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The Evolution and Transformation of China's Economic Model: A Pathway Analysis Since the Reform and Opening-Up

Xinyi Ding

Department of Science and Technology Studies, University College London, London, United Kingdom
zcrhxdi@ucl.ac.uk

Abstract: Amid ongoing shifts in the global economic landscape and rising geopolitical uncertainties, China is critically transitioning from a latecomer advantage-based catch-up model to a path of independent transformation. This paper explores the coexistence of "Evolution" and "Transformation" as dual development modes, using the new energy vehicle (NEV) and semiconductor industries as case studies. These two sectors represent contrasting trajectories in China's industrial strategy: the NEV industry demonstrates a hybrid model—combining global integration with increasing technological autonomy—while the semiconductor industry faces structural constraints due to external technological blockades and high-end import dependence. This divergence exemplifies the tension between path-dependent evolution and disruptive transformation. The study identifies several barriers to industrial upgrading, including global technology restrictions, limited policy coordination, and structural imbalances across sectors. The paper recommends enhancing indigenous innovation through targeted policy support, improving inter-agency coordination, and fostering strategic self-reliance in critical sectors while preserving engagement in global cooperation. This research contributes to a deeper understanding of China's evolving modernization strategy. It offers theoretical insights into how other developing economies might navigate similar challenges in balancing global integration with domestic resilience.

Keywords: Development, Transformation, Politics, Innovation, Globalisation

1. Introduction

1.1. Research background

Since China's reform and opening-up over forty years ago, its economic policies and globalisation have driven rapid growth; China's economy experienced rapid expansion for three decades, averaging over 9% annual GDP growth. Though recent years have slowed, it maintains a solid 5% growth rate [1]. China's economic growth has evolved from factor-driven to investment-driven and now towards innovation-driven. Initially relying on cheap labour and resource exports, it transitioned to capital-intensive infrastructure and manufacturing. Today, China prioritises technology and independent R&D to sustain long-term growth [2]. This shift in strategy not only sustains growth but also fosters sustainable and low-carbon development, aligning with China's long-term economic transformation

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goals; the economy has been growing steadily, and stepping into the 21st century, with the acceleration of technological change, China has seized the opportunity to is seeking the transformation of high-tech industries to transform economic growth from quantitative to qualitative change [3].

While its economy is growing steadily, the feasible path for China's future innovation-driven development is still precarious. As the world's second-largest economy, China's economic strength is evident. However, its GDP remains disproportionately reliant on agriculture and industry, while the service sector lags compared to developed countries [1]. The limitations of this growth model are becoming more and more apparent when the traditional industries reach the saturation stage; if China is unable to improve the technological content of the manufacturing industry to achieve industrial upgrading, science and technology, and service industry value-added decline in its economic growth will gradually slow down or even atrophy. China must prioritise innovation in technology, finance, and high-end services to sustain long-term growth as its new economic pillars. The current world pattern is complex and volatile, and geopolitics, trade barriers, and other factors hurt China's industrial transformation and multilateral trade cooperation. Therefore, China must find an independent, open, and compatible path of development and innovation to cope with the ever-changing international trade situation. To understand China's economic trajectory, it is essential to review relevant theories and models.

1.2. Literature review

1.2.1. Economic development theories & growth models

Economic growth has been extensively studied in academic literature. The economic growth model shows that capital accumulation, labour supply, and technological progress are the mainstreams of economic growth [4]. Porter further asserts that economies must shift from investment-driven to innovation-driven development to maintain competitiveness [5]. Following the reform, China's economic development shifted from labour-intensive industries to high-tech sectors. However, some scholars noted that it is still at a bottleneck in some high-end technology industries, limiting China's technological self-sufficiency [6].

1.2.2. Industrial upgrading & latecomer strategies

The topic of industrial upgrading in developing countries has also received much attention. Gerschenkron argued that latecomer countries could leverage technological diffusion from developed nations and follow the comparative advantages of their factors to achieve rapid economic growth [7]. China's development trajectory exemplifies this theory, with notable breakthroughs in high-speed rail and new energy vehicles. However, some high-value-added science and technology fields, such as the chip manufacturing industry, remain dependent on imports from other developed countries [6]. This underscores China's ongoing challenges in achieving technological self-sufficiency in high-barrier industries.

1.2.3. Overdependency & challenges in key sectors

China still suffers from technical barriers and supply chain dependence in the high-tech sector, especially in the semiconductor industry. Despite the large amount of FDI attracted by the reform and opening up, China is still at the low end of the global value chain and mainly undertakes the assembly task [6]. Foreign-funded enterprises occupy the core link due to their technology, capital, and marketing advantages. The competitiveness of Chinese enterprises is limited, so the government has

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implemented a series of localisation strategies [8]. However, whether we can break through the high-tech bottleneck and eliminate external dependence is still a problem that needs to be solved.

1.3. Research gap

Most existing studies on China's economic development are grounded in the latecomer advantage theory, which suggests that developing countries can achieve economic growth by emulating developed nations' technological and industrial models. However, as geopolitical factors such as global trade barriers and resource restrictions reshape global supply chains, developing economies' traditional industrial upgrading pathways are encountering unprecedented challenges.

While existing research has established a clear distinction between evolution (gradual industrial upgrading) and transformation (structural economic shifts), the question remains: Is China's economic model still in the evolution phase, or has it transitioned into a stage of transformation? Alternatively, can these two processes coexist within China's development trajectory? Despite its significance, this issue has yet to be systematically examined.

This study aims to construct a new analytical framework by integrating "evolution" and "transformation" as dual lenses to examine China's economic development trajectory. It seeks to address the central research question: How can China balance evolutionary continuity with structural transformation under the shifting dynamics of global trade, technological constraints, and geopolitical tensions? By exploring this question, the study contributes to understanding how emerging economies may simultaneously leverage globalisation and foster indigenous innovation to sustain long-term development.

1.4. Research framework

This study examines evolution and transformation as two development models to assess China's economic trajectory.

Based on latecomer advantage theory, the evolution model emphasises gradual industrial upgrading, technology acquisition, and labour reallocation as key growth drivers, aligning with early-developing economies leveraging globalisation [7].

The transformation model, by contrast, involves structural shifts driven by policy intervention, innovation, and institutional reforms to transition from factor-driven to innovation-driven growth. Successful transformation requires technological upgrading and strategic adaptation to global market changes to avoid stagnation and industrial lock-in [9].

This study explores whether China's economy is transitioning from evolution to transformation or if both models coexist to maximise economic output. Case studies in new energy and high-end manufacturing will be used to analyse this dynamic process.

2. Case description

2.1. Rationale for case selection

China has entered a critical stage of economic development, where industries follow distinct trajectories. Some remain integrated into global supply chains through evolution, while others undergo structural transformation driven by innovation and policy.

This study examines the new energy vehicle (NEV) and semiconductor industries, essential to China's high-tech sector and economic growth. While they occupy key positions in the global value chain, they face industrial upgrading challenges at different stages. By comparing these industries, this study explores the coexistence of evolution and transformation, offering insights into China's dual-track development strategy. These industries were selected because they represent distinct stages of China's industrial upgrading and highlight the coexistence of Evolution and Transformation.

2.2. Case study 1: new energy vehicle (NEV) industry

China's new energy vehicle (NEV) industry has experienced rapid growth, emerging as one of the world's largest NEV markets [10]. Government policies, subsidies, and investment in technological innovation have driven this expansion.

China's reliance on imported raw materials like lithium and nickel aligns with the Evolution model, reducing costs and facilitating global trade. However, in high-value segments like battery technology, firms such as BYD and CATL have achieved technological breakthroughs, particularly in power batteries and electronic control systems, reflecting a shift toward transformation [10].

This dual-track model allows the NEV industry to benefit from global supply chain efficiencies while fostering self-sufficiency in core technologies, demonstrating how Evolution and Transformation coexist within China's industrial development strategy. While the NEV industry demonstrates significant transformation, Semiconductors are essential to telecommunications and artificial intelligence, making them one of China's most strategic high-tech industries.

2.3. Case study 2: semiconductor industry

The semiconductor industry is a strategic yet highly dependent sector in China's high-tech landscape, essential to telecommunications and artificial intelligence. It is one of China's most strategic high-tech industries. However, the sector remains highly dependent on foreign supply chains. China relies on imports in chip design and manufacturing equipment, with EDA software dominated by US firms. Export restrictions like those imposed on Huawei have severely impacted domestic chip design capabilities, keeping this field in the Evolution stage.

Conversely, China has progressed in IC Capital Equipment and low-end chip manufacturing (28nm and above), gradually reducing external dependence. This shift signals an ongoing transition toward transformation [11]. While demand for self-sufficiency is strong, China's semiconductor industry remains constrained by global supply chains, positioning it at a critical Evolution-to-Transformation stage, unlike the more advanced shift seen in the new energy vehicle sector.

2.4. Empirical assessment of the coexistence of evolution and transformation

China's economic model exhibits a dual-track approach across various industrial sectors and supply chain segments. In the new energy vehicle (NEV) industry, downstream sectors, such as battery raw material manufacturing, leverage global supply chains, exemplifying the Evolution model. Concurrently, upstream sectors emphasise independent innovation in high-end technologies to mitigate potential external constraints, achieving industrial transformation. Conversely, the semiconductor industry is transitioning from reliance on advanced foreign materials toward self-sufficient research and development, moving from Evolution to Transformation. This transition faces challenges like trade barriers and resource restrictions, indicating a prolonged progression. These cases illustrate China's strategic adjustments amid global economic shifts to balance technological autonomy and global integration.

3. Analysis of the problem

3.1. Analysis of influencing factors

What factors influence the industrial upgrading of China's NEV and semiconductor sectors?

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3.1.1. Intensity and direction of policy support

The Chinese government has introduced subsidies and tax exemptions to accelerate NEV adoption and innovation. Additionally, strict environmental regulations, such as emission and energy efficiency standards, have been introduced to drive industrial upgrading and enhance battery technology innovation, positioning China as a global leader in the NEV sector [10].

In contrast, the semiconductor industry faces more significant structural challenges due to high technical barriers, geopolitical constraints, and export restrictions on critical technologies. Although the government provides financial incentives and strategic policy support to core enterprises like Huawei, these measures primarily facilitate mid-range chip production, as advanced semiconductor manufacturing relies heavily on foreign suppliers. The US monopoly over EDA software and high-end fabrication equipment significantly restricts China's ability to achieve complete semiconductor self-sufficiency, limiting the effectiveness of state-led industrial policies in this sector [11]. While policy support is crucial, technological innovation is equally important in industrial upgrading.

3.1.2. Technological innovation capability and independent research and development

Technological innovation is key to industrial upgrading in NEV and semiconductor sectors. China's new energy vehicle (NEV) industry, led by CATL (Ningde Times) and BYD, has established a dominant global power battery market through sustained independent innovation. Based on quarterly installation data from SNE Research, CATL maintained its dominant position in the global battery market throughout 2021 and 2022, with a particularly sharp rise in Q4 2022, reaching nearly 65 GWh. BYD also exhibited strong growth, surpassing LGES by the end of 2022. These trends underscore the strength of China's battery innovation capabilities and highlight the nation's growing leadership in global EV supply chains [12].

Advances in lithium-ion battery technology have significantly enhanced energy efficiency, while continuous cost reductions have accelerated the commercialisation of NEVs. The NEV supply chain has become increasingly sophisticated, with specialised firms engaged in production, assembly, and distribution, reinforcing China's competitive advantage [13].

In contrast, China's semiconductor industry remains highly dependent on foreign suppliers for high-end chip design and manufacturing. The domestic research and development (R&D) capacity for critical materials and EDA (Electronic Design Automation) software is significantly weaker than that of leading semiconductor-producing nations, limiting progress in advanced chip fabrication. While mid-range chip production (14nm, 28nm nodes) has seen gradual localisation, high-end logic chips, including high-performance processors and AI chips, remain subject to severe technological and supply chain constraints.

3.1.3. Degree of dependence on global supply chains

In the new energy vehicle (NEV) industry, Chinese manufacturers continuously increase innovation efforts, advance new energy technologies, and accelerate product iteration to strengthen domestic and global competitiveness. The transformation-driven model has enabled companies to leverage cost reductions in key materials, such as batteries, driven by intensified market competition. Additionally, cross-border collaborations in technological research, development, and charging infrastructure have further integrated China into the global value chain, allowing it to benefit from cost efficiencies and technological spillovers associated with globalisation [10].

In contrast, China's semiconductor industry remains constrained by foreign resource monopolies, particularly in EDA (Electronic Design Automation) software, which relies heavily on US suppliers. US export controls have directly limited China's high-end chip manufacturing capabilities, preventing access to cutting-edge tools essential for advanced semiconductor design. Moreover, the core R&D expertise in EDA remains concentrated in the US and Europe, and while China is actively cultivating domestic talent, surpassing well-established industry leaders remains a long-term challenge, reinforcing its dependence on restricted foreign technologies [11]. These cases illustrate China's strategic adjustments amid global economic shifts to balance technological autonomy and global integration. While the NEV industry benefits from global supply chain efficiencies, the semiconductor sector remains constrained by foreign monopolies in critical technologies, highlighting the divergent challenges in China's dual-track industrial strategy.

3.2. Identification and analysis of problems

What are the key challenges facing China's NEV and semiconductor industries?

3.2.1. Insufficient technological autonomy

The semiconductor industry remains one of the most technologically challenging sectors, relying on foreign expertise in high-end chip design and manufacturing. This dependence has made China particularly vulnerable to "technological chokepoints," where a few leading global players tightly control access to critical tools and materials. One of the most significant constraints is China's reliance on ASML's advanced lithography machines, essential for producing cutting-edge semiconductors with higher transistor densities. However, under pressure from the United States, the Dutch government has restricted the export of ASML's most sophisticated lithography systems to China, significantly limiting the country's ability to advance in high-end chip manufacturing. These restrictions have affected leading Chinese firms such as Huawei, curbing their competitiveness in the global semiconductor market. Whitwam highlights that China's semiconductor industry remains 10 to 15 years behind global leaders, making the pursuit of self-sufficiency an immense challenge [14]. Unlike industries where supply chains can be diversified, semiconductor development requires highly specialised equipment and knowledge, creating structural barriers that impede China's ability to achieve technological independence shortly. While technological autonomy is critical, supply chain coordination also poses significant challenges for China's industrial development.

3.2.2. Lack of coordination between upstream and downstream of the industrial chain

China's NEV industry faces challenges in upstream resource supply, threatening its long-term sustainability. The upstream sector includes extracting critical minerals such as lithium and cobalt, essential for battery production. These minerals are primarily sourced from a few geographically dispersed but highly concentrated regions, including the Democratic Republic of Congo, Argentina, Chile, and Australia. Reliance on a few suppliers exposes China to geopolitical risks and trade restrictions. If China's access to these resources were restricted, it would require substantial investment in alternative sources or substitutes, disrupting the balance between upstream resource acquisition and downstream industrial development.

Additionally, mineral extraction is inherently unsustainable, as finite reserves will eventually face depletion. Prolonged dependence on imported resources could undermine the long-term viability of China's NEV industry, necessitating strategic measures to mitigate supply chain vulnerabilities. Furthermore, large-scale mining operations often result in irreversible environmental degradation, conflicting with global sustainability goals. To secure its leadership in the NEV sector, China must enhance domestic mineral processing capabilities and invest in resource efficiency, recycling technologies, and international partnerships to ensure a stable, diversified, and sustainable supply chain. Addressing these structural challenges is crucial for maintaining competitiveness while aligning with global environmental and economic imperatives.

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3.2.3. Uncertainty in the international trade environment

The US technology sanctions on China have severely restricted the Chinese semiconductor industry's access to advanced technologies, limiting its independent research and development capabilities and slowing industrial progress. At the same time, the ongoing technological rivalry between China and the United States, driven by the pursuit of global dominance, presents significant challenges to globalisation. In addition, the US has adopted a so-called "multilateralism" strategy, expanding its network of allies to constrain China's high-tech industry advancements further. This escalating geopolitical tension underscores the urgent need for China to achieve technological self-sufficiency and drive independent innovation to mitigate external dependencies and sustain long-term industrial development.

3.3. Comparative analysis between China and western countries

China's new energy vehicle (NEV) industry benefits from strong market demand, comprehensive policy support, and an increasingly sophisticated industrial chain fueled by growing innovation capabilities. Government initiatives—such as large-scale investments in charging infrastructure—have attracted numerous foreign automotive brands to enter the Chinese market and collaborate on NEV research and development [10]. As global low-carbon and sustainability agendas advance, new energy sectors worldwide are experiencing rapid expansion. This trend presents both opportunities for international cooperation and intensified product competition. Western markets still retain a competitive edge due to long-established brand influence, highlighting the need for China to enhance R&D investment and foster independent innovation to gain long-term technological and cost advantages beyond Western dominance.

In contrast, while China's semiconductor industry holds significant capacity in low-end manufacturing, it continues to face major barriers in developing advanced chips. These obstacles are mainly due to trade restrictions and core technology blockades imposed by Western countries. In particular, the monopoly held by Western firms in Electronic Design Automation (EDA) software has forced China to increase R&D expenditure and develop domestic alternatives, often at high cost. As a result, China's semiconductor industry is currently in a difficult transitional phase—facing structural resistance as it moves from gradual evolution toward transformative innovation. This reflects broader challenges in reducing dependency and achieving long-term self-reliance in strategic sectors. While China's NEV industry benefits from strong domestic demand and policy support, its semiconductor sector struggles with technological barriers and trade restrictions, highlighting the divergent paths of China's industrial development.

4. Policy architecture for industrial upgrading

4.1. Precision funding allocation: from elite capture to ecosystem vitality

In recent years, China has made substantial financial commitments to strengthen its scientific and technological foundations, with targeted investments in semiconductors, artificial intelligence, and advanced manufacturing. The total scale of strategic emerging industry investment funds (SEIIF) has exceeded 100 billion yuan, reflecting the centrality of technology to national development. However, the current resource allocation structure remains overly concentrated among a handful of elite institutions and centrally administered enterprises. In contrast, innovative small and medium-sized enterprises (SMEs), local research platforms, and high-potential startups face limited access to funding, human capital, and commercialisation channels. This structural asymmetry has weakened the capacity of China's innovation ecosystem to generate scalable and widely applicable breakthroughs.

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Moreover, the prevailing emphasis on short-term, quantifiable outcomes—such as publication counts or patent filings—has led to a neglect of original, high-risk research with long-term strategic value. A comprehensive overhaul of the R&D funding logic is urgently needed to address this. Policymakers should adopt a more problem-oriented approach, integrating the entire innovation chain from basic research to applied development and industrial scaling. The establishment of a multi-tiered support mechanism—structured as "exploration, pilot implementation, and large-scale diffusion"—can promote higher precision in funding allocation. In parallel, national innovation platforms such as State Key Laboratories should be more tightly integrated with sector-specific industrial alliances, ensuring that research outputs align with critical technological bottlenecks. Such reforms will enhance the autonomy and resilience of China's strategic science and technology capacity from the ground up [15].

4.2. Critical materials security: from external dependence to circular autonomy

Although China's new energy vehicle (NEV) sector has achieved notable progress in battery innovation and manufacturing scale, its upstream supply chain remains vulnerable due to excessive reliance on imported raw materials. Key inputs such as lithium, cobalt, and nickel are geographically concentrated in a limited number of countries—such as the Democratic Republic of Congo, Chile, and Australia—making the entire industry susceptible to supply disruptions, price volatility, and geopolitical shocks.

China should pursue diversified global resource strategies to safeguard long-term development, including establishing long-term supply agreements and joint ventures in resource-rich regions. In addition, it is imperative to accelerate domestic R&D on low-grade resource extraction and promote large-scale deployment of closed-loop recycling technologies. Developing a domestic circular economy, especially in critical mineral recovery and reuse, can serve as a buffer against external shocks and reduce the environmental footprint of upstream production. These efforts will lay the foundation for a more sustainable and self-reliant industrial ecosystem.

4.3. Adaptive policy architecture: sector-specific upgrading pathways

The contrasting trajectories of the NEV and semiconductor industries highlight the necessity of differentiated policy strategies. Rather than pursuing a one-size-fits-all model, China should institutionalise a dual-track industrial upgrading framework. For industries still in the early stages of transformation, building foundational research capacity, nurturing industrial clusters, and supporting technology transfer mechanisms should be emphasised. For sectors with technological breakthroughs, attention should shift toward international market expansion, regulatory harmonisation, and standard-setting to enhance global competitiveness.

Crucially, cross-departmental coordination and policy-tool integration must be strengthened. The linkage between industrial policy and financial instruments—such as tax incentives, equity investment, innovation bonds, and procurement preferences—can significantly improve policy efficiency. A coherent institutional framework will ensure that different sectors receive appropriate and timely support and maximise the return on public innovation investment by aligning it with long-term strategic objectives-—a practice increasingly reflected in international cases such as South Korea's "K-Battery Act, which legally binds R&D, production, and recycling chains to ensure coherent resource coordination across industrial segments [16].

5. Conclusion

Grounded in the contemporary realities of China's economic development, this study constructs a dual-path coevolution framework to examine the coexistence of two distinct development trajectories:

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evolution and transformation. By comparing the new energy vehicle (NEV) and semiconductor industries, the paper reveals how China adopts differentiated strategies across various segments of the industrial value chain. While integration into the global value chain fosters steady, incremental growth under the evolution model, industrial transformation is concurrently pursued through state-led initiatives and technological self-reliance. This dual-track approach demonstrates substantial institutional flexibility and strategic adaptability under growing geopolitical and economic uncertainty.

5.1. Theoretical contributions

This research contributes to the theoretical discourse on industrial upgrading in developing economies by highlighting the potential for simultaneous engagement in globalisation and independent innovation. The findings offer valuable policy implications, particularly for countries seeking to balance external integration with domestic capability building. In high-tech sectors, the interaction between top-down policy support and bottom-up market dynamics emerges as a decisive factor in overcoming structural bottlenecks and accelerating industrial upgrading.

5.2. Limitations and research frontier

Nonetheless, this study is limited by its reliance on secondary data and industry-level case analysis. Lacking empirical validation of firm-level dynamics and policy implementation outcomes—a limitation that echoes the coordination inefficiencies and fragmented resource alignment discussed in Section 4.2. Future research could incorporate mixed methods—such as field surveys, stakeholder interviews, and econometric analysis—to deepen understanding of the dual-track development model's internal logic and outcome efficiency. Additionally, expanding the analytical scope to cover emerging strategic sectors like artificial intelligence and green energy could help assess the evolution-transformation paradigm's broader applicability and evolutionary dynamics in a rapidly changing global landscape.

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