-related language in China's national **Five-Year Plans (FYPs)** from 2001 to 2021. The

[10] State Council 2015

data reveal a notable rise in innovation discourse beginning in the mid-2000s, followed by a sharp uptick in security-oriented terms in the most recent planning cycle.



Source: Author's original dataset, based on keyword frequency analysis of China's 10th to 14th Five-Year Plans (2001–2025), corresponding to the periods 2001–2005 (10th FYP), 2006–2010 (11th FYP), 2011–2015 (12th FYP), 2016–2020 (13th FYP), and 2021–2025 (14th FYP).

Figure 2. *Innovation vs. Security Mentions in China's National Five-Year Plans (2001–2025)*

Despite this high-level strategic direction, actual implementation of industrial policy occurs primarily at the **provincial and municipal level**. Provincial and cities administer industrial policy through a combination of direct subsidies, tax incentives, subsidized lending, and public venture capital funds, often with the goal of fostering local champions in strategic industries. However, due to fragmentation in policy execution, implementation varies widely across regions, sometimes resulting in resource duplication, inefficiencies, and uneven economic benefits. For example, while first-tier cities like Beijing, Shanghai, and Shenzhen have successfully leveraged industrial policy to drive high-tech innovation in sectors like EV, many third-tier cities have struggled to absorb the benefits of these policies, leading to inefficient capital allocation and excess capacity in industries such as solar panels and shipbuilding.[11]

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[11] Kalouptsidi 2018; Barwick et al. 2019

Importantly, China's industrial policy is often described not to aim to replace market forces but rather to guide and complement them—a concept described as "steership" or "market-facilitating".[12] Unlike traditional state-led planning models, China's approach relies on strategic incentives, financial support, and regulatory frameworks to subtly shape market behavior while allowing firms to operate within a largely competitive environment. This "market-facilitating" strategy seeks to provide long-term direction for industrial development without directly controlling firm-level decisions, attempting to make firms respond to broader state priorities while still navigating market-driven competition.[13]

Mechanisms of Industrial Policy

China's industrial policy operates through multiple policy instruments, each serving a different function in shaping economic outcomes:

1. **Subsidies** – Direct financial support to firms in target industries, often used to offset R&D costs, capital expenditures, and export expansion.
2. **Tax Incentives** – Preferential tax treatment for firms investing in strategic sectors, particularly for R&D spending and high-tech manufacturing.
3. **Subsidized Lending & Credit Access** – State-backed banks provide below-market interest rates to firms in key sectors, primarily benefiting large **state-owned enterprises (SOEs)** and politically connected enterprises.
4. **Targeted Public Venture Capital** – Government investments, particularly in high-risk, high-reward industries such as semiconductors, EV, and AI. These investments are often channeled through **government venture capital (GVC)** using fund-of-funds structures, where public capital is leveraged to attract private investment.

While these mechanisms have helped accelerate industrial upgrading, foster innovation, and enhance China's global competitiveness, they have also raised concerns about economic distortions and long-term sustainability.

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[12] Naughton 2021; Stiglitz 2017
[13] Based on an anonymized interview with a policy expert.

Impacts of Industrial Policy: The Debate on Efficiency and Distortion

The impact of China's industrial policy remains controversial, with strong evidence supporting both its benefits and downsides:

Positive Effects:

- Productivity Growth & Competition – Properly designed industrial policy fosters firm productivity growth through enhancing internal market competition while portecting against external competiion.[14]
- Technological Upgrading – industrial policy has accelerated innovation, increased R&D spending, and led to higher patent filings, particularly in industries receiving targeted government support.[15]
- Sectoral Spillovers – strategic sectoral investments have generated cross-industry spillover effects, supporting the broader economy.[16]

Negative Effects:

- Resource Misallocation & Excess Capacity – some sectors have suffered from inefficient investment, leading to overproduction and low returns, particularly in capital-intensive industries like shipbuilding and solar energy.[17]
- Declining Financial Transparency – government support can lead to lower effective tax rates and weaker financial reporting standards, potentially undermining market discipline.[18]
- Overemphasis on Quantity Over Quality in Innovation – while industrial policy increases patent applications, evidence suggests that firms focus more on low-quality, incremental innovation rather than breakthrough technological advancements.[19]

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[14] Aghion et al. 2015; Juhász 2018
[15] Tan et al. 2017; Yu et al. 2016; Li & Zheng 2016
[16] Lane 2022; Song & Wang, 2013
[17] Beason & Weinstein 1996; Kalouptsidi 2018; Yang & Luo 2018
[18] Guo et al. 2019; Li & Wu 2019
[19] Li & Zheng 2016

1.2 Rising Inequality Levels in China

Income inequality in China has undergone significant transformations over the past four decades, reflecting broader shifts in economic policy, market reforms, and regional development strategies. Between early 1980s and 2010, inequality increased consistently, with wealthier populations experiencing particularly high-income growth, even as all income groups saw improvements. However, from 2010 to 2021, income inequality declined slightly, suggesting a potential turning point in China's economic trajectory (see **Figure 3** for trends in real GDP growth and inequality).

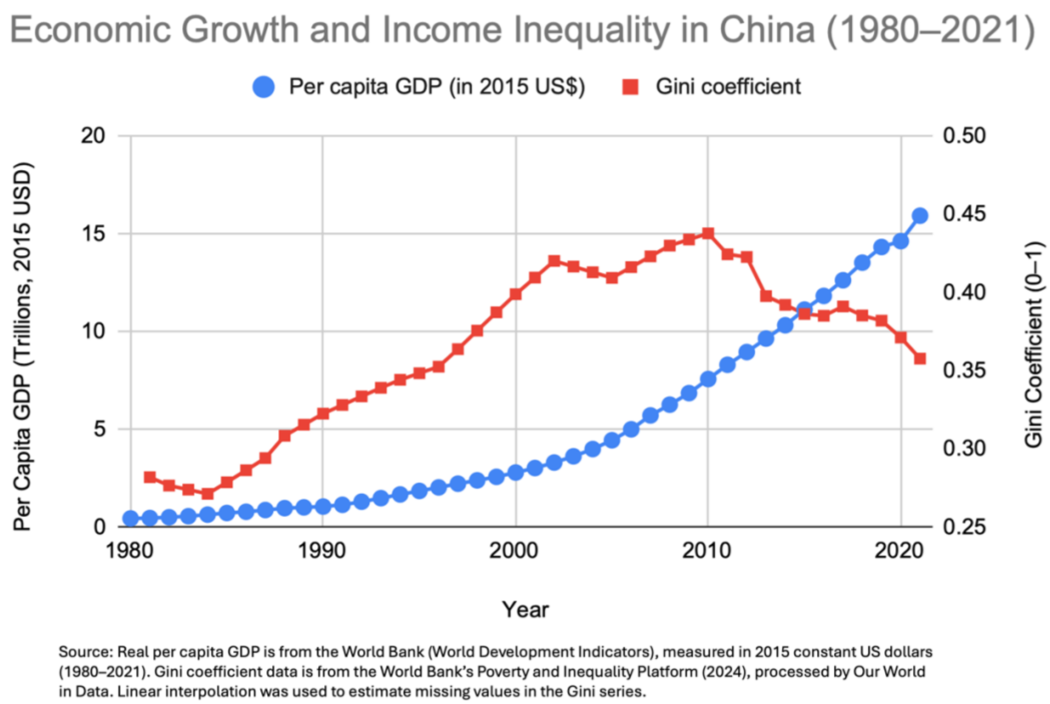

Figure 3. *Economic Growth and Income Inequality in China (1980–2021)*

A widely used measure of inequality, the **Gini coefficient**, increased from 0.28 in 1981 to 0.44 in 2010, before declining slightly to 0.36 in 2021.[20,21] These patterns seem to closely align with the **Kuznets hypothesis**, which suggests that as economies develop, inequality first rises before

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[20] Independent estimates vary slightly depending on methodology and source. See Zhang (2021), Kanbur et al. (2021), Wan et al., (2018), and Sicular et al. (2020) for alternative measurements and similar trends.
[21] See Figure 3 for trends based on World Bank data processed by Our World in Data.

stabilizing or declining when broader segments of the population gain access to economic opportunities.[22] In China's case, the transition from a planned, egalitarian economy to a market-based system created new income disparities, particularly during the late 1990s and early 2000s, when economic liberalization accelerated.

Key Factors Driving Income Inequality

Despite the recent stabilization, income inequality in China remains highly pronounced, driven by several structural factors:

1. Urban–Rural Divide

The urban–rural income gap has historically been the largest contributor to China's inequality. While the income ratio between urban and rural households was 1.9 in 1985, it peaked at 3.3 in 2009 before declining to 2.4 in 2013.[23] The **household registration ("*hukou*") system**, which restricts rural residents' access to urban jobs, social services, and education, has reinforced this divide. Even when rural migrants move to cities, they often face discriminatory employment practices and receive lower wages than their urban-born counterparts.

2. Regional Inequality

Economic reforms have disproportionately benefited coastal provinces, leading to persistent East-Central-West income disparities. Government development strategies, such as the creation of **special economic zones (SEZs)**, concentrated economic activity along the coast while leaving many central and western provinces behind. Although regional inequality has stabilized since 2010, interprovincial disparities remain a key structural issue, with some estimates suggesting that interprovincial Gini coefficients increased by 52% from the 1950s to 2013.[24]

3. Education and Human Capital Differences

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[22] Kuznets 1955
[23] See Zhang (2021) for a comprehensive survey on the current economic literature on income inequality in China.
[24] Liao and Wei 2016

Wage inequality accounts for 40-60% of overall income inequality in China, with educational attainment playing a crucial role.[25] The return to education has risen sharply, increasing wage gaps between high- and low-skilled workers. However, access to higher education is highly unequal, disproportionately favoring students from wealthier, urban backgrounds. Additionally, educational quality varies significantly across regions, further exacerbating disparities in economic opportunities.

4. Migration and Labor Market Segmentation

China's rural-to-urban migration has also shaped inequality patterns. Migrants tend to work in low-wage, informal sector jobs with limited benefits, and occupational mobility is restricted, meaning that many migrants remain in low-income jobs for long periods. Social networks, *hukou* restrictions, and firm hiring practices further limit their ability to transition into higher-paying urban jobs.

5. Market Structure and Ownership Changes

Market reforms have restructured China's labor market, widening the wage gap between workers in SOEs and the private sector. Workers in SOEs—especially in monopolistic industries such as finance, telecommunications, and energy—typically enjoy higher wages and more generous pension benefits. Meanwhile, privatization in competitive sectors has contributed to greater income differentiation, as wages are increasingly driven by productivity and skill levels rather than uniform state-mandated pay scales.

6. Trade, Technology, and Globalization

The rise of trade liberalization and **skill-biased technological change (SBTC)** has further intensified income inequality. China's export-driven economic model has created strong demand for high-skilled labor, benefiting urban professionals and coastal high-tech industries while leaving many low-skilled workers behind. Similarly, **foreign direct investment (FDI)** has

[25] Zhang 2021

accelerated industrial upgrading, but these benefits have been unevenly distributed, disproportionately favoring high-tech industries in developed regions.

7. Redistribution and Labor Protections

Despite economic growth, China's redistribution policies have played a limited role in reducing inequality compared to developed economies. Pension systems remain biased toward urban residents, reinforcing the income gap between formal and informal workers. Minimum wage laws and labor protections have been implemented, but their enforcement varies across regions and industries, limiting their effectiveness in addressing income disparities.

1.3 Theoretical Channels Linking Industrial Policy and Inequality

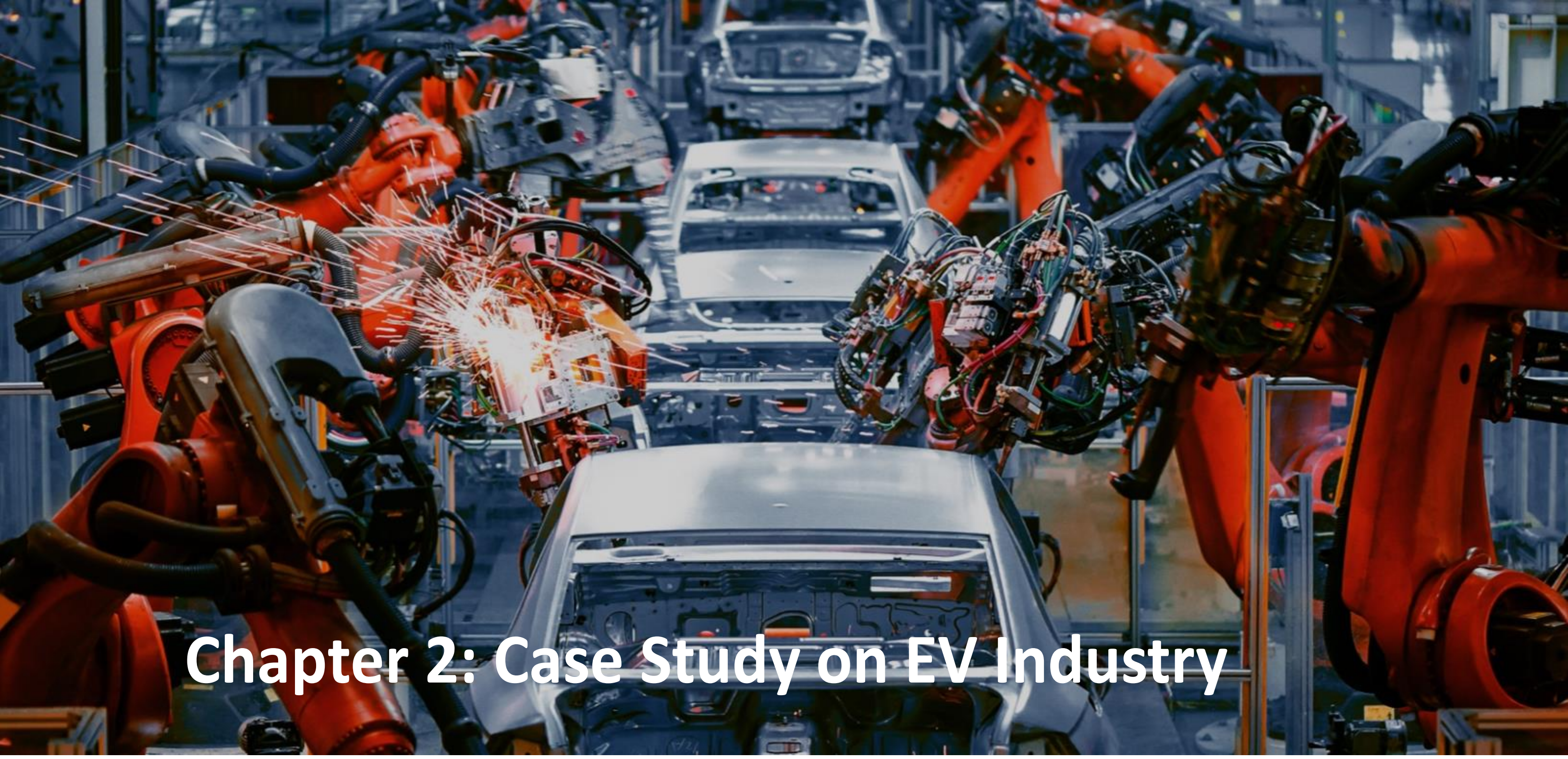
Existing research on China's industrial policy has mainly focused on firm-level outcomes, including productivity, innovation incentives, and market distortions, but its effects on household inequality remain underexplored. Given the central role of municipal governments in policy implementation, it is essential to assess how industrial policy affects income disparities across cities, sectors, and worker groups. This study identifies three theoretical channels—**regional disparities, sectoral biases, and ownership favoritism**—through which industrial policy may influence household income distribution.

First, municipal industrial policies often intensify regional inequality due to **intercity competition within provinces**. Cities frequently engage in duplicated, rather than coordinated, efforts by offering similar subsidies, tax incentives, and infrastructure investments. Such competition may create winner-takes-all scenarios, where successful cities attract capital and talent, fostering globally competitive firms, while others incur economic losses and job displacement. If policy support predominantly benefits developed urban areas, it could widen disparities between prosperous and struggling cities.

Second, industrial policies typically exhibit sectoral bias toward **high-tech and emerging industries** such as semiconductors, AI, and advanced manufacturing. While these policies accelerate technological upgrading and productivity, they may exacerbate inter-industry inequality by disproportionately benefiting skilled workers in targeted sectors. Consequently, wage gains may accrue largely to educated urban professionals, leaving workers in traditional sectors like agriculture and low-end services behind. However, certain specialized technical roles within high-tech sectors **do not require advanced formal education**, potentially boosting wages among less-educated workers in supported industries. Nonetheless, this dynamic could reinforce the overall skill premium and workforce segmentation in China's labor market.

Finally, industrial policy may **favor SOEs over private firms**, further skewing income distribution. SOEs often benefit from privileged political access, securing disproportionate subsidies, tax breaks, and favorable financing. This advantage could create an uneven playing field, disadvantaging potentially more efficient private firms. While quantifying SOE favoritism remains challenging due to limited transparency, such bias would result in ownership-based inequality, with SOE workers enjoying better wages and job stability, and private-sector workers facing greater income volatility.

Together, these theoretical channels suggest industrial policy can either reinforce or alleviate existing inequalities. This study empirically examines the first two mechanisms using city-level policy data and household income surveys, evaluating whether industrial policies deepen inequalities or promote more inclusive growth.



Chapter 2: Case Study on EV Industry

2.1 Sector Background and Policy Framework

China's electric vehicle (EV) industry evolved from modest pilot programs in the early 2000s to global dominance by the 2020s. By 2023, China represented **60% of global EV sales** and 80% of battery sales, producing over 20 million **new energy vehicles (NEVs)** across passenger and commercial fleets. [26] This transformation was driven by carefully sequenced industrial policies across central and local governments, combining subsidies, regulation, infrastructure investment, and strategic market openness.

The policy framework unfolded in five key phases:

1. **Concept Initiation (1990s–2000):** Early R&D funding through national science programs targeted EV technologies—including **battery electric vehicles (BEVs)**, **plug-in hybrid electric vehicles (PHEVs)**, and **fuel cell electric vehicles (FCEVs)**—positioning EVs as a strategic alternative to Western internal combustion engine dominance.
2. **Project Launch and Pilot (2001–2010):** The **"863" Program** (a high-tech R&D initiative by the central government) elevated EVs as a strategic priority, leading to demonstration vehicles

[26] IEA 2024; Wahington Post 2025; ICCT 2021

and key component breakthroughs. A major turning point came in 2009 with the launch of the **"Ten Cities, Thousand Vehicles" Pilot Program**, which funded large-scale public EV deployment and charging infrastructure in pilot cities.[27]

3. **Scale-Up (2011–2015):** National plans signaled full commitment to the sector, especially through the **2012–2020 NEV Industry Development Plan**.[28] Subsidies expanded to private consumers, local governments offered industrial support, and the domestic EV supply chain began taking shape.
4. **Market Transition and Opening (2016–2020):** The state gradually phased out subsidies, introduced stricter technology requirements, and implemented the **dual-credit system** to ensure long-term market viability. This mechanism effectively replaced the "carrot" of subsidies with the "stick" of credit compliance, incentivizing continued investment in NEVs.[29] Foreign ownership caps were removed in the EV sector, allowing **Tesla** to enter without a local joint venture—marking a shift toward selective openness.
5. **Popularization and Upgrading (2021–2024):** Under the **"Dual Carbon" strategy**, EVs became mainstream, reaching 41% of total car sales by 2024.[30] China solidified its global lead in battery production, deployed millions of chargers, and phased out direct purchase subsidies at the national level by the end of 2022. The industry entered a competitive, market-driven phase guided by regulations and industrial consolidation.

The development required significant **administrative capacity**. Central ministries managed subsidies, standards, and approvals, while provincial and municipal governments tailored local implementation and direct firm investment. This fostered widespread policy experimentation and competition among numerous enterprises. **Table 1** summarizes the evolution of China's EV policy.

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[27] MOF & MOST 2009
[28] State Council 2012
[29] The dual-credit system, introduced in 2017 and implemented in 2019, required automakers to meet a fleet-average fuel consumption target *and* a certain number of NEV credits (via selling EVs) proportional to their production. Companies that fall short must purchase credits from those with excess (similar to California's zero-emission vehicle mandate). See ICCT 2021 for more info.
[30] Wang 2025

Table 1. *Phased Evolution of China's EV Industry Policy (1990s–2024)*

Phase	Timeframe	Key Policies & Developments	Outcomes
Concept Initiation	1990s-2000	Inclusion in national science plans (e.g., 8th FYP); early R&D funding	Technical groundwork; initial EV prototypes developed
Pilot & Project Launch	2001-2010	"863" Program; EV entry regulations; "Ten Cities, Thousand Vehicles" pilot program (2009)	Standard-setting, public fleet adoption; ~27,000 NEVs deployed in pilot cities by the end of 2012[31]
Scale-Up	2011-2015	2012–2020 NEV Plan; consumer purchase subsidies; tax emeptions; industrial parks; infrastructure expansion	Sales boom: from 18k (2013) to 330k (2015)[32]; cities competed to host EV firms
Market Transition	2016-2020	Subsidies gradually phase-out; dual-credit system; foreign JV liberalization	Market pressure replaces subsidies; EVs spread inland; Tesla enters without JV requirement
Popularization & Upgrading	2021-2024	**2021–2035 NEV Plan**[33]; end of national EV purchase subsidies[34]; charging/battery swap expansion; industrial consolidation	Sales exceed 12.9m/year and 41% market share[35]; China leads in batteries & commercial EVs

From 2001 to 2024, China constructed a comprehensive policy architecture to support its EV industry, blending national strategic direction, targeted subsidies, local implementation, and iterative policy refinement. This approach facilitated intense **internal competition**, a theme explored further in the next section.

[31] Zhang 2023
[32] ICCT 2021
[33] State Council 2020
[34] MOF et al. 2021
[35] Zhang & Gao 2025

2.2 Evidence of Internal Competition and Market Selection

Unlike traditional industrial policies favoring national champions, China's EV strategy emphasized **sector-wide support rather than picking specific firms**. The central government established an open policy and funding environment, encouraging extensive competition among private, state-owned, and foreign companies. This approach unfolded in three stages: a period of openness, followed by a market shakeout, and culminating in a "survival of the fittest" phase.

1. Period of Openness: Broad Entry and Subsidy Access

Throughout the 2010s, China actively welcomed firm entry into the EV sector. More than 400 companies entered the space, ranging from legacy state-owned automakers (e.g. **SAIC**, **BAIC**) to dynamic startups (e.g. **BYD**, **NIO**, **Xpeng**, **Li Auto**).[36] Central policies deliberately avoided restricting support to a few incumbents. Companies that met baseline technical standards could access purchase subsidies, tax incentives, and production licenses.

Between 2009 and 2022, the Chinese central government spent at least ¥450 billion on NEV promotion—including direct purchase subsidies and tax exemptions—widely distributed across eligible models and firms (see **Table 2** on the next page).[37] This figure does not include the many additional monetary and non-monetary incentives provided by local governments, such as license plates convenience, operating subsidies, land support, and favorable procurement policies. Crucially, **state-owned enterprises were not prioritized**. According to a 2019 audit by the **Ministry of Industry and Information Technology (MIIT)**, among the 40 companies that received central government consumption subsidies between 2012 and 2015, 22 were private firms and 18 were state-owned enterprises.[38] This openness fostered pluralism and rapid experimentation, though it also introduced the risk of low-quality entrants and subsidy abuse, as evidence by the 1-billion-yuan subsidy cheating scandal in 2016.[39]

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[36] Moss 2018; Bloomberg 2023
[37] Our estimate is likely a conversative one; see Dipippo et al. (2022) for a high-end estimate of ¥953 billion between 2009 and 2021.
[38] See China Association of Automobile Manufacturers for the auditing report.
[39] Yan & Dou 2016

Table 2. *Major Central Government Subsidies for NEVs in China*

Subsidy Type	Time Frame	Estimated Amount	Responsible Agencies
NEV Purchase Subsidy	2009 – 2022/12/31 (ended)[40]	¥166.8 billion *(lower bound)*[41,42]	MOF, MIIT, MOST, NDRC
Vehicle Purchase Tax Exemption	2014/9/1 – present (until end of 2027)	¥200+ billion *(by end of 2022)*[43]	MOF, STA, MIIT
New Energy Public Bus Operational Subsidy	2015/1/1 – 2019/12/31[44]	¥45 billion[45]	MOF, MIIT, MOT, NDRC
Vehicle and Vessel Tax Exemption	2012/1/1 – present	< ¥20 billion (*unofficial estimates, by 2022*)[46]	MOF, STA
Charging Infrastructure Subsidy	2013/1/1 – present	< ¥15 billion (*by end of 2020*)[47,48]	MOF, MIIT, MOST, NDRC

2. Period of Shakeout: Declining Subsidies, Rising Standards

By the mid-2010s, the government began tightening the rules of the game. After initial explosive growth, signs of overcapacity and subsidy fraud emerged. In response, authorities raised

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40 MOF et al. 2020; MOF et al. 2021; Wang 2023
41 Zhang 2023; Zhou 2023
42 This number represents a lower-bound estimate and does not include subsidies for vehicles sold before 2022 but still pending final settlement.
43 Official estimate by the MOF; see Zeng 2023
44 MOF et al. 2015
45 MOF 2019a; MOF 2019b; MOF 2020; MOF 2021
46 Using conservative assumptions (¥660/year per vehicle) and cumulative stock of eligible vehicles—namely, pure electric commercial vehicles and plug-in hybrid electric vehicles (PHEVs)—we estimate total vehicle and vessel tax exemptions to be ¥150–200 billion by 2022. The upper bound reflects additional exemptions for fuel cell commercial vehicles, broader local implementation, and continued accumulation through 2025.
47 MOF 2022a; MOF 2022b; MOF 2024
48 Official data shows ¥10.6 billion allocated between 2016 and 2020; the figure is rounded to "<¥15 billion" to account for limited public data prior to 2016.

technical thresholds (e.g. minimum driving range, battery energy density) and phased down cash subsidies beginning in 2017. The **dual-credit system** introduced in 2019 replaced direct subsidies with market-based incentives, requiring firms to meet fuel economy and EV sales quotas or purchase credits.

These measures induced a **massive market shakeout**. Dozens of underperforming companies exited, and the once-fragmented sector began to consolidate. Several highly publicized failures—including the collapse of battery maker **OptimumNano** in 2018 and EV startup **WM Motor** in 2023—illustrated the risks of weak technology and unsustainable business models.[49,50] Meanwhile, firms like NIO survived through local bailouts, notably Hefei's ¥5 billion investment in 2020. [51] By 2021, the top 20% of brands accounted for 85% of NEV sales in China, signaling a new phase of **market concentration**. [52]

3. Survival of the Fittest: Winners Emerge by 2024

By 2024, the sector exhibited clear signs of **natural selection**. BYD—through vertical integration (batteries, chips, motors), sustained innovation (e.g. **Blade Battery**, **DM hybrid tech**), and scale—rose to dominate with over 30% of domestic NEV market share.[53] Tesla's Shanghai Gigafactory also emerged as a success story, leveraging China's efficient supply chains and labor to become its most productive plant globally. Both firms competed under the same policy conditions as others—there was no exclusive favoritism, as both received huge central government subsidies over the years[54]—highlighting the effectiveness of the competitive ecosystem.

Conversely, many rivals either exited the market or continued to operate at a loss. As of 2023, BYD was among the few consistently profitable EV manufacturers in China.[55] Most others still

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49 Qin 2019
50 Du 2024
51 Ren 2023; Garcia-Galindo 2024
52 Ding 2022
53 Zhang 2025
54 See MOF (2022a) for an example of NEW purchase subsidies allocated to both firms as top 2 recipients.
55 Zhao 2024

depended on external capital. This market discipline, reinforced by the complete phaseout of central purchase subsidies by the end of 2022, ensures that only technically and commercially viable firms will survive. As a result, by mid-2023, only about 100 of the most competitive Chinese electric-car makers remained, down from a peak of roughly 500 in 2019.[56]

Driving Forces Behind Market Selection

1. Local Government Competition

Municipal governments played a critical role in shaping firm trajectories. Many cities sought to cultivate local champions, offering industrial parks, land, financing, and policy advantages. Shenzhen's long-term support for BYD is a prime example of successful alignment between local policy and firm capacity. In contrast, Shiyan's failed bet on OptimumNano—a top-three battery firm that collapsed—illustrates the consequences of poor vetting and over-enthusiastic backing.

This **competitive federalism** produced mixed outcomes. Some cities emerged as innovation hubs; others experienced industrial failures. Nevertheless, the diversity of local experimentation contributed to the broader evolution of the sector.

2. Competitive Mechanisms

The central government also embedded **market competition into policy design**. Tightening technical standards, the dual-credit mandate, and the eventual removal of subsidies compelled firms to innovate or exit. The MIIT explicitly encouraged industry consolidation, stating in 2021 that the sector had too many "small, scattered" players and should undergo mergers and reorganizations led by stronger firms.[57]

These competitive mechanisms—rather than top-down planning—drove the emergence of dominant players and elevated industry-wide technical capabilities.

3. Ownership: Performance Over Public or Private

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[56] Bloomberg 2023
[57] Meng 2021

Contrary to conventional assumptions, SOEs have not dominated the EV race. While some, like SAIC, remain competitive, many state firms underperformed or lost ground. BYD—a private firm—has emerged as China's largest automaker by volume. In 2022, of the top 10 EV firms by sales, a majority were private or mixed-ownership entities, demonstrating that China's EV policy favored performance over ownership form.

In summary, China's EV sector presents **strong evidence of internally driven competition and market selection**. The state built the arena and kept out external giants for a time, while letting a multitude of domestic players battle it out. In doing so, it avoided having to choose one "national champion" early on; instead, it allowed a *natural selection* process (albeit influenced by local government interventions) to play out. The result by 2024 is a more concentrated industry with a handful of leaders – which is exactly what the MIIT envisioned when encouraging firms to "grow bigger and stronger via mergers."[58] This strategy fostered **innovation through competition** – companies had to rapidly improve range, cost, and features to win customers in a subsidy-scaling-down environment, which accelerated technical progress.

The next section will drill down to the **city level**, comparing cases to see how local policy execution affected which firms or regions emerged on top in this internal competition.

2.3 City-Level Comparison: Winners and Losers

China's EV revolution was not uniformly distributed across regions. Some cities—thanks to strategic foresight, capable governance, and firm-government alignment—emerged as EV powerhouses. Others fell behind due to weak industrial coordination, poor partner selection, or technological misjudgment. This section compares two emblematic cases—Shenzhen (a standout success) and Shiyan (a cautionary tale)—with shorter notes on Hefei and Luoyang.

Shenzhen: EV Capital Built from Scratch

Shenzhen had **no traditional auto industry** to speak of in the 1990s – it was known as a tech and manufacturing hub for electronics. But this seeming disadvantage became an advantage:

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[58] Meng 2021

Shenzhen's leadership decided early to "build a car city from scratch" focusing on EVs.

Key factors in Shenzhen's success:

- **Policy Foresight and Early Support**: As early as 2003, Shenzhen adopted a NEV strategy and formed a long-term partnership with BYD, which had just acquired a small automaker. The city offered land, subsidies, and policy incentives, becoming one of the most aggressive implementers of the "Ten Cities, Thousand Vehicles" pilot program.
- **Public Fleet Electrification:** Shenzhen's government not only supported manufacturing but also **created local demand**. It mandated aggressive electrification of public transport. By **2017, Shenzhen became the world's first metropolis to electrify 100% of its public buses (16,359 buses)** and by 2018 nearly all of its ~22,000 taxis were electric.[59] These moves were backed by city subsidies (for bus operators to buy electric) and strong political will. BYD, being local, won the bulk of these bus and taxi orders, which in turn gave it scale to improve its products and reduce costs. The environmental and branding benefits were also clear – Shenzhen's transit electrification cut emissions dramatically and made the city a showcase for green tech.
- **Industrial Ecosystem:** With BYD as anchor, Shenzhen attracted over 300 suppliers and infrastructure providers.[60] It supported an integrated supply chain and deployed targeted subsidies (e.g., for taxi drivers, charging stations).
- **Administrative Efficiency:** Shenzhen is known within China for its relatively efficient and flexible governance. It could swiftly roll out charging stations, streamline permits for BYD's expansion, and adjust policies as needed. For instance, when taxi drivers were hesitant about EVs, Shenzhen offered subsidies for EV taxi drivers and built a dense network of taxi-only charging stations. This high-quality implementation made Shenzhen's EV policies unusually effective compared to some other cities where bureaucracy or local protection slowed progress.

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[59] Diao 2023; Yang 2017; Shenzhen Municipal Transportation Bureau 2019
[60] Policy Research Office of Shenzhen Municipal People's Government 2023

Shenzhen's success as China's EV capital illustrates the power of strategic alignment between government policy and industrial development. Today, the city hosts BYD's largest production facilities and R&D centers, generating thousands of skilled jobs and significantly contributing to the local economy and tax base. Its aggressive push for transit electrification has led to cleaner air and a reputation as a national leader in green technology, which in turn attracts further investment. Workers in Shenzhen's EV sector benefit from better job opportunities and higher wages than they might have in low-end manufacturing—BYD alone employs tens of thousands in the city, with assembly-line wages reportedly above the local average.

Shenzhen's pioneering role has made it a model for other cities, with its policies frequently referenced in national guidelines. Ultimately, its success stemmed from a rare combination of early vision, capable governance, and deep collaboration with an entrepreneurial firm, forming a virtuous cycle that embedded both innovation and scale in the city's development strategy.

Shiyan: An Auto City's Painful Transition and Reinvention

Located in Hubei province, Shiyan was historically China's inland automotive hub, known for its heavy vehicle manufacturing under Dongfeng Motor. However, as China shifted to EVs, Shiyan's reliance on diesel truck manufacturing became a liability.

Phase 1: Misguided Transition and Collapse (2013–2018)

- In 2013, Shiyan sought to enter the EV market as diesel bus demand declined.[61]
- The city experienced a brief boom when Shenzhen-based OptimumNano established a production base, but the model relied on risky credit financing and immature technologies.
- By 2017, Shiyan had seven EV assembly firms and an annual capacity of 100,000 vehicles.[62] However, many vehicles produced failed to meet the actual requirements to qualify for subsidy.

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[61] Fang & Di 2023
[62] Fang & Di 2023

- In 2019, OptimumNano defaulted on nearly ¥19.7 billion and collapsed, leaving hundreds of suppliers unpaid.[63] Shiyan's nascent EV ecosystem imploded—production lines halted, partner firms were stuck with unsold inventory, and enthusiasm evaporated.
- The episode highlighted the risks of mistakenly betting on an uncompetitive player.

Phase 2: Strategic Repositioning (2021–Present)

- After setbacks, Shiyan pivoted to hydrogen fuel-cell trucks in 2021, aligning with its commercial vehicle strengths. The city produced 100 hydrogen trucks by late 2022 and began focusing on special-use EVs.
- Shiyan also released a 2023–2025 action plan to produce 800,000 vehicles annually and positioned itself as a green transport hub, seeking collaborations with regions like Guangdong.[64]

Outcomes and Lessons

In the short term, Shiyan fell behind: by 2023, it ranked only 18th in national EV output despite its industrial base.[65] However, despite its early struggles, Shiyan's shift to hydrogen and niche EVs shows promise. By focusing on specialized areas, Shiyan may carve out a role in China's EV landscape, especially with the government's push for greener heavy transport.

The contrast with Shenzhen is instructive: while Shenzhen paired bold vision with phased, high-capacity implementation and a strong partner (BYD), Shiyan's early bet lacked due diligence and technical depth. It underscores the need for local governments to assess industrial partners carefully, sequence their policy support, and avoid overly ambitious, tech-immature ventures.

Other Cities's Experiences

- **Luoyang (Henan Province):** Luoyang is another city with an older industrial base

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[63] Fang & Di 2023
[64] Dai 2023
[65] Fang & Di 2023

(tractors, defense industry) that aimed to jump on the EV bandwagon. Its recent EV-related activity has focused primarily on raw materials and auto parts—such as battery components—rather than full vehicle production.[66] The city has not yet produced a major EV brand. It's mention as a "loser" likely refers to it *not* becoming a significant player despite efforts. The takeaway is that interior cities without strong tech ecosystems find it harder to compete with coastal innovation centers.

- **Hefei (Anhui Province):** Hefei is actually a **surprise winner** in recent years, thanks to the bold move of investing in NIO. In 2020, when NIO was near bankruptcy, Hefei's city government provided a lifeline of ¥5 billion and in return got a stake in NIO and persuaded NIO to build its future factories there.[67] This paid off massively: NIO recovered, and Hefei now hosts NIO's expanded production facilities and R&D. Hefei's case is instructive: a mid-tier city bet on a promising but struggling private firm (essentially *picking a winner at the local level*), and it succeeded due to that firm's inherent strengths. It highlights that local governments can play venture capitalist, but it's a risky play that only works if the company is fundamentally strong (unlike Shiyan's OptimumNano case).

Winners vs. Losers Summary

Successful EV cities like Shenzhen, Shanghai, Hefei share traits:

- They **complemented national policy** with effective local initiatives and resources.
- They had either a local firm with strong capability or attracted a top firm (Tesla to Shanghai, NIO to Hefei).
- They invested in human capital (R&D centers, skilled labor) and infrastructure (charging, testing facilities).
- They maintained flexibility – adjusting plans when needed (e.g., Shanghai pivoting to allow Tesla which initially undercut local SAIC, but ultimately invigorated the ecosystem).

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[66] Yu 2024
[67] Garcia-Galindo 2024

Less successful cases like **Shiyan, Luoyang** often:

- Relied on traditional SOEs that were slower to innovate.
- Chose partners/projects that were subsidy-driven rather than tech-driven.
- Suffered from weaker integration in high-tech supply chain (far from coastal tech hubs).
- Potentially had local bureaucratic hurdles or less favorable business environments for new private enterprises.

However, the story isn't static; some "losers" are trying new strategies (Shiyan with hydrogen, Luoyang with attracting battery plants like CATL's planned factory in Luoyang).[68] The **inter-city competition** that China fostered means even laggards are not giving up – they learn from the winners and attempt to catch up, which in itself propels the national industry forward.

2.4 Implications for Efficiency and Equity

China's strategy of fostering internal competition under state guidance in the EV industry has significant implications for **economic efficiency, innovation, and equity**. This section assesses the impact of this approach, balancing benefits against costs.

Innovation and Efficiency Considersations

The competitive model **accelerated innovation** dramatically. Firms competed to improve battery technologies, achieving an **85% reduction in battery costs and a 2.2-fold increase in energy density** from 2012 to 2021.[69] Consumers benefited from improved EV performance and reduced prices, advancing cost parity with gasoline vehicles faster than in other markets.[70] Market competition naturally directed resources towards **efficient producers** like BYD and CATL, with additional efficiency gains from the dual-credit policy incentivizing incumbents towards EV production.[71] Additionally, having multiple firms experiment with different designs (e.g., battery

[68] Lee 2022; Li 2025
[69] Meng 2021
[70] IEA 2024
[71] Li 2023

swapping by NIO, extended-range EVs by Li Auto, etc.) increased the chances of finding successful solutions.

However, this approach had **short-term inefficiencies**:

- **Redundant Investment:** Many local EV plants remained underutilized and never reached meaningful output.[72] Capital and land were sometimes wasted on factories that produced only a trickle of vehicles before shutting down.
- **Subsidy Cost and Misallocation:** Over ¥200 billion in **central government tax exemptions** was spent between **2014 and 2022**, primarily through purchase tax exemptions.[73] Some of this essentially subsidized failures or low-quality vehicles that quickly went off-road, raising questions about opportunity costs and potentially more efficient use of the capital.
- **Local Protectionism:** When cities favored local brands irrespective of quality, it could lead to suboptimal outcomes and undermine overall industry efficiency. The central government tried to mitigate this by publishing national catalogs of recommended EV models and sometimes withholding subsidies if local models didn't meet standards, but minor inefficiencies remained.

Equity and Fairness Considerations

Labor and regional outcomes from EV policy varied widely:

- **Job Creation:** Successful EV firms like BYD created substantial employment opportunities its workforce surpassed 900,000 in 2024, including 520,000 manufacturing workers.[74] Many of these are **"good" manufacturing jobs**, essential for the middle-skill labor force, offering above-average local wages (especially with overtime) and stable employment for workers without a bachelor's degree—thanks to strong and growing demand.[75] The

[72] Xiao & Tang 2024
[73] Shen 2023
[74] Zhang 2024
[75] Bradsher 2023

sector also creates high-quality jobs for college graduates: BYD hired 50,000 new graduates in 2023 alone and employs 110,000 R&D staff, reflecting the growing need for high-skilled talent.[76] Notably, many of BYD's factories are located in inland cities such as Xi'an, Changsha, and Hefei, contributing to more balanced regional development.

- **Job Loss in Legacy Industries:** Traditional auto manufacturing regions like northeast China faced disruptions, exacerbating regional inequalities. The government encouraged firms like FAW to transition into EV manufacturing to mitigate this.[77]
- **Regional Winners and Losers:** Advanced coastal cities (Shenzhen, Shanghai) benefited greatly, while interior regions often lagged, prompting central initiatives to geographically balance EV-related investments and promote rural EV adoption.[78]
- **Impact of Failed Ventures:** Workers and suppliers caught in failed EV ventures often paid a price. In the OptimumNano case, 599 suppliers left with ¥5.4 billion in unpaid bills meant many layoffs and bankruptcies down the supply chain.[79] Local governments sometimes stepped in to pay partially or re-employ workers in new projects, but not always fully. Sometimes it's even **difficult to shut down failed EV companies in China because of the social impact, to the point that local officials resort to "bribes" to get a firm to close**.[80] This indicates the authorities' awareness of job losses and their attempts (albeit inefficient) to manage the fallout.
- **Broad income Distribution:** The EV push has potential to improve income distribution by creating manufacturing jobs in a growing sector, many of which are accessible to workers without university degrees, providing upward mobility. Moreover, EVs being a new field allowed private entrepreneurs to rise, not only the traditional state capital – this could be seen as a more inclusive growth. However, the heavy state subsidy could be viewed as a transfer of public funds that ultimately enriched certain investors.

[76] Zhang 2024
[77] Zhao 2024
[78] NDRC & NEA 2023; MIIT et al. 2023; Liaowang 2023
[79] Fang & Di 2023
[80] Palmer 2024

Balancing Efficiency and Equity

China's EV industrial strategy reflects a **dynamic balancing act** between promoting market efficiency and ensuring equitable outcomes. In the early stages, the government fostered intense internal competition by supporting a wide array of firms, which helped prevent monopolies, kept consumer prices low, and spurred rapid innovation. This pluralistic environment allowed both SOEs and private companies to compete on relatively equal footing. Over time, as the market matured, policymakers shifted toward consolidation, encouraging mergers and stronger coordination across the supply chain to eliminate redundancy and improve scale economies. Leading firms like BYD and GAC emerged not through exclusive favoritism, but by surviving and thriving in this high-pressure environment.

To address growing regional disparities, the central government began guiding new investments—such as battery factories and component suppliers—toward less-developed inland and rustbelt regions. This strategy aimed to geographically rebalance the gains of EV sector growth through targeted industrial planning. Overall, the approach reflects a pragmatic two-phase strategy: **first, catalyze innovation through broad-based support; then, consolidate for long-term sustainability and more inclusive growth.**

In summary, the internal competition model has trade-offs:

- **Pros:** Rapid innovation, lower costs, multiple opportunities for regions/firms, prevention of complacency, large-scale employment and eventual global competitiveness.
- **Cons:** Significant upfront cost, temporary inefficiencies, painful shake-outs for weaker players, and uneven regional gains.

China has managed these trade-offs by progressively shifting to a more structured industrial policy—**emphasizing quality, consolidation, and inclusion**—after the wild growth phase established global scale. This dynamic approach—looser rein initially, tighter rein later—is a defining characteristic of China's industrial strategy.

2.5 Tesla's Entry into China – Openness Amid Protection

A pivotal moment in China's EV industry narrative was the decision to allow **Tesla** – the world's leading EV maker – to establish a wholly-owned factory in Shanghai in 2018.[81] This move initially seemed at odds with China's historical protection of its auto market (which forced foreign automakers into joint ventures with domestic firms for decades). Understanding **why Tesla was allowed 100% ownership** and what impact it had is crucial for interpreting China's broader strategic approach.

The Policy Context and the Decision

Tesla's 2018 entry as China's first wholly foreign-owned car plant was not an isolated exception, but a product of broader liberalization and trade context:

- In April 2018, China's **National Development and Reform Commission (NDRC)** announced a phased removal of foreign ownership restrictions in auto manufacturing—starting with NEVs (effective July 2018), followed by commercial vehicles in 2020, and passenger cars in 2022.[82] This signaled China's intention to deepen market reforms and open up key sectors.
- At the same time, China was engaged in a tense trade dispute with the United States (2018 was the height of US-China trade tensions). Granting Tesla 100% ownership rights could signal goodwill and reinforce China's image as a global investment destination.[83]
- Tesla, unlike legacy automakers bound by joint ventures, was uniquely positioned to seize this opening.[84] By July 2018, Tesla had signed an agreement with Shanghai to build a Gigafactory (see **Table 3** below for details). From groundbreaking to production, the process took less than a year—demonstrating China's bureaucratic efficiency and infrastructure speed, enabled by strong government support and fast-track approvals.[85]

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[81] Reuters 2019
[82] An & Shen 2018
[83] Osawa 2020
[84] Yin 2018
[85] Hull & Zhang 2019

Table 3. *Key Terms of the Tesla–Shanghai Gigafactory Agreement*[86]

Tesla's Commitments	Shanghai Government Incentives
Tax Obligations: Pay at least ¥2.23 billion (~$323M) annually starting in 2023[87]	**Cheap Land**: 864,885 m² plot leased at ¥973 million ($140.51M), just 10% of market price[88]
Capital Investment: Invest at least ¥14.08 billion (~$2B) in the Shanghai factory[89]	**Low-Cost Loan**: ¥10 billion (~$1.4B) five-year loan at ~3.9% interest rate[90], in addition to previously-obatined ¥8.5 billion (~$1.2B) loan[91]
Localization: 100% of components to be locally sourced by end of 2022[92]	**Subsidies**: ¥590 million ($85M) in 2019, including ¥320M in cash and ¥270M in grants[93]

The Logic and Impact of Letting Tesla In

Tesla's entry was not a passive opening-up but a carefully calibrated move that aligned with China's strategic goals in the EV sector. While the policy environment appeared open, it was guided by long-term industrial upgrading and strategic control. It illustrates how China strategically uses targeted openness to strengthen domestic capabilities, foster competition, and position itself in global value chains:

- **Catalyzing Competitive Pressure ("Catfish Effect"):** Tesla's arrival created intense pressure on Chinese EV makers, especially in the premium segment. This could and did end up accelerating innovation in design, autonomous driving, and efficiency, just like

[86] Data based on official SEC filings and translated agreements disclosed by Tesla (2019, 2020a, 2020b).
[87] See Tesla (2019), Exhibit 10.82, Article 20, for tax obligations and clawback provisions tied to performance.
[88] Cheng 2018; Kai 2020; Sun & Jourdan 2018; See Tesla (2019) Article 4 for land area and Article 9 for land fee.
[89] See Tesla (2019), Article 19, for capital investment benchmarks.
[90] Sun et al. 2019; See Tesla (2020b) for an example of an early favorable loan agreement secured by Tesla.
[91] Zhai 2020
[92] Though not explicit in the agreement, it is widely reported as a condition in Chinese-language media. See Cen (2022), Wang (2020), and Ma (2023) for some examples.
[93] See p.95 (Tesla 2020a), p. 95, for disclosures on "certain incentives" provided by the Shanghai municipal government in connection with Gigafactory development.

what Apple did to China's smartphone industry.[94] It aligned with the government's aim to "squeeze out the excess and let the strongest survive."[95]

- **Technology Learning and Spillovers:** Chinese firms quickly absorbed Tesla's practices—**over-the-air updates**, **minimalist UI**, and **battery integration**—and embedded them into their own products.[96] This horizontal learning deepened local capabilities.
- **Supply Chain Upgrading:** By 2024, more than 95% of components in Tesla Shanghai vehicles were sourced locally.[97] Companies like **CATL**, **Fuyao Glass**, and others became part of Tesla's global supply chain, helping to scale and globalize Chinese suppliers.[98]
- **Market Expansion and Global Export Base:** Tesla broadened the EV consumer base and helped normalize EV ownership among middle-class urban consumers. Meanwhile, the Shanghai Gigafactory became an export base to Europe, bolstering China's role as a global EV manufacturing hub.[99]
- **Local Development Gains:** Tesla's presence transformed *Lingang* (where the Gigafactory was built) from a quiet suburb into a dynamic industrial cluster. With a commitment to hire at least one local worker per US$1.8 million in revenue, Tesla created thousands of jobs.[100] The region attracted housing developers, ecosystem suppliers, and skilled labor—laying the foundation for long-term tax revenue and economic growth.

There are also substaintial risks and potential downsides:

- **Investment Risk:** The Shanghai government and Chinese banks that provided loans made large upfront investments with uncertain returns. Their bet paid off, but failure would have had political and financial consequences.

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94 Li 2024
95 Yang 2024
96 Yuan 2021; for example, Tesla popularized **NCA (Nickel Cobalt Aluminum)**/**NCM (Nickel Cobalt Manganese)** batteries and now **LFP (Lithium Iron Phosphate)** batteries in standard models, which Chinese makers also adopted widely, according to one of the expert interviews.
97 Tesla's China VP Tao Lin revealed this on Weibo, see Sohu 2024.
98 Zhang & An 2020
99 Fan 2024
100 Upton 2019

- **Foreign Dominance Concerns:** Allowing a global leader like Tesla into the domestic market carried significant risk—there was a real possibility that Tesla, with its technological edge and brand appeal, could outcompete local firms and dominate the EV sector. Fortunately, the gamble was eventually rewarded: by 2023, Chinese brands retained a commanding 80% share of the domestic NEV market, and BYD even surpassed Tesla in global EV sales.[101]
- **Data Security Concerns:** There were legitimate concerns over potential data leakage from Tesla's vehicles, given their extensive sensors and connectivity features. However, the Chinese government chose to trust—but verify—by requiring Tesla to localize data storage and restrict the use of sensitive sensors. This cautious trust was further demonstrated when Tesla was later included in the government's procurement whitelist[102]—a notable signal of confidence and a powerful showcase of China's willingness to be open to foreign firms, so long as they respected national security boundaries.

A Model of Strategic Openness

The Tesla case illustrates China's pragmatic and confident shift toward *strategic openness*. It broke its decades-old joint venture rule—allowing Tesla to operate without a Chinese partner—marking a significant departure from past industrial policy. This move signaled growing confidence that domestic firms could withstand **full competition**, something unthinkable just 5–10 years earlier. Importantly, the openness was selective and purposeful: by admitting a global EV leader, China not only injected pressure into its own market but also indirectly spurred Japanese and German automakers to accelerate their EV strategies—often by partnering with Chinese firms.

From 2020 to 2024, Tesla's entry reshaped the Chinese EV market. A 2023 price war, triggered by Tesla's cuts, forced down prices across the board—benefiting consumers but challenging

[101] Hoskins 2025
[102] Bloomberg 2024

firms. While some weaker players struggled, survivors became more competitive and better prepared to go global. Tesla's success (~600,000 units sold in China in 2023) also attracted more foreign investment: VW partnered with Xpeng in 2023, and BMW raised its stake in its Chinese JV to 75%, bringing capital, technology, and credibility into China's EV ecosystem.[103]

Meanwhile, Chinese brands—having battled Tesla at home—gained the confidence to expand abroad. Companies like BYD, MG, and NIO are now pushing into Europe and Southeast Asia, often citing their success in the domestic market as proof they can compete globally.[104]

Tesla's arrival marked a turning point: China moved from a *protected, high-growth* phase to a ***more open, globally integrated*** phase. The bet paid off—China retained its EV crown (accounting for 60% of global EV sales in 2024), its firms emerged stronger, and the country now hosts one of the world's most advanced automotive production hubs.

2.6 Takeaways

The evolution of China's EV industry from 2000 to 2024 illustrates how industrial policy is not only formulated but operationalized across levels of government. This case provides a concrete example of **how local industrial policy operates in practice** and its **dual impact on efficiency and equity**.

At its core, the state played an active, catalytic role—creating an enabling environment through subsidies, infrastructure, and regulatory reform, then stepping back to let competition and local experimentation shape outcomes. Municipal governments, in particular, became powerful executors and innovators, tailoring policies to attract firms, support ecosystem formation, and absorb policy risks. The result was a dynamic, competitive, and fast-evolving EV sector.

Importantly, China's strategic openness—epitomized by Tesla's entry into Shanghai without a joint venture—showed a high level of confidence in domestic industry. While this posed real risks of foreign dominance, domestic firms ultimately retained market leadership and

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[103] Li 2024; Kharpal 2025; Cao 2024
[104] Zhang 2024; Ghoshal 2024

strengthened through competition. Tesla's success spurred productivity gains, expanded the EV consumer base, and catalyzed new industrial clusters in *Lingang*. Yet boundaries were clearly set: Tesla was required to localize data storage and comply with national security norms, showing that **openness was conditional and state-steered**.

The internal competition strategy boosted **innovation and efficiency**, with firms racing to improve technology, cut costs, and scale operations. At the same time, it produced **uneven equity outcomes**. Cities like Shenzhen and Hefei flourished, while others like Shiyan struggled. High-quality firms grew rapidly, generating skilled employment and local tax revenue, but failures also left job losses and idle factories in their wake. Some workers, especially in legacy sectors, were displaced.

Thus, China's EV industrial policy showcases a unique development model: **leveraging the state's capacity to coordinate, catalyze, and compete—while adapting policy instruments over time to ensure both economic upgrading and social stability**. For policymakers, it reinforces the value of:

- **Strategic patience and iterative policy design** over multiple phases,
- **Harnessing local implementation capacity and internal competition**,
- And **embracing targeted openness** to spur innovation, while managing concerns.

As China's EV sector moves from subsidy-driven growth to global expansion, the case shows that **industrial policy can drive both competitiveness and broad-based development—if the right balance between direction and discipline is struck**.

Chapter 3: Quantitative Analysis

3.1 Documenting Key Empirical Patterns of Industrial Policy

This section presents empirical findings on the patterns of city-level industrial policy in China, drawing from a city-level industrial policy dataset between 2000 and 2018. The analysis highlights three key dimensions**: temporal trends, geographic distribution, and sectoral composition**. Understanding these patterns helps assess the broader implications of industrial policy on regional development, firm competitiveness, and labor market inequality.

Temporal Trends in Industrial Policy

To understand how China's industrial policy evolved over time, we begin by examining the number of city-level policies introduced each year. **Figure 4** shows the annual total of such policies between 2000 and 2018, disaggregated by sector. As the chart reveals, industrial policy intensity surged in the mid-2000s, stabilized after the 2008 Global Financial Crisis, and entered a phase of recalibration after 2014.

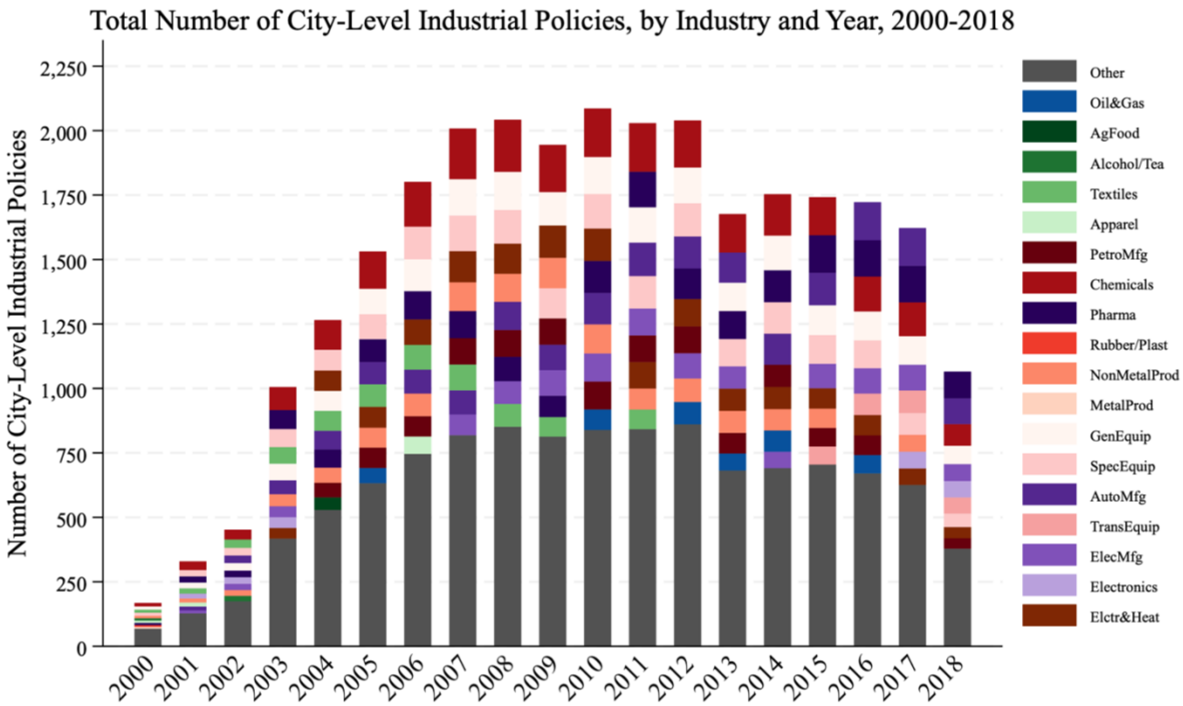

Figure 4. *Bar Chart of City-Level Industrial Policies in China, 2000-2018*

The evolution of city-level industrial policies can be divided into three distinct phases:

1. **Rapid Expansion (2004-2008):**
    - The number of city-level industrial policies grew rapidly, with the total number of policies increased 70% during the period.
    - This surge reflects China's proactive approach to industrial upgrading, especially after 2006, when China launched the **Medium-to-Long-Term Program for Science and Technology Development (2006–2020) (MLP)** and decided to double down on its support for economically important industries.
    - Policies during this phase focused heavily on 1) chemical raw materials and products manufacturing, 2) general equipment manufacturing, and 3) and specialized equipment manufacturing. This is likely because these are upstream sectors and provides disporprotionate benefit in correcting market distortions.[105]

[105] See Liu (2019) for a discussion on the connection between upstreamness and industrial policy effectiveness.

2. **Peak Period (2009-2013):**
    - The total number of policies plateaued between 2008 and 2012, with an annual average of around 2,000 policies nationwide.
    - This period coincided with China's post-financial crisis stimulus policies, where central government dedicated $580 billion stimulus package, and local governments began to aggressively promote industrial growth to counter external economic shocks.
    - Industrial policy emphasis shifted from traditional manufacturing to more technology-intensive sectors, reflecting the central government's push for innovation-driven development, perhaps as a result of the Strategic Emerging Industries Initiative announced in 2009.[106]
3. **Structural Shift (2014-2018):**
    - The number of city-level industrial policies somewhat declined after 2013, with significant structural change in terms of supporting capital-intensive downstream sectors such as 1) pharmaceutical, 2) automobile manufacturing, 3) electrical machinery and equipment, and 4) computer, communication and other electronic equipment manufacturing.
    - This decline likely reflects a shift towards more targeted and selective industrial policies, as central authorities emphasized "quality over quantity" in economic planning.
    - The **"Made in China 2025" initiative** (2015) and the **"Internet Plus" Action Plan** (2015) further steered policies towards supporting emerging high-tech industries such as semiconductors, electric vehicles, and pharmaceuticals, which likely contributes to the rise of these industries.

These trends suggest that while municipal industrial policy was initially broad-based and expansive, it has become more selective and sector-specific over time.

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[106] Naughton 2021

Geographic Trends

National-Level Patterns: Expansion Beyond Coastal Regions

One quick thing to notice from **Figure 5** is that city-level industrial policies are almost ubiquitous across China, indicating its prevalence throughout the country. Another striking pattern in the data is the geographic expansion of industrial policy from coastal cities to inland regions.

In the early 2000s, most industrial policies were concentrated in China's coastal provinces, including Guangdong, Jiangsu, and Zhejiang. These regions were already well-integrated into global supply chains, and industrial policy served to enhance their competitive edge.

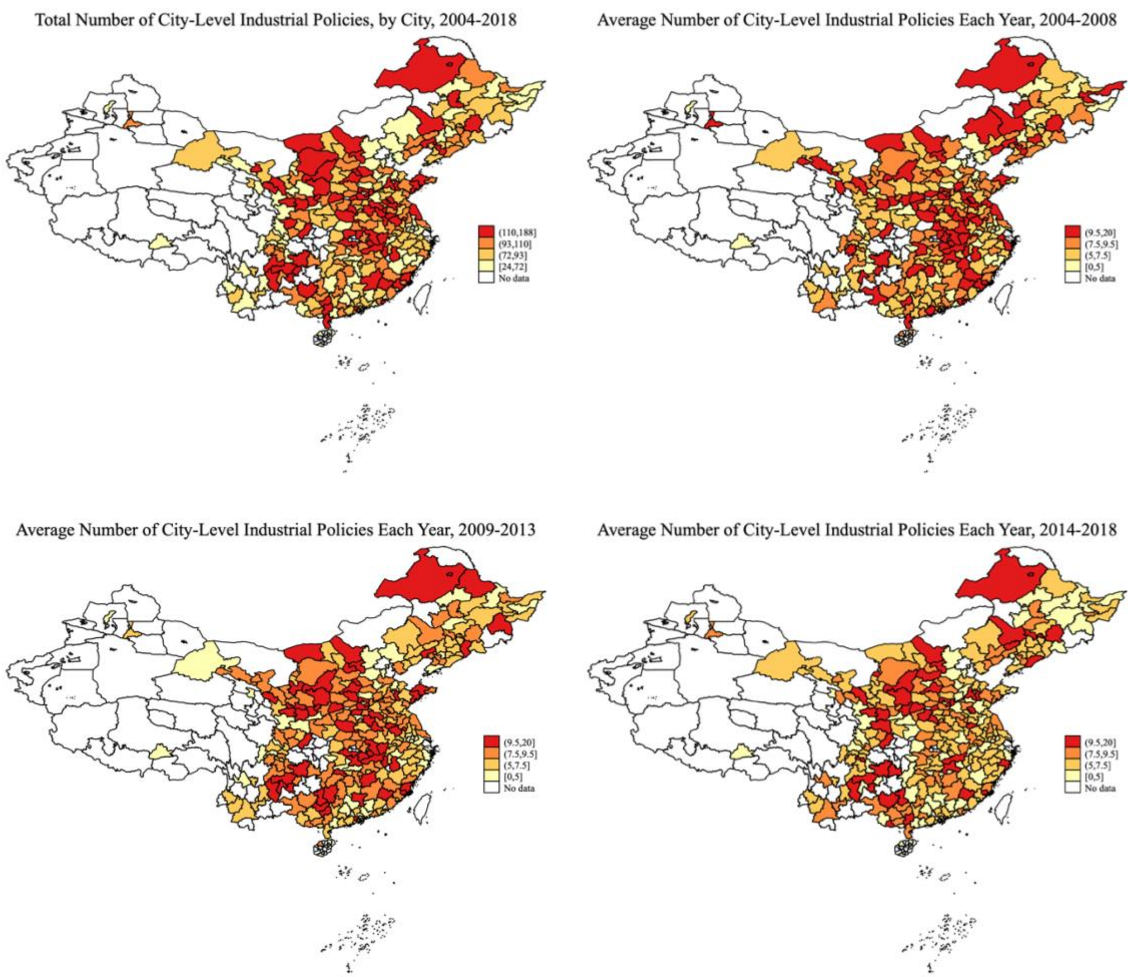

Figure 5. *Spatial Patterns of City-Level Industrial Policies in China, whole period of 2004-2018 (upper left), first phase of 2004-2008 (upper right), second phase of 2009-2013 (lower left), and third phase of 2014-2018 (lower right)*

By the 2010s, however, inland cities such as those in Henan, Shanxi, and Gansu began adopting industrial policies at much higher rates. Several factors may explain this shift:

- **Government Redistribution Efforts:** the central government's push for "balanced development" encouraged inland cities to adopt proactive industrial policies, even if their economic fundamentals were weaker.
- **Intercity Competition:** Local governments within inland provinces competed for similar industries, often duplicating efforts rather than specializing in complementary sectors.
- **Infrastructure Upgrades:** Improved high-speed rail networks, logistics hubs, and industrial parks made inland cities more attractive for investment.

This transition suggests that while China's industrial policy initially reinforced coastal dominance, the later expansion attempted to spread growth more evenly—though the effectiveness of this shift remains an open question.

Regional-Level Patterns: Competition and Duplication Within Provinces

While China's central government set the broad strategic directions, implementation was delegated to local governments. This decentralized approach gave rise to a mix of coordination and **policy duplication**, particularly within provinces where cities competed to become local industrial hubs. Two empirical patterns help clarify these dynamics (**Table 4** on the next page).

First, cities within the same province are more likely to support the same industries. Using a city-pair overlap index—which captures how often two cities back at least one common industry in a given year—we find that being located in the same province increases the likelihood of policy overlap by **1.09 percentage points** ($p < 0.01$). While the effect is modest in magnitude, it is highly statistically significant and suggests that intra-provincial administrative boundaries may encourage imitation or redundant industrial promotion across cities.

Second, this duplication is especially pronounced in strategic sectors. When focusing on high-tech industries[107], the results become much starker: city pairs with overlapping high-tech focus

[107] Defined as R&D intensity over 2% in the 2022 national R&D expenditure report, see NBS et al. (2023).

are associated with a **31.8 percentage point** higher probability of supporting at least one common industry. However, when both cities are in the same province and focus on high-tech, the effect becomes slightly negative (**−1.15 percentage points**), suggesting possible strategic avoidance or a weak form of coordination once the overlap becomes too visible.

These results support a key argument from the previous section: **China's local governments often engaged in competitive federalism**, trying to outdo each other to attract EV-related investment. The overlap underscores how this often resulted in duplicated efforts, especially within the same province, as cities rushed to promote similar industries and technologies.

At the same time, the differentiated effect for high-tech industries hints at a more nuanced dynamic: cities may start by copying each other but then diverge as policy sophistication increases, or as pressure from provincial authorities mounts to reduce wasteful competition. This aligns with broader national trends observed in the previous sections—early openness, followed by shakeouts and increased pressure for consolidation.

Table 4. Effect of Same-Province Industrial Overlap on Overlap Index

VARIABLES	(1) overlap	(2) overlap
same_province	0.0109***	0.0120**
	(0.0026)	(0.0050)
hightech_overlap		0.3185***
		(0.0011)
same_province x hightech_overlap		-0.0115**
		(0.0050)
constant	0.8546***	0.6787***
	(0.0005)	(0.0010)
Observations	436,070	436,070
R-squared	0.127	0.293
year fixed effect	yes	yes
origin & destination city fixed effects	yes	yes

Notes: The dependent variable is a binary indicator equal to 1 if a city pair supports at least one common industry in a given year. *hightech_overlap* equals 1 if both cities support at least one common high-tech industry. Standard errors are heteroskedasticity-robust (HC) and reported in parentheses. All regressions use OLS with year and city fixed effects. Significance: *p<0.10, **p<0.05, ***p<0.01.

Sectoral Composition and Transition

A defining characteristic of China's city-level industrial policies is their gradual shift from traditional manufacturing to high-tech industries.

Table 5. *Table of Top 10 Supported Industries at City Level in China, 2000*

Year	Industry	Count of Cities	High Tech? (Y/N)
2000	C: Chemical Raw Materials and Chemical Products Manufacturing	13	N
	C: General Equipment Manufacturing	13	Y
	C: Textile Industry	12	N
	C: Specialized Equipment Manufacturing	12	Y
	C: Pharmaceutical	9	Y
	C: Alcohol, Beverage, and Refined Tea Manufacturing	9	N
	C: Non-metallic Mineral Products	9	N
	C: Textile, Apparel, and Accessories	9	N
	C: Rubber and Plastic Products Manufacturing	7	N
	C: Metal Products	6	N

A notable trend of city industrial policy is the decline of traditional industries, particularly textile manufacturing, which was once a major recipient of government support. However, the number of policies targeting the textile sector declined significantly during the 2000s, as can be seen from comparing **Table 5** above and **Table 6** on the next page, reflecting a broader shift away from low-value, labor-intensive industries. This transition aligns with China's economic upgrading strategy, which prioritizes high-tech, capital-intensive sectors over traditional manufacturing. As labor costs in China have risen and global competition has intensified, industrial policy has increasingly focused on fostering innovation and technological advancement rather than sustaining industries that rely on low-cost labor and mass production.

Table 6. *Table of Top 10 Supported Industries at City Level in China, 2009*

Year	Industry	Count of Cities	High Tech?
2009	C: Chemical Raw Materials and Chemical Products Manufacturing	183	N
	C: General Equipment Manufacturing	130	Y
	D: Production and Supply of Electricity and Heat	125	N
	C: Non-metallic Mineral Products	118	N
	C: Specialized Equipment Manufacturing	117	Y
	C: Petroleum Processing, Coking, and Nuclear Fuel Processing	102	N
	C: Electrical Machinery and Equipment Manufacturing	99	Y
	C: Automobile Manufacturing	99	N
	C: Pharmaceutical	83	Y
	C: Textile Industry	76	N

At the same time, high-tech and capital-intensive industries have received growing policy support, particularly in pharmaceuticals, biotechnology, and EVs. Since 2016, China has significantly increased policy incentives for the pharmaceutical and biotechnology sectors, reflecting a strategic push for technological self-reliance in critical industries. Similarly, the automobile industry (which contains the EV industry as a sub-category) was a relatively minor policy focus in the late-2000s, became a top industrial policy priority by 2018, as evidenced by comparing **Table 6** above and **Table 7** on the next page. This shift aligns with China's ambition to become a global leader in green energy and mobility, positioning itself at the forefront of the transition toward electric and autonomous vehicles. On a broad level, the top industries supported by industrial policies have shirted more towards high-tech industries (defined as R&D intensity larger than 2%), shifting from 3 industries in top 10 in 2000 to 4 in 2009 and 6 in 2018.

Additionally, China's industrial policy has evolved to support entire supply chains rather than individual industries, fostering upstream-downstream linkages within key sectors. Earlier policies tended to focus on basic raw material industries, such as chemicals and general equipment, but recent policies have increasingly targeted advanced applications, including EV production, electronics, and medical devices. This suggests an effort to build complete domestic supply chains, reducing reliance on foreign inputs and enhancing national self-sufficiency in strategic industries. This shift is particularly evident in China's semiconductor and EV sectors, where industrial policy has aimed to integrate materials supply, component production, and final assembly into a unified ecosystem.

Table 7. *Table of Top 10 Supported Industries at City Level in China, 2018*

Year	Industry	Count of Cities	High Tech?
2018	C: Pharmaceutical	103	Y
	C: Automobile Manufacturing	100	N
	C: Chemical Raw Materials and Chemical Products Manufacturing	84	N
	C: General Equipment Manufacturing	71	Y
	C: Electrical Machinery and Equipment Manufacturing	66	Y
	C: Computer, Communication, and Other Electronic Equipment Manufacturing	63	Y
	C: Railways, Ships, Aerospace, and Other Transportation Equipment Manufacturing	63	Y
	C: Specialized Equipment Manufacturing	53	Y
	D: Production and Supply of Electricity and Heat	43	N
	C: Petroleum Processing, Coking, and Nuclear Fuel Processing	40	N

In sum, city-level industrial policies in China have been dynamic and adaptive, evolving in response to shifting national priorities—such as technological self-reliance and post-crisis recovery—as well as local conditions, including factor endowments and bureaucratic incentives, creating duplication of efforts or forms of coordination. Rather than being uniform or static, these policies reflect a complex interplay between top-down strategic direction and bottom-up implementation. Notably, the growing emphasis on high-tech and capital-intensive sectors marks a decisive turn toward advanced manufacturing and innovation. This evolution raises a central question for the next section: have these shifts in policy scope and industrial focus translated into more equitable income growth among different groups of workers?

3.2 The Impact of Industrial Policy on Household-Level Inequality

The empirical findings in this section suggest that while industrial policies can boost overall wages in targeted industries, the distribution of these benefits is uneven across educational backgrounds and industrial structures.

Industrial Policy Increases Employment Likelihood and Household Income

Table 8 on the next page presents our baseline findings. Industrial policy is associated with higher employment rates. Households whose heads work in policy-supported industries are **0.9–1.3 percentage points** more likely to be employed, a statistically significant effect. Although modest in absolute terms, this gain is meaningful given the already high baseline employment rate (97.5%) in the sample. This finding suggests that industrial policy can play a role in stabilizing local labor markets and reducing joblessness.

Households in policy-supported industries also tend to earn more. Our estimates suggest a **6–7% increase** in per capita household income, although the result is not statistically significant. Nonetheless, the size of the effect points to meaningful economic benefits for households engaged in targeted industries, particularly in the form of higher wages.

These findings are consistent with the idea that industrial policy can improve economic outcomes for targeted sectors, though the benefits may not be evenly distributed across all worker groups.

Table 8. *Impact of Industrial Policy on Employment and Income of Households Working in Those Sectors*

VARIABLES	(1) employ	(2) employ	(3) employ	(4) log_fincome2_per_win	(5) log_fincome2_per_win
ip	0.009***	0.011**	0.013***	0.060	0.067
	(0.003)	(0.005)	(0.005)	(0.066)	(0.074)
Observations	28,794	28,773	28,768	27,330	27,326
R-squared	0.015	0.022	0.042	0.201	0.227
year fixed effect	yes				
city fixed effect	yes	yes		yes	
industry fixed effect	yes				
industry X year fixed effect		yes	yes	yes	yes
city X year fixed effect			yes		yes

Notes: The dependent variable is either employment status of head of household (columns 1–3; linear probability model) or log per capita net household income (columns 4–5), winsorized at the top 1%. *ip* is a binary indicator equal to 1 if the household head works in a city-supported industry that year. Regressions include fixed effects and control for inter-city mobility. Standard errors are heteroskedasticity- and autocorrelation-robust (HAC). Significance: *p<0.10, **p<0.05, ***p<0.01.

Strong Effects in High-Tech Sectors and Unequal Benefits Across Education Levels

Disaggregating by sector type reveals industrial policy is most effective in high-tech industries. Policy support in these sectors is associated with an **11.7% increase** in household income and a **3.0 percentage point** increase in employment probability (**Table 10**, column 1; **Table 9**, column 1), both statistically significant. No comparable effects occur in low-tech sectors, suggesting policies targeting innovation-intensive industries—defined by R&D intensity above 2%—yield greater economic outcomes.

High-tech sectors, such as pharmaceuticals, electrical machinery, and computer equipment manufacturing, consistently receive government support and generate substantial economic spillovers, including productivity improvements, robust domestic supply chains, and deeper global market integration. Consequently, interventions in these sectors significantly enhance household income and employment. However, these concentrated benefits also raise important distributional questions, an issue we turn to next.

Table 9. Impact of Industrial Policy on the Employment Status of Head of Household Working in High-Tech/Low-Tech Sectors

VARIABLES	(1) employ	(2) employ
	(high_tech)	(low_tech)
ip	0.030**	0.009*
	(0.011)	(0.005)
Observations	403	18,687
R-squared	0.416	0.031
city fixed effect	yes	yes
Industry X year fixed effects	yes	yes

Notes: The dependent variable is a binary indicator of employment status of head of household. *ip* is a binary indicator for city-level policy support for the household head's industry. Estimates are based on a linear probability model with fixed effects. Standard errors are HAC robust. Significance: *p<0.10, **p<0.05, ***p<0.01.

Table 10. *Impact of Industrial Policy on the Income of Households Working in High-Tech/Low-Tech Sectors by Education Level*

VARIABLES	(1) fincome2_per_win	(2) fincome2_per_win	(3) fincome2_per_win	(4) fincome2_per_win
	(high_tech)	(low_tech)	(high_tech)	(low_tech)
ip	0.117**	-0.020	0.308**	-0.032
	(0.041)	(0.067)	(0.118)	(0.076)
edu_level			0.466	0.232***
			(0.290)	(0.014)
ip_edu_level			-0.455*	-0.027
			(0.272)	(0.101)
Observations	380	17,893	379	17,820
R-squared	0.444	0.127	0.467	0.130
city fixed effect	yes	yes	yes	yes
industry X year fixed effect	yes	yes	yes	yes

Notes: Dependent variable is log per capita net household income. *ip* is a binary indicator for city-level policy support for the household head's industry**.** *edu_level* equals 1 if the household head has high school or higher education, 0 otherwise. Interaction term *ip × edu_level* captures differential effects by education. Standard errors in parentheses are HAC robust. Significance: *p<0.10, **p<0.05, ***p<0.01.

Within high-tech sectors, policy impacts vary significantly by education. Workers with lower educational attainment (middle school or below) experience **income gains of approximately 31%,** while highly educated workers (high school or above) see **income reductions of around 15%** (**Table 10**, column 3). This divergence suggests industrial policy disproportionately benefits technically skilled labor compared to formally educated professionals.

This outcome likely stems from high-tech policies favoring production-oriented activities—such as EV assembly and electronics manufacturing—over R&D or design roles. Consequently, skilled blue-collar positions experience greater demand, while university-educated workers face role mismatches and stagnant wages.

These findings have implications for China's long-term industrial upgrading. Although policies currently benefit less-educated workers, declining returns to higher education could discourage investment in advanced skills, potentially limiting future innovation capacity. Policymakers should thus complement industrial policy with workforce development strategies—such as apprenticeships and R&D-linked training—that align educational pathways with evolving industrial needs, benefiting workers across all education levels.

3.3 Summary of Findings

Table 10. *Key Findings from Industrial Policy Analysis*

Dimension	Key Findings
Case Study: EV Industry	China's EV policy emphasized industry-wide competition over firm winner-picking, combining subsidies, regulation, and strategic opening (e.g., Tesla's entry). This enabled rapid growth and shakeout, with top firms like BYD emerging through market competition. City outcomes varied—Shenzhen and Hefei thrived due to strong local execution, while Shiyan faltered. The approach boosted innovation but created regional disparities.
Temporal Trends	Industrial policy grew rapidly (2004-2008), peaked (2009-2013), then became more selective (2014-2018), shifting focus from traditional manufacturing to high-tech industries.
Geographic Trends	Initially concentrated in coastal cities, industrial policy later expanded inland. Cities within the same province often duplicated efforts. However, in high-tech sectors, duplication was less pronounced within the same province, suggesting some policy differentiation or strategic coordination.
Sectoral Shifts	Support transitioned from traditional manufacturing (e.g., textiles) to high-tech sectors (e.g., EVs, semiconductors, and pharma), with increased focus on value chains.
Overall Effect on Employment and Income	Industrial policy increases employment likelihood and household income in supported industries overall, though average income effects are statistically insignificant.
High-Tech vs. Low-Tech	Policy is significantly more effective in high-tech industries, generating larger gains in household income and employment. Low-tech industries show minimal response.
Education and Income within High-Tech Industries	In high-tech sectors, industrial policy disproportionately benefits lower-educated workers. Wage gains are concentrated among technical and vocational workers, while more educated workers see little or negative impact.

Chapter 4: Recommendations

This chapter provides strategic recommendations to enhance equity and effectiveness in China's municipal industrial policies, accelerating industrial upgrading and equitable distribution based on findings from Chapters 2 and 3. The **National Economics Foundation (NEF)** can advocate these policies and provide analytical support to municipal government policies.

4.1 Criteria for Evaluating Policy Options

To identify the best course of action, potential policy options have been evaluated against a set of key criteria that reflect priorities under China's institutional context:

1. **Effectiveness:** Impact on **industrial upgrading** and inclusive growth, considering employment, wages, productivity, and innovation.
2. **Equity:** Fair distribution of benefits across regions, sectors, and social groups, especially among low-income, less-educated, or rural populations. Policies with high equity scores are those that reduce income/opportunity gaps.
3. **Feasibility (Political and Administrative):** Likelihood of successful implementation within China's governance system. This includes political acceptability (alignment with central government priorities) and administrative capacity (whether municipal governments have the tools and expertise to deliver results).
4. **Cost-Efficiency:** Achieving desired outcomes with **fiscal responsibility**, maximizing social and economic returns relative to public expenditure and minimizing resource misallocation.

4.2 Summary of Strategic Priorities and Recommendations

Table 11. *Summary of Strategic Priorities and Recommendations*

Strategic Priority	Policy Recommendations	Expected Impact	Feasibility	Timeframe
I. Invest in Local Skill Development	**Rec 1:** Target workforce training for low/mid-skilled workers in supported sectors	**High** (improves earnings and employment for disadvantaged workers; supports industrial growth by alleviating skill gaps)	**Medium** (requires coordination with educational institutions; pilots can start in high-capacity regions)	**Medium-term**
	Rec 2: Expand vocational education aligned with industry needs			**Long-term**
II. Focus on Vertical Quality Upgrading	**Rec 3:** Shift industrial incentives from horizontal expansion to vertical upgrading and innovation	**High** (boosts long-term competitiveness)	**High** (within local authority)	**Medium-term**
	Rec 4: Integrate labor outcomes (wages, job quality) into subsidy criteria	**High** (improves job quality)	**Medium** (requires new monitoring capacity)	**Long-term**
III. Improve Targeting & Accountability	**Rec 5:** Ex-ante distributional impact assessments proposed subsidies	**Medium** (ensures funds reach intended groups)	**High** (can be done with existing staff)	**Immediate**
	Rec 6: Enhance inter-city coordination to reduce redundant competition	**Medium** (improves overall efficiency)	**Medium** (requires provincial leadership)	**Long-term**
	Rec 7: Strengthen firm accountability tied to employment and wage outcomes	**High** (ensures promised benefits materialize for workers)	**High** (can be enforced via contracts)	**Immediate**

4.3 Detailed Policy Recommendations

I. Invest in Local Skill Development

Industrial policy has thus far contributed to wage growth predominantly for lower-skilled workers, but **much of those gains have resulted from labor shortages rather than genuine up-skilling**. Chapter 3 showed that in high-tech sectors, less-educated workers experienced wage increases partly because talent supply was tight – not necessarily because workers became more productive or skilled. This situation is not sustainable; once the labor supply catches up, wages could stagnate without further skill improvements. Moreover, workers with higher education have seen relatively **smaller or even negative income effects** in policy-supported industries, indicating a mismatch between the skills produced by the education system and those demanded by new industries. To avoid growth stagnation and support equitable upward mobility, **municipal governments need to invest in human capital development** as a core component of industrial policy. The following two recommendations focus on expanding and better targeting local skill development initiatives:

- **Recommendation 1: Align and prioritize workforce training for low- and mid-skilled workers in policy-supported industries.** Municipal governments should collaborate with technical colleges, vocational schools, and industry associations to develop targeted training programs in sectors identified for industrial policy support (such as electric vehicles, semiconductors, green energy, and industrial automation). This means designing curricula and certification programs that equip workers with the specific technical skills those industries require (for example, battery maintenance for EVs or machine operation for automation equipment). By prioritizing subsidies or grants for training programs in tandem with industrial subsidies, local authorities can ensure that the **local labor force is prepared to fill the higher-paying jobs** created by industrial upgrading. *(Lead implementer: Municipal governments in partnership with local educational institutions and industry;* ***Timeline: Medium-term*** *– develop programs within 1-2 years and scale up thereafter.)*

- **Recommendation 2: Expand vocational education and certification pathways linked to high-tech industry needs, with a focus on lagging regions.** To broaden the base of skilled workers, especially outside the major coastal cities, the government should invest in scaling up vocational education infrastructure. This could include establishing **regional training centers** in inland provinces and industrial hubs, upgrading equipment and curricula at existing vocational schools, and leveraging digital e-learning platforms to deliver technical courses to a wider audience. Importantly, the content of these programs must stay **aligned with evolving industry standards** – for instance, offering certifications in software-driven manufacturing, robotics maintenance, or renewable energy technology. Emphasizing vocational and technical education will open pathways for rural students or laid-off workers from declining industries to transition into the new industrial jobs. NEF can assist by conducting needs assessments for skills in different regions and helping develop standardized certification frameworks that are recognized by employers across cities. *(Lead implementer: Municipal and provincial education authorities, supported by industry partnerships;* ***Timeline: Long-term*** *– significant expansion over 3-5 years, with initial steps and pilot programs beginning immediately.)*

Justification: China's human capital development **has not kept pace with industrial growth**, as demonstrated by skill shortages in rapidly expanding industries like EVs. Investing in targeted skill training ensures broader and sustained income gains, particularly for lower-skilled workers.

II. Focus on Vertical Quality Upgrading

Current municipal industrial policies often prioritize **quantity**—such as the number of firms established or total output—**over quality**, risking inefficiency and unsustainable growth. Chapter 2's examination of the electric vehicle boom revealed that **cities which simply launched numerous EV firms or projects (horizontal expansion) often ended up with underutilized factories and failed companies**, whereas those that cultivated technological leaders (through quality R&D and strict standards) produced enduring competitive firms. Chapter 3 reinforced this, showing significant employment growth without corresponding (statistically significant) overall wage increases. In other words, **industrial policy has succeeded in putting more people**

to work—but not necessarily in helping them move up the value chain or enjoy improved economic security.

Two primary concerns arise: first, overreliance on low-cost labor over innovation undermines long-term competitiveness; second, it may **reinforce labor market inequalities**, as many newly created jobs may be low-wage, offering limited upward mobility.

Municipalities should pivot toward **vertical upgrading** strategies – encouraging firms to innovate, improve productivity, and create high-quality jobs. The following two recommendations lay out reforms to embed this focus into industrial policy implementation:

- **Recommendation 3: Refocus industrial subsidy criteria toward product quality, innovation, and value-added** rather than mere production volume. Municipal governments should **shift their subsidy allocation and evaluation metrics** away from rewarding scale for its own sake, and toward rewarding firms that demonstrate technological improvement and higher value creation. Subsidies should prioritize firms demonstrating high R&D investment, new patent development, compliance with international standards, and productivity enhancements. Traditional metrics such as total employment or output should be secondary to these quality-focused indicators.[108] By doing so, **public funds will flow to enterprises that are genuinely upgrading**, rather than those merely expanding. National guidelines and inter-city peer learning facilitated by NEF workshops can support these shifts. *(Lead implementer: Municipal Development and Reform Commissions / industry bureaus, with guidance from central policy directives;* ***Timeline: Medium-term*** *– revise funding guidelines within the next policy planning cycle, e.g. 1-2 years.)*
- **Recommendation 4: Incorporate explicit labor market outcomes into subsidy evaluations.** Firms should clearly outline expected employment impacts, wage levels, and employee training programs in their subsidy proposals. Funding approval should

[108] For example, instead of giving a blanket subsidy to any new semiconductor factory, a city might provide larger incentives to firms that produce chips at cutting-edge process nodes or to those that invest heavily in local R&D collaborations with universities.

partially depend on these commitments. Municipalities must subsequently **monitor and assess** actual outcomes, including local hires, wages, and training programs.[109] Firms delivering robust employment outcomes should receive priority for future support, while underperformers should be reconsidered. Integrating these employment metrics into local officials' performance evaluations will further align incentives with inclusive growth objectives. *(Lead implementer: Municipal* ***Development and Reform Commissions (DRCs)*** *and Human Resources bureaus, with potential support from NEF in designing tracking systems;* ***Timeline: Long-term*** *– develop the framework and data systems over 2-4 years, with pilot programs earlier.)*

Justification: Prioritizing quality over quantity fosters sustainable growth and **higher-quality jobs**. The EV industry case shows clearly that policy supporting genuine innovation rather than rapid expansion yields more durable success.

III. Improve Targeting and Accountability

The effectiveness of industrial policies hinges significantly on p**recise targeting and strong accountability**. Our research identified two challenges in China's municipal industrial policy implementations: policy fragmentation (cities competing redundantly for similar sectors, as shown in Chapter 3.1) and weak ex-ante evaluations leading to inadequate accountability. Fragmentation results in inefficient investments and exacerbates regional inequality. Additionally, many subsidy programs historically lacked rigorous **pre-screening**, resulting in low-quality outcomes or incomplete projects (as in the example of Shiyan in Chapter 2.3), undermining public confidence and intended benefits.

The following recommendations address these challenges through improved targeting and strengthened accountability:

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[109] For instance, a biotech startup seeking government funding might be asked to commit to creating a certain number of skilled technician jobs at a wage above the city average, or to partner with a vocational school for a talent pipeline.

- **Recommendation 5: Institutionalize ex-ante distributional impact assessments for industrial subsidies.** Municipalities should formally evaluate potential impacts on local employment, wages, and inequality before approving major subsidies. Projects demonstrating broad-based benefits, such as extensive moderate-skill employment or equitable regional distribution, should be prioritized. This evaluation, similar to environmental assessments, embeds equity from the outset, ensuring policies proactively address inequality. *(Lead Implementer: Municipal DRCs and policy research offices; Timeline:* ***Immediate****—apply to all new proposals in the next fiscal year.)*
- **Recommendation 6: Strengthen inter-regional coordination to prevent redundant competition among cities.** Provincial authorities should establish coordination mechanisms—such as an industrial policy committee—to harmonize city-level initiatives. The goal is to identify potential overlap and work out a **complementary approach** where each city focuses on a niche or different segment of the value chain, or possibly agrees that one city leads the initiative while others channel their funds elsewhere. Provincial DRCs can facilitate this through guidelines, data sharing, and joint initiatives, supported by NEF-convened dialogues and analytical reports. *(Lead Implementer: Provincial DRCs and municipal governments; Timeline:* ***2–5 years****, initial coordination pilots sooner.)*
- **Recommendation 7: Tie subsidies directly to firm performance via clear accountability measures.** Firms receiving substantial government support must report **key performance indicators (KPIs)** such as job creation, wages, training provided, and technological outputs. Municipalities should **define explicit benchmarks** in subsidy agreements, monitoring compliance and enforcing **clawback clause** requiring partial or full repayment of public funds.[110] This accountability ensures public funds generate tangible, intended outcomes and discourages subsidy misuse. *(Lead Implementer: Municipal industry and finance bureaus, legal offices; Timeline:* ***Immediate****—integrate into all new subsidy agreements.)*

[110] A relevant example is the Tesla Gigafactory in Shanghai, which was required to meet specific investment and tax revenue thresholds or risk losing land-use rights and incentives (see Chapter 2.5).

Justification: Rigorous ex-ante assessments and strengthened accountability enhance policy **efficiency, equity, and transparency**. Systematically embedding these measures ensures industrial policies deliver equitable economic outcomes, bolsters public trust, and optimizes resource allocation.

4.4 Final Recommendation

China's municipal industrial policy has successfully driven economic growth and structural upgrading, but must now adapt to prioritize **inclusive prosperity**. Based on the analysis provided, a two-phase strategic approach is recommended: **immediately** prioritize reforms in **subsidy targeting and governance** (Priorities II and III) to enhance efficiency and accountability, and, over the **medium term** (2-3 years), significantly expand investments in **workforce skills and human capital development** (Priority I). This sequencing allows for rapid improvements in policy effectiveness and equity, building momentum while laying the groundwork for sustainable and inclusive long-term growth.

This integrated strategy addresses identified weaknesses: it reduces **policy fragmentation** and resource misallocation through improved coordination and targeting, enhances **labor market mobility and skills** through targeted education initiatives, and ensures broader distribution of economic benefits. Crucially, it **maintains the dynamism** underpinning China's industrial growth by supporting innovation and competitiveness more effectively and equitably.

Implementing these recommendations will transform municipal industrial policies from mere engines of growth into robust mechanisms for inclusive prosperity. With its strong connections to policymakers and analytical expertise, the NEF is ideally positioned to advocate, guide, and support these policy changes, aligning local industrial policies with China's broader goals of **high-quality development and common prosperity**.

Appendices

Appendix A: Methodological Details

This study combines two principal datasets:

1. **City-Level Industrial Policy Data (2005–2018):** A novel, time-varying database constructed from municipal government work reports across 284 Chinese prefecture-level cities. Using automated text analysis methods adapted from Juhász et al. (2022), we extract and classify city–year–industry level references to policy support. Sentences referencing support (e.g., “promote,” “subsidize,” or “develop”) are mapped to two-digit CIC industry codes. A binary indicator is created for whether a given city supported a specific industry in a given year.[111]
2. **Household-Level Data (CFPS):** The China Family Panel Studies (CFPS), a nationally representative longitudinal survey, provides rich demographic, employment, and income information. We restrict our sample to employed household heads with assigned industry information, and exclude managerial occupations that could not be reliably matched to industry codes.

[111] Details of the data construction process can be found in Appendix. E of Lin et al. (2024).

Sample Selection and Matching Strategy

To link household-level outcomes to city–industry-level policy exposure, we assign each household head in the CFPS dataset to a two-digit industry category using their reported occupation codes. The CFPS uses the Chinese Census Occupation Classification (CSCO), which we manually map to the China Industry Classification (CIC) system—the same coding system used in the construction of our industrial policy dataset. This mapping allows us to infer the industry affiliation of each household head and match it to city-year-industry level policy exposure based on the respondent's city of residence and year of observation.

One important caveat of this approach is **the exclusion of top executives and managerial positions** whose occupational codes do not correspond uniquely to a specific industry. For example, codes such as "10510 Enterprise Executives," "10520 Department Managers or Supervisors in Business Operations," and "10530 Other Department Managers or Supervisors" are classified by job function rather than industry, making it impossible to assign them to a distinct CIC category. These individuals are therefore excluded from the sample. As a result, our analysis focuses on the effects of industrial policy on the broader labor force, rather than on firm-level leadership or owners. This choice improves the precision of our industry-policy match but limits the scope of the study to workers rather than executives.

Key Variables

- **Treatment Variable:** a binary indicator equal to 1 if the household's industry in their city receives explicit local government support in that year, 0 otherwise.
- **Outcome Variables:**
    - *Employment status* (binary);
    - *Log per capita household net income* (winsorized at the top 1%); and
    - *Inequality measures*, including Gini coefficients and 90–10 log income gaps at city-year and city-year-industry levels.
- **Control Variables:** household demographics (e.g., age, gender, education, and migration status).

Appendix B: Regression Models and Specifications

The following baseline regression model is used to estimate the impact of city-level industrial policy on household outcomes:

$$Y_{h,c,t} = \beta_0 + \beta_1 Policy_{c,i(h),t} + \boldsymbol{X}_{h,c,t}\boldsymbol{\Gamma} + \gamma_c + \gamma_{i,t} + \varepsilon_{h,c,t}$$

Where:

- $Y_{h,c,t}$ represents household-level outcomes (employment or income);
- $Policy_{c,i(h),t}$ indicates whether household h's matched industry i (assigned based on head of household's occupation code) in city c received support in year t;
- $\boldsymbol{X}_{h,c,t}\boldsymbol{\Gamma}$ includes household-level controls (migration, demographics);
- γ_c: city fixed effects;
- $\gamma_{i,t}$: industry–year fixed effects;
- Errors clustered at the city level.

Robustness Check

To ensure the validity and stability of the estimated effects, a series of robustness checks are conducted. First, the baseline specification is re-estimated using **alternative fixed effects** structures, including city–year fixed effects and city–industry fixed effects. These allow for finer control of time-varying shocks at the city level and persistent differences in city–industry characteristics, thereby reducing the risk of omitted variable bias.

Second, **lagged policy indicators** are introduced to test for delayed effects of industrial policy. Specifically, the models incorporate 2-year and 4-year lagged policy exposure variables to assess whether the impacts on household employment and income outcomes take time to materialize. This is particularly relevant in the context of capital-intensive industrial policies, where infrastructure investment or firm-level expansion may not immediately translate into household-level gains.

Third, the analysis explores the use of **alternative measures of inequality** at both the city-year and city–industry–year levels. In addition to the Gini coefficients, the study calculates the log income variance and the 90–10 income gap (the log difference between the 90th and 10th percentile of income) to capture different aspects of income dispersion. These metrics provide a more nuanced picture of how industrial policy may influence the structure of income inequality across space and sectors.

Heterogeneity Analyses

To better understand for whom industrial policies generate the largest effects—and whether they contribute to equitable growth—the study examines heterogeneity along two dimensions.

First, it investigates whether the impact of industrial policy differs **by education level**. An interaction term is included between the policy support indicator and a binary variable denoting whether the household head has completed high school or above. This allows the analysis to test whether lower-skilled households benefit more—or less—from industrial policy support relative to their more educated counterparts, thereby informing the distributional consequences of such interventions.

Second, the analysis considers variation **by industry type**, categorizing sectors as either high-tech or low-tech based on official Chinese R&D classifications. The policy indicator is interacted with a high-tech sector dummy to assess whether income and employment effects are concentrated in technology-intensive industries. This is particularly relevant given China's increasing emphasis on industrial upgrading and innovation-driven growth.

Event Study and Parallel Trends

To strengthen causal identification, an **event study framework** is employed to assess the dynamic effects of industrial policy and verify the parallel trends assumption underlying the difference-in-differences strategy. The event study plots coefficients on leads and lags of policy support indicators, relative to the first year a household's city–industry combination received government support. The absence of statistically significant coefficients in the pre-treatment periods provides evidence that households in supported and unsupported sectors were on similar trajectories before the policy intervention—lending credibility to the claim that observed post-treatment differences are causally attributable to the industrial policy.

Appendix C: List of interviews

The author conducted a series of formal and informal conversations with national policymakers, academic researchers, municipal officials, and industry experts between October 2024 and March 2025. These interviews were held in both online and in-person formats and were essential in providing qualitative insights into the design, implementation, and on-the-ground impact of industrial policy in China.

Many of these conversations were held off the record or under conditions of anonymity. In several cases, interviewees explicitly requested that their names and affiliations not be disclosed. To respect these requests and to protect the privacy of the remaining individuals and organizations involved, the author has chosen not to publish a detailed list of participants. Instead, insights from these conversations are reported in aggregated form and have been incorporated throughout the report to inform the analysis and interpretation of both the case study and the empirical findings.

A full list of interviewees and affiliations can be provided to faculty reviewers or authorized readers upon request, subject to confidentiality agreements.

Appendix D: Sample Interview Questions

Local Policy Design and Implementation

- How does your city decide which industries or sectors to prioritize in industrial policy?
- What specific criteria are used to identify “strategic” industries for local support?
- What forms of support are commonly used (e.g., subsidies, tax incentives, infrastructure)?
- How do local governments coordinate industrial policy goals with provincial or national authorities?
- Have policy priorities shifted over time in response to political or economic changes?

Impact and Evaluation of Industrial Policy

- What indicators or benchmarks are used to assess the effectiveness of municipal industrial policies?
- Have there been formal evaluations of the social or economic impacts of these policies?
- How do you track employment or wage effects in targeted sectors?
- Are there mechanisms to prevent duplication or wasteful competition with other cities?

Electric Vehicle (EV) Industry Case Study

- What role has your city played in promoting the EV industry?
- What have been the most effective local interventions to support firms like BYD or others?
- How has the development of the EV industry affected employment opportunities and wage levels in your city?
- What are the major challenges in coordinating with firms, research institutions, or other cities?

Equity and Distributional Effects

- To what extent are income distribution or labor market equity considered in policy design?
- Have you observed any unintended consequences—such as regional inequality or industry-specific wage disparities—resulting from industrial policy?
- Are there policies in place to ensure that lower-skilled or less-educated workers benefit from industrial upgrading?

Academic and Research Perspectives

- What are the strengths and weaknesses of China’s current industrial policy approach at the city level?
- How does China’s municipal policy model compare with other countries in terms of efficiency and equity?
- What areas of industrial policy design require further empirical research or data transparency?

Appendix E: Glossary of Key Terms

"863" Program: a high-tech research and development initiative launched by China's central government in 1986 to reduce dependence on foreign technology and promote indigenous innovation. Proposed by leading scientists including Qian Xuesen, the program targeted strategic technologies across multiple sectors. In the 2000s, it elevated electric vehicles (EVs) to a national priority, funding early R&D and laying the groundwork for large-scale NEV development.

"Dual Carbon" strategy: China's national climate policy announced in 2020, setting goals to peak carbon emissions by 2030 and achieve carbon neutrality by 2060. The strategy positions NEVs as a key enabler of decarbonization in the transport sector and guides policy support toward green technologies and industrial upgrading.

"Internet Plus" Action Plan: A national strategy launched by the Chinese government in 2015 to integrate the internet, big data, and artificial intelligence with traditional industries such as manufacturing, healthcare, and agriculture. The plan aims to drive innovation, improve efficiency, and promote new business models by encouraging digital transformation across sectors.

"Made in China 2025" initiative: A national industrial strategy launched in 2015 aimed at upgrading China's manufacturing sector, enhancing innovation, and reducing dependence on foreign technology across ten key sectors, including robotics, aerospace, and new energy vehicles.

"Ten Cities, Thousand Vehicles" Pilot Program: a 2009 policy initiative launched by China's Ministry of Finance (MOF) to accelerate NEV adoption by deploying around 1,000 NEVs annually in selected pilot cities. It expanded in three phases to cover 25 cities—together accounting for over 30% of China's vehicle ownership—including major auto hubs like Shanghai, Shenzhen, and Changchun. The program catalyzed NEV infrastructure and public fleet electrification, laying the foundation for national industrial policy and future market development.

2012–2020 NEV Industry Development Plan: a comprehensive national policy issued by the State Council in 2012 to promote large-scale adoption of NEVs. It expanded subsidies to private consumers, supported R&D and industrial parks, and positioned NEVs as a pillar of China's strategic emerging industries.

Administrative Capacity: The ability of government institutions to effectively implement, manage, and monitor policy interventions.

BAIC (Beijing Automotive Industry Holding Co.): a prominent SOE and early NEV adopter, often supported through local government initiatives in Beijing.

Battery electric vehicles (BEVs): fully electric vehicles that run exclusively on electric power stored in rechargeable batteries. They produce zero tailpipe emissions and are a core component of China's NEV strategy. Examples include the BYD Dolphin and Tesla Model 3.

Battery integration: the design and engineering process of embedding the battery more efficiently into the vehicle's chassis or structure, improving safety, performance, and interior space. Advanced integration, such as cell-to-pack or cell-to-body design, reduces weight and manufacturing complexity while enhancing energy density and driving range.

Blade Battery: a lithium iron phosphate (LFP) battery technology developed by BYD, featuring a unique flat and elongated cell design that enhances space utilization, thermal stability, and safety. Its resistance to thermal runaway makes it one of the safest battery types in mass production, and it underpins many of BYD's newer electric vehicle models.

BYD: China's leading NEV manufacturer, known for full vertical integration across batteries, chips, and motors, as well as innovations like the Blade Battery and DM hybrid tech.

CATL (Contemporary Amperex Technology Co. Ltd.): the world's largest EV battery maker, supplying cells to nearly all major Chinese and global automakers. Headquartered in Ningde, CATL is known for innovation, scale, and a dense supplier ecosystem.

China Family Panel Studies (CFPS): A large-scale, nationally representative longitudinal survey in China used to study household income, employment, and demographics.

Clawback Clause: A contractual condition requiring firms to return subsidies or incentives if promised outcomes—such as investment, job creation, or tax revenue—are not achieved.

Development and Reform Commissions (DRCs): Government agencies at the provincial and municipal levels responsible for economic planning, investment approval, and industrial policy coordination. DRCs operate under a dual leadership structure: they report administratively to local governments and professionally to the National Development and Reform Commission (NDRC), China's central economic planning body. This dual relationship allows DRCs to align local implementation with national strategic priorities while tailoring policies to local conditions.

DM hybrid tech (Dual Mode hybrid technology): BYD's proprietary hybrid system that allows vehicles to operate in both pure electric and hybrid modes. The technology combines an internal combustion engine with an electric motor and battery, enabling flexible driving range, high fuel efficiency, and lower emissions—particularly popular in China's plug-in hybrid (PHEV) market.

Dual-Credit System: a market-based regulatory mechanism, officially titled the *Parallel Management Regulation for Corporate Average Fuel Consumption and New Energy Vehicle Credits*, introduced in 2018. It requires automakers in China to meet fuel efficiency targets and produce a certain quota of New Energy Vehicles (NEVs), or purchase credits from firms that exceed these targets. Modeled partly after California's Zero Emission Vehicle (ZEV) program, the system links fuel economy and NEV performance, incentivizing continued investment in clean vehicles even as direct subsidies are phased out.

Five-Year Plans (FYPs): China's national economic and social development blueprints issued every five years since 1953. They outline strategic goals, priorities, and policy directions for guiding growth, industrial policy, and reform.

Fuel cell electric vehicles (FCEVs): vehicles powered by electricity generated through a chemical reaction between hydrogen and oxygen in a fuel cell. FCEVs emit only water vapor and are promoted for heavy-duty applications such as buses and trucks, particularly in inland cities seeking industrial repositioning.

Fuyao Glass: a major supplier of automotive glass for both domestic and foreign EV makers. Though not exclusive to NEVs, it plays a critical role in the high-value, precision component supply chain for electric and smart vehicles.

Gini Coefficient: A statistical measure of income or wealth inequality within a population, ranging from 0 (perfect equality) to 1 (maximum inequality).

Government Venture Capital (GVC): Government-backed investment funds used to support high-risk, high-reward innovation in strategic sectors.

Horizontal Expansion: Industrial growth strategy focused on increasing the number of firms or output quantity, often at the cost of efficiency or quality.

Household Registration ("*hukou*") System: China's internal registration system that ties individuals' access to public services—such as education, healthcare, and housing—to their registered place of residence, limiting labor mobility and contributing to urban-rural inequality.

ICCT (International Council on Clean Transportation): An independent nonprofit organization that conducts research and provides technical and policy analysis to improve the environmental performance and energy efficiency of transportation systems. The ICCT plays a key role in benchmarking vehicle emissions standards and evaluating clean transportation policies worldwide, including those in China.

IEA (International Energy Agency): An intergovernmental organization established in 1974 that provides policy advice, data, and analysis on global energy systems, with a focus on energy security, sustainability, and economic growth. The IEA is known for its authoritative reports on energy trends, including electric vehicle (EV) adoption and climate targets.

Industrial Policy: Government strategies and actions aimed at promoting the development and competitiveness of specific industries or sectors.

Internal Competition: Policy-induced rivalry between cities or firms within a country, aimed at encouraging innovation and performance.

Key Performance Indicators (KPIs): Quantifiable metrics used to evaluate a firm's performance in achieving specific objectives, particularly in the context of public subsidies. Common KPIs include job creation, wage levels, workforce training, investment scale, and technological outputs. They help ensure accountability and alignment between government support and policy outcomes.

Kuznets Hypothesis: An economic theory proposed by Simon Kuznets suggesting that as an economy develops, income inequality first increases and then decreases, forming an inverted-U curve over time.

LFP (Lithium Iron Phosphate) Battery: A lithium-ion battery that uses iron phosphate as the cathode material. LFP batteries are cheaper, safer, and more thermally stable than NCA or NCM batteries, though they have lower energy density. They are increasingly adopted in mass-market EVs and favored by Chinese manufacturers.

Li Auto: specializes in extended-range electric vehicles (EREVs) combining electric motors and backup gasoline engines, targeting families in urban markets.

Medium-to-Long-Term Program for Science and Technology Development (2006–2020) (MLP): A national strategic plan issued by the State Council to guide China's innovation-driven development, focusing on strengthening indigenous innovation capacity, reducing reliance on foreign technologies, and advancing science and technology as core drivers of economic growth.

Minimalist UI (user interface): a design approach that emphasizes simplicity, clean layouts, and reduced visual clutter in vehicle dashboards and infotainment systems. Inspired by consumer electronics (e.g., smartphones), this style—popularized by Tesla—prioritizes intuitive interaction and often replaces physical buttons with touchscreen controls.

Ministry of Finance (MOF): Responsible for fiscal policy, public budgeting, taxation, and the management of central government expenditures and revenues.

Ministry of Industry and Information Technology (MIIT): Regulates China's industrial development, technological standards, and information industries. It plays a central role in guiding sectoral upgrading and implementing national industrial strategies.

Ministry of Science and Technology (MOST): The central government agency responsible for formulating and implementing China's science and technology policies, managing national research programs, and promoting innovation and high-tech development.

Ministry of Transport (MOT): Oversees China's transportation infrastructure, including roads, railways, waterways, and public transit systems. It plays a key role in logistics, trade facilitation, and regional connectivity.

National Bureau of Statistics (NBS): China's official statistical agency responsible for collecting, analyzing, and publishing economic, demographic, and social data at the national and local levels.

National Development and Reform Commission (NDRC): China's top macroeconomic management agency responsible for formulating industrial policy, approving major investment projects, and coordinating economic strategy across regions and sectors.

National Economics Foundation (NEF): A policy research institute established in 2015 to promote theoretical innovation and the development of economics in China. NEF funds research, supports doctoral training, and organizes academic initiatives and scholarly events. NEF also serves as the client for this project.

National Energy Administration (NEA): A Chinese government agency under the National Development and Reform Commission (NDRC) responsible for formulating and implementing national energy policies. The NEA oversees energy planning, regulation, and development across sectors including electricity, renewables, and new energy vehicles (NEVs), and plays a key role in advancing China's energy transition and carbon neutrality goals.

NCA (Nickel Cobalt Aluminum) Battery: A type of lithium-ion battery that uses a cathode made of nickel, cobalt, and aluminum oxides. Known for its high energy density and long lifespan, NCA batteries are commonly used in high-performance electric vehicles, including Tesla models. However, they rely heavily on cobalt, which raises cost and sourcing concerns.

NCM (Nickel Cobalt Manganese) Battery: A widely used lithium-ion battery type composed of nickel, cobalt, and manganese. NCM batteries offer a balance of energy density, thermal stability, and cost, making them suitable for both electric vehicles and energy storage systems. Variants such as NCM 811 and NCM 622 refer to the ratio of the three metals.

New Energy Vehicles (NEVs): a category of vehicles that includes battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and fuel cell electric vehicles (FCEVs). In China, NEVs have been a major focus of industrial policy, receiving extensive subsidies, tax incentives, and regulatory support from central and municipal governments. They are central to the country's strategy for technological upgrading, green transition, and reducing dependence on imported fossil fuels.

NIO: a premium EV startup known for battery swapping, autonomous driving features, and design. Headquartered in Shanghai with significant operations in Hefei.

OptimumNano: once a top-three battery firm backed by the city of Shiyan; collapsed in 2018 due to financial mismanagement and poor vetting, becoming a cautionary tale in local industrial policy.

Over-the-air updates: a technology that allows automakers to remotely deliver software updates to vehicles via wireless internet, without requiring physical service visits. Widely adopted by Tesla, OTA updates enable continuous feature improvements, bug fixes, and even performance upgrades, transforming vehicles into upgradable digital platforms.

Plug-in hybrid electric vehicles (PHEVs): vehicles that combine an internal combustion engine with a rechargeable electric battery. They can run on electricity for shorter distances and switch to gasoline for extended range, serving as a transitional technology in the NEV landscape.

Policy Duplication: The phenomenon where multiple cities pursue the same industrial goals or sectors, leading to redundant investments and inefficiencies.

SAIC (Shanghai Automotive Industry Corporation): a major state-owned enterprise (SOE) and joint venture partner with Volkswagen and GM, actively participating in the EV sector.

Skill-Biased Technological Change (SBTC): A process where technological advancements increase demand for high-skilled labor, potentially widening wage inequality.

Special Economic Zones (SEZs): Designated areas within China that offer preferential policies—such as tax incentives, reduced regulation, and greater openness to foreign investment—to attract capital, technology, and talent. SEZs have played a key role in China's economic reform and opening-up strategy since the 1980s.

State Council: The chief administrative authority of the People's Republic of China, also known as the Central People's Government. It functions as the national cabinet and oversees ministries, commissions, and provincial governments.

State Taxation Administration (STA): The central authority for tax collection and administration in China, overseeing the implementation of national tax laws and regulations across all levels of government.

State-Owned Enterprises (SOEs): Firms that are wholly or partially owned by the government. In China, SOEs play a key role in strategic sectors and often receive preferential access to capital, subsidies, and regulatory support.

Tesla (Shanghai Gigafactory): the first wholly foreign-owned auto factory in China, Tesla's Shanghai facility became its most productive globally, contributing to technology spillovers and supply chain upgrading.

Vehicle and Vessel Tax: A tax levied on the ownership of motor vehicles and vessels in China, commonly collected at the local level. It serves as a source of local revenue and may be used to fund infrastructure and environmental initiatives.

Vehicle Purchase Tax: A national tax in China levied on the purchase of automobiles, typically at a rate of 10% of the vehicle's taxable price. Certain categories, such as new energy vehicles (NEVs), are eligible for exemptions or reductions under industrial policy initiatives to encourage clean energy adoption and boost domestic consumption.

Vertical Upgrading: Improving the quality, technological sophistication, and value-added of industrial output rather than merely expanding production.

Vocational Education: Education and training programs focused on equipping students with specific trades or technical skills needed in the workforce.

WM Motor: an EV startup that received substantial early investment but filed for bankruptcy in 2023, illustrating the risks of overcapacity and lack of profitability in a competitive sector.

Xpeng: a Guangzhou-based smart EV company focused on autonomous driving and mid-range electric sedans and SUVs.

Zero Emission Vehicle (ZEV): A vehicle that produces no tailpipe emissions of greenhouse gases or air pollutants during operation. ZEVs typically include battery electric vehicles (BEVs) and hydrogen fuel cell vehicles (FCEVs).

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