Manufacturing Transformation Paths in the Context of Land Policy Impacts: A Case Study Based on the Pearl River Delta Region

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Abstract: Land policy plays a crucial role in promoting market-oriented reform and industrial transformation within the manufacturing industry. This paper establishes an interdisciplinary framework of "system-behavior-path" and investigates the Pearl River Delta, focusing on comparative case studies of the Zhongshan Torch Development Zone and Taishan Industrial New Town. The study reveals how institutional designs influence enterprise behavior through either incentive or constraint mechanisms. In Zhongshan, the "industrial areas reformation" policy encourages technological upgrading and efficient land use, fostering an endogenous path of "local transformation." Meanwhile, Taishan's "access + subsidy + guidance" approach exemplifies an exogenous path by leveraging location and cost for industrial transfer. The paper suggests strategies to address land resource constraints and manufacturing transformation issues, including comprehensive mechanisms for industrial area reform, adapting land elements to evolving productive forces, enhancing government-enterprise collaboration, and capitalizing on policy "window periods." This provides a theoretical and practical foundation for optimizing land policy and advancing manufacturing transformation.

Keywords: Land Policy; Manufacturing Transformation; Pearl River Delta Region; Market-Oriented Reforms; New Quality Productivity

1. Introduction

Land policy is essential for China's development, driving the rational distribution of land and social stability[1]. Since the reform and opening up, China has seen significant land policy reforms, notably with the Land Management Law of 2020 and the 2022 Circular from the Ministry of Natural Resources, which promote market-oriented land allocation and innovative industrial usage. These changes aim to enhance land resource efficiency. In response to central policy, local governments are actively reforming land policies to address challenges from the pandemic, real estate downturn, and industrial imbalances, creating new opportunities for manufacturing development.[2] It outlines the need for a modernized industrial system and a manufacturing powerhouse, which raises the bar for the manufacturing industry's transformation. However, many manufacturing sectors in the Pearl River Delta are still in the early stages of this transformation, facing challenges such as rising land costs, limited resources for expansion, and inflexible land allocation. These issues highlight the conflict between land marketization and the need for effective reforms in the manufacturing sector. It is essential to explore the connections between land policy changes and manufacturing transformation to understand how policy orientation influences spatial reconfiguration and behavior in this sector. This study will identify bottlenecks hindering manufacturing transformation and provide insights for local governments and enterprises to improve land policies and overcome transformation challenges. Utilizing case studies from the Pearl River Delta, the research focuses on the micro-level impact of land policy, analyzing how manufacturing enterprises adapt strategies in response to these changes. This approach will enhance understanding of how institutional environment shifts affect industrial development and contribute to the broader study of land policy and industrial transformation.

2. Literature Review

Since the 1990s, China's urbanization has sparked significant scholarly focus on land and

manufacturing issues, leading to numerous studies and valuable research on land policy and manufacturing transformation.

2.1 Review of Research on Land Policy

As far as land policy is concerned, it mainly focuses on the intensive use of land, rural homesteads and land arrangements for new urbanization.

Intensive land use refers to the sustainable development of land resources through optimizing land use and improving land utilization. The research of Chinese scholars on intensive land use mainly focuses on three aspects [3]: First, it focuses on sustainable land use; second, it aims to improve land utilization efficiency; and third, it considers the economic, social, and ecological benefits of land intensification. Some scholars argue that these benefits exhibit spatial heterogeneity[4], and the rational allocation of land resources according to local conditions is conducive to mitigating the contradiction between regional ecological protection and economic development.

Rural residential land is collectively owned, and farmers use it to meet basic housing needs based on their membership in economic organizations. As the functions and demands on this land evolve, the transfer system has shifted from prioritizing fairness to balancing fairness and efficiency, ultimately leading to marketization.[5] (Zhang Yongchao and Guo Jie, 2025). The new concept of "one house, one family group, one unit" expands the scope of the residence base [6] (Du Yuneng et al., 2024).

New urbanization aims to enhance the overall quality of cities by transitioning from quantitative to qualitative measures. Research has linked it to urban-rural factor flows, carbon emissions, and the digital revolution. Studies on its relation to land policy primarily focus on rural land reform to improve infrastructure, foster urban-rural integration, and innovate the rural collective construction land system.[7] (Wang Qingri and Zhang Zhihong, 2014).

2.2 Review of Research on Manufacturing Transformation

The research on manufacturing transformation focuses on three key areas: the link between the digital economy and manufacturing, paths of transformation, and changes in manufacturing within the Pearl River Delta.

The connection between the digital economy and manufacturing transformation focuses on resource shifts, reconfigured production modes, and changes in enterprise forms, clarifying common misunderstandings about digital transformation in the manufacturing sector.[8] (Liu Jiuru, 2023). The transformation of the manufacturing industry is analyzed through innovative R&D methods, organizational approaches, and market segmentation. It highlights that relying on imitation of production technology for growth fails to bring about fundamental changes, hindering sustainable transformation and upgrade of the sector. [9] (Lu Xianxiang and Teng Yu WISDOM, 2021).

The literature on the Pearl River Delta's manufacturing industry transformation highlights how digitalization drives industrial upgrading. This impact is primarily seen through enhanced innovation capabilities and improved financial development. However, as digitization increases, its benefits exhibit a threshold effect: the advancement of the manufacturing sector becomes more pronounced with higher levels of digital economy development.[10] (Xie Baojian and Li Qingwen, 2024).

2.3 Review of Studies on the Interaction between Land Policy and Manufacturing Transformation

There are fewer studies on the link between land policy and manufacturing transformation, and there is only one literature that analyzes the research on the path of land policy and industrial transformation and upgrading. This literature summarizes the path of promoting industrial upgrading in China in terms of industrial layout, planning concepts, internal institutions, and regulatory instruments [11] (Lu Weimin and Ma Zuqi, 2011). However, there are some differences between this literature and the PRD region in terms of research time, background, and policies, and it does not adequately discuss the impact mechanism of policies and the micro-response level of enterprises.

In summary, there is a lack of empirical research on the connections between land-use efficiency and economic efficiency. Most studies adopt a static perspective and fail to trace the dynamic paths of enterprises influenced by land factors. Additionally, there's insufficient interdisciplinary integration; land policy mainly intersects with geography, while manufacturing transformation focuses on economics, neglecting the impacts of land policy on the manufacturing sector, such as

production costs and decision-making. Furthermore, systematic analysis of land policies in the Pearl River Delta region is limited, particularly regarding recent initiatives like industrial area reforms and upgrades. This paper aims to construct a "regime-behavior-path" analytical framework, examining how recent land policies in the Pearl River Delta have influenced factor allocation, market structure, and the institutional environment through incentives or constraints. By adopting an interdisciplinary approach, the research will highlight the impact of land policies on the manufacturing industry, addressing gaps in existing theoretical and practical studies.

3. Construction and Logical Structure of the Research Framework

3.1 Establishment of an Analytical Framework on "Regime-Behavior-Path"

Regime is central to the political sphere, with policy arising from regime formation. Analyzing policy change can indicate regime changes in specific contexts. The "regime-behavior-path" framework in Figure 1 draws on new institutionalism, behavioral science, and path dependence theories. New institutionalism addresses regime generation, maintenance, and evolution, helping to explain how land policies emerge amid spatial struggles and how internal and external factors hinder their implementation as regimes evolve over time. [12] Path dependence, political power enforcement, institutional cooperation, and conceptual support are key to maintaining the regime. Additionally, behavioral science theory, which emerged in the 1930s, analyzes human behavior by studying psychological factors. [13] Behavioral science examines strategies for organizational change and management at the organizational level. Path dependence theory indicates that regime change significantly influences path formation. Thus, selecting the right regime and continuously adjusting the path is essential for optimizing progress and avoiding the control trap of the regime.

The shift in land policy has altered how enterprises behave spatially, resulting in diverse transformation paths, illustrated by the "regime-behavior-path" framework. The new regime highlights the logic behind policy generation and evolution. New institutionalism suggests that policy results from interactions among network participants within institutional constraints[14]. Policy evolves in response to macro regime demands from governance subjects and objects amid external changes like urbanization and resource limitations. (Paul Pierson, 2000) can be reflected in three aspects: first, path dependence (the inertia of land policy); second, game negotiation (the balance of interests between local governments, transformation enterprises, land owners and other parties); third, feedback improvement (the government continuously adjusts in the process of land policy implementation). Following this, behavioral science theory explains the micro-response mechanism of enterprises. Under the influence of policy evolution, enterprises have to perceive and adjust the policy signals based on the limited theory (Herbert Simon, 1978) and the actual situation. Enterprise behavior can be classified into three modes: transformation and upgrading, location relocation, and passive exit. The first type actively seeks transformation to improve spatial and industrial layout, while the second is forced to relocate to avoid losses and reintegrate resources based on location differences. The third type of enterprises are forced to accept the situation of rising costs due to the land factor, and thus withdraw from the market. Finally path dependence theory elucidates the process of behavioral evolution towards paths. Firms' initial behavior is gradually solidified into long-term paths through self-reinforcing mechanisms (Arthur, 1989) as a result of policy interventions, during which behavior needs to be continuously adapted and adjusted in order to consolidate the advantages that have been created. Three distinct pathways can be identified: 1. Enterprises that respond to policy by upgrading their technology, following the path of "policy incentive-land intensification-efficiency improvement." 2. Some enterprises are prompted by policy to relocate, resulting in either the path of "policy incentive-regional outflow" or "policy stimulus-regional relocation-capacity integration." 3. Those enterprises that struggle to adapt to policy changes face elimination, following the path of "policy squeeze-cost out of control-forced to exit." This framework highlights that the effectiveness of a policy depends not just on its design but also on identifying a "window period" for intervention, particularly regarding sunk costs during transitions. Land policy should utilize supply

prices and industrial guidelines to promote timely transformations in manufacturing. This strategy aims to boost enterprise initiative and avoid unproductive paths, ultimately supporting sustainable development.

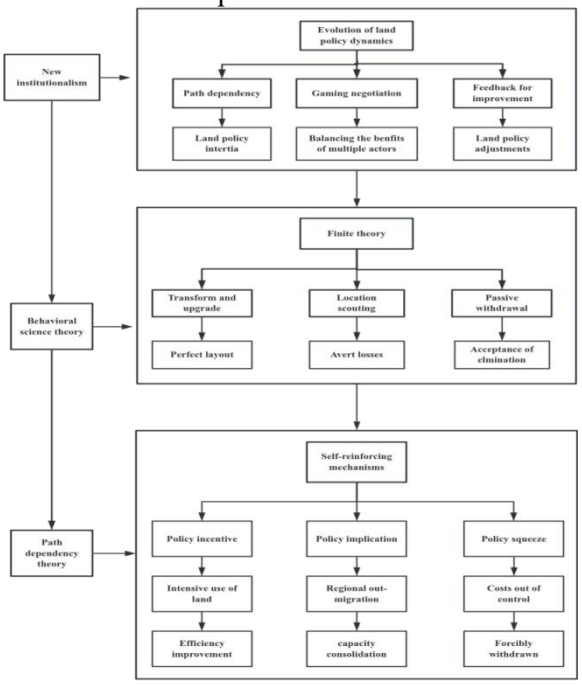


Figure 1. The "Regime-Behavior-Path" Analytical Framework

3.2 The Regime-Driven Logic Behind the Transformation of the Manufacturing Industry

The "Made in China 2025" initiative emphasizes the importance of manufacturing in the national economy. Amidst significant shifts in the global manufacturing landscape and changes in China's economy, transforming the manufacturing industry has become a key concern for governments to promote high-quality, sustainable development. This chapter focuses on external pressures stemming from the regime, while briefly touching on market factors like order outflow and rising costs. These regime pressures compel firms to assess their structural deficiencies and future paths, leading them to adopt strategies such as transformation, relocation, or exit. This adjustment process is influenced by various regime factors like government coordination and policy adaptation, resulting in significant differences among firms. Successful transformations provide insights for improving regimes to foster new development models. For instance, the Guangdong Provincial Department of Industry and Information Technology highlighted the digital transformation of the Pearl River Delta, showcasing Midea Group as a leader in intelligent manufacturing. Understanding how land policy influences the choices of manufacturing firms is key to creating a tailored land policy framework (see Figure 2).

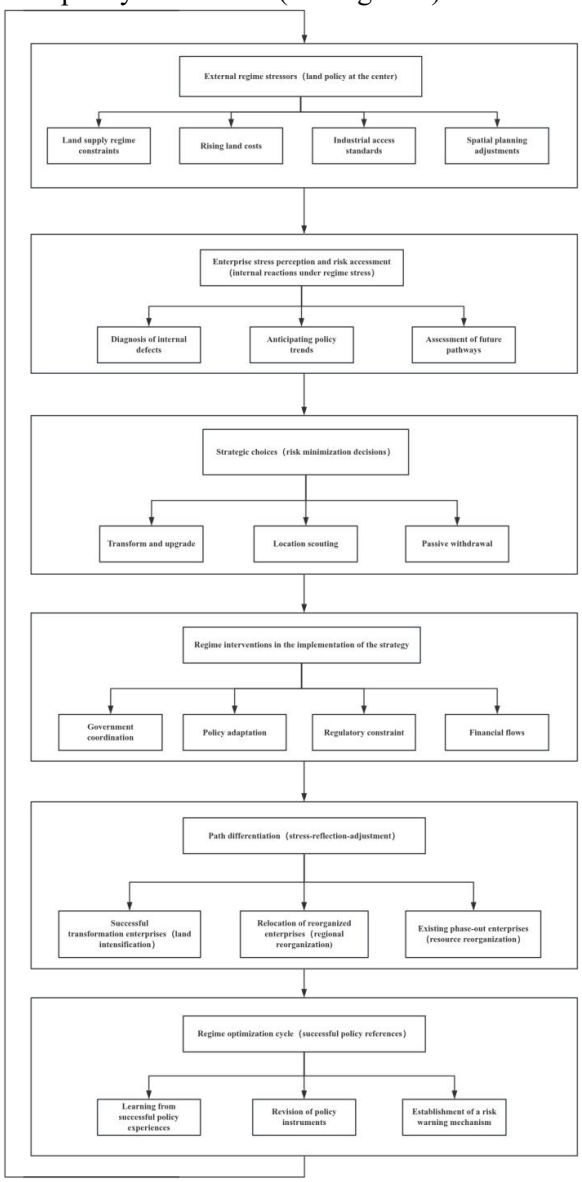


Figure 2. Analytical Framework for the Regime Drivers behind Manufacturing Transformation

4. Manufacturing Development Dilemma and Land Governance Challenges

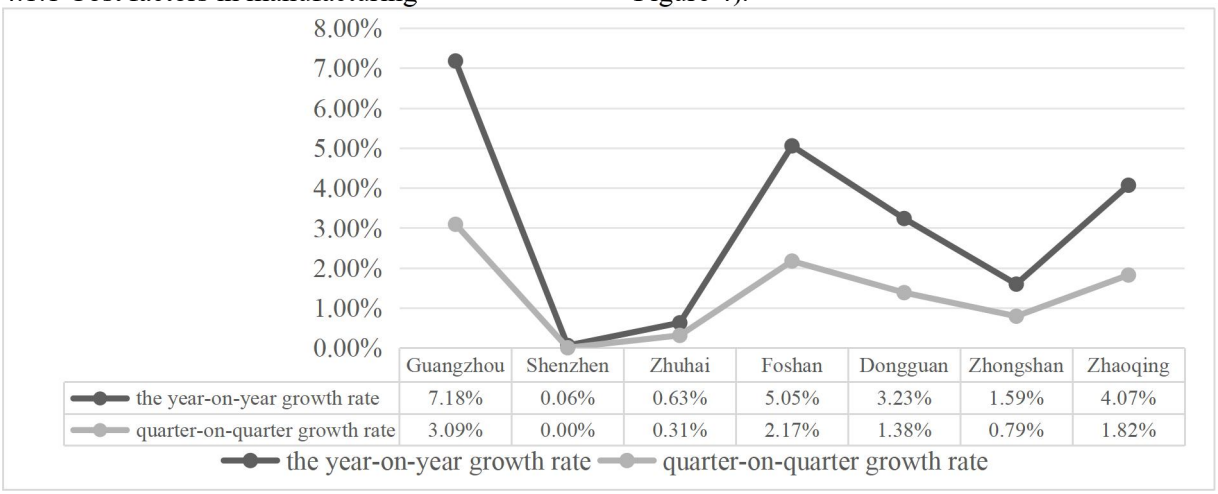
4.1 Manufacturing Development Dilemma

Manufacturing is the main body of the real economy and an important factor in the construction of a modernized economy. Since the reform and opening up, China's manufacturing industry has achieved rapid

development in more than 40 years. Since 2012, China's manufacturing industry has been the largest globally, with a value of about 4 trillion U.S. dollars in 2019, contributing 35% to global manufacturing and leading to significant GDP growth. However, the sector now faces challenges due to U.S.-China tensions and weak global economic recovery, resulting in a slowdown. Key issues include decreased export orders, industrial relocations, weak domestic demand, and land policy impacts, affecting manufacturing costs and spatial layout.

4.1.1 Cost factors in manufacturing

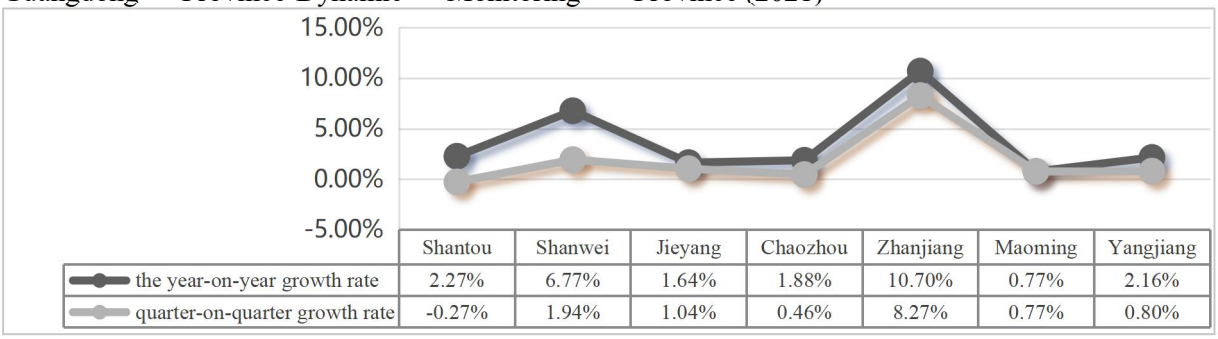
Acquisition cost significantly impacts manufacturing costs, affecting cost control, profitability, and supply chain stability. Land supply constraints have raised initial acquisition costs for manufacturers. Data from the Pearl River Delta (PRD) indicate a notable increase in land prices in 2021 (see Figure 3). [16] The year-on-year growth rate of industrial land prices in the core PRD area is 4.3%, while it's 3.19% for the coastal economic zone's east and west wings. The chain growth rates are 1.87% for the PRD core and 1.15% for the coastal zones (see Figure 4).



	Guangzhou	Shenzhen	Zhuhai	Foshan	Dongguan	Zhongshan	Zhaoqing
the year-on-year growth rate	7.18%	0.06%	0.63%	5.05%	3.23%	1.59%	4.07%
quarter-on-quarter growth rate	3.09%	0.00%	0.31%	2.17%	1.38%	0.79%	1.82%

Figure 3. Industrial Land Prices in the Core Area of the Pearl River Delta in 2021

Source: Department of Natural Resources of Guangdong Province-Dynamic Monitoring Report on Urban Land Prices in Guangdong Province (2021)



	Shantou	Shanwei	Jieyang	Chaozhou	Zhanjiang	Maoming	Yangjiang
the year-on-year growth rate	2.27%	6.77%	1.64%	1.88%	10.70%	0.77%	2.16%
quarter-on-quarter growth rate	-0.27%	1.94%	1.04%	0.46%	8.27%	0.77%	0.80%

Figure 4. Industrial Land Prices in the Eastern and Western Wings of the Coastal Economic Belt in 2021

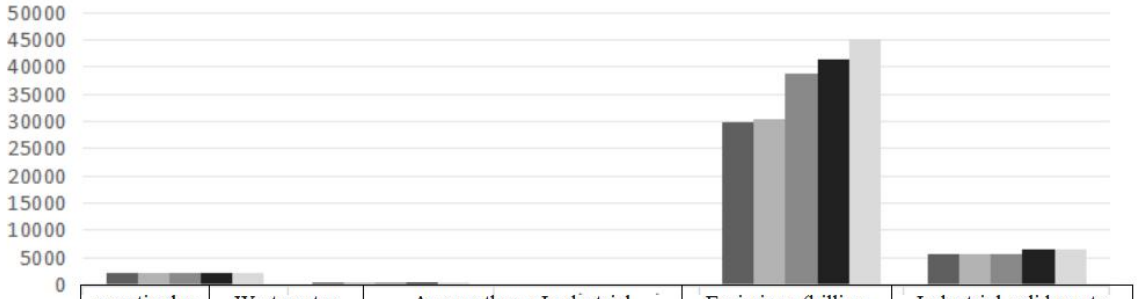
Source: Department of Natural Resources of Guangdong Province-Dynamic Monitoring Report on Urban Land Prices in Guangdong Province (2021)

The year-on-year growth rate refers to the growth rate of the land price level value in the current reporting period (valuation date: December 31, 2021) compared with the same period of the previous year (valuation date: December 31, 2020).

The quarter-on-quarter growth rate refers to the growth rate of the land price level value in the current reporting period (valuation date: December 31, 2021) compared with the previous reporting period (valuation date: June 30, 2021).

The reduction in new land supply has driven up land prices, significantly increasing acquisition costs for manufacturers. High industrial rents reflect the rising manufacturing expenses amid industry transformation. In the post-epidemic era, some local governments raise land taxes and fees to alleviate financial pressures, often transferring these costs to manufacturers. This situation forces companies to either bear high rents or

consider relocating, which dampens investment in industrial land.[17] Comprehensive policies like "Retirement of two industries into three" and "upgrading of industries" aim to optimize land resource allocation and promote high value-added industries. However, their implementation has not effectively addressed the cost challenges faced by manufacturing firms. Key issues include high relocation and logistics costs, poor industrial suitability in new areas, and financial pressures from reconstructing production lines. These challenges increase uncertainty in industrial transformation. The policies, while focused on structural change, lack customized support and complementary measures, which hinders their effectiveness in alleviating cost pressures on manufacturers (see Figure 5 and Figure 6).



	a particular year	Wastewater (billion tons)	Among them: In dustrial wastewater (billion tons)	Emissions (billion cubic meters)	Industrial solid waste (thousand tons)
Series 1	2014	90.51	17.76	29793.8	5665.09
Series 2	2015	91.15	16.15	30547.48	5608.6
Series 3	2016	93.83	13.16	38846.12	5609.76
Series 4	2017	88.2	13.03	41267.54	6339.99
Series 5	2018	90.4	12.25	45023	6623.36

Figure 5. Industrial Waste Data of Guangdong Province from 2014 to 2018

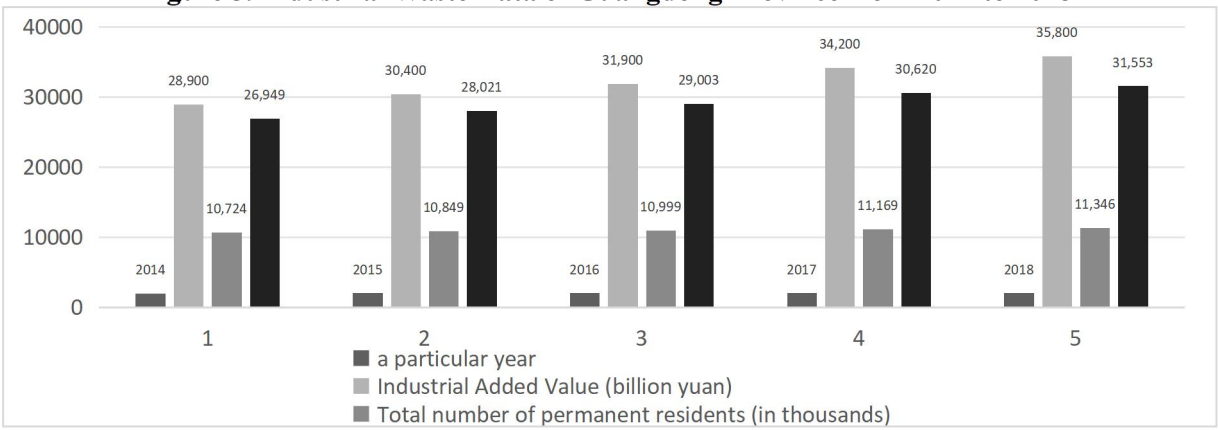


Figure 6. Per Capita Industrial GDP of Guangdong Province from 2014 to 2018

Source: According to the Guangdong Provincial Department of Natural Resources-Report on the Dynamic Monitoring of Urban Land Prices in Guangdong Province (2021).

4.1.2 Manufacturing layout factors

The Pearl River Delta region has struggled with unified territorial planning and lacks comprehensive metropolitan design[18]. While areas like Guangzhou-Foshan and Shenzhen-Dongguan-Huizhou have formed metropolitan clusters, issues of homogenized competition and resource mismatch persist, causing imbalances in manufacturing layouts due to administrative divisions. Policies aimed at industrial reform have led some manufacturers to relocate from the PRD to other regions in Guangdong, but poor coordination and inadequate local support hinder successful integration after relocation. Additionally, the PRD's manufacturing growth has been marked by a "development first, planning later" approach, resulting in inefficient, polluted, and fragmented industrial parks and factories. [19] From 2014 to 2018, industrial environmental pollution in Guangdong Province increased, highlighting a need for improved treatment effectiveness. In Foshan City, village-level industrial parks cover 367,000 acres, about half

of the city's industrial land, yet contribute only 7.8% to the industrial output value. These parks face issues of "low volume, low investment, and low output," indicating an imbalance between manufacturing output and land resources. The poor layout of the manufacturing industry in the PRD hampers high-end, sustainable development and poses a bottleneck for the industry's transformation and upgrading.

4.1.3 Manufacturing scale factors

Increasing marginal costs are squeezing enterprise development in the Pearl River Delta (PRD) region due to limited land resources. As land acquisition costs continue to rise, manufacturing enterprises are facing significant pressures that inhibit their growth. Furthermore, the lengthy approval process for industrial land acquisition restricts flexibility and responsiveness to the market, which limits competition and the potential for enterprise expansion. Local governments often favor larger, established companies when allocating land, making it difficult for small and medium-sized enterprises to compete. While this may boost short-term output for larger firms, it undermines the overall health of the industry and risks creating a polarized landscape of enterprises.

4.2 Land Governance Challenges

China has deepened land reform, with Guangdong Province exploring ways to optimize land use. The province has implemented measures for high-quality development, aiming to enhance the relationship between people and land and promote harmonious coexistence with nature. [20] The urbanization of the Pearl River Delta (PRD) has largely been driven by rural industrialization and the rise of township and village enterprises. However, inadequate land planning has led to inefficient, disordered, and fragmented land use. Increasing land resource constraints and shifts in industrial structure are now key challenges for the high-quality development of the manufacturing sector. This analysis focuses on the inherent issues of land governance and related land policy problems in the PRD region.

4.2.1 Inherent problems of land

The inherent issues of land stem from its irreversible and non-renewable constraints, independent of policy implementation. During urbanization, the PRD's core region exhibits spontaneous evolution, contrasting with the orderly land use in the YRD region. The two main problems in the PRD are high land development and limited land supply.[21] Over the past 40 years, land development intensity in the PRD region has surpassed the 30% warning line, with Shenzhen at 50% and Dongguan at 48.5%. Alongside this excessive development, the region is also facing a shortage of land stock and spatial resources.[22] In Dongguan City, there are 429,000 acres of unutilized land, but only 60,000 acres of construction land can be developed. In 2015, the construction land development intensity was 46.2%, significantly higher than the provincial average. Guangdong issued about 15,000 acres of new land, while the demand exceeded 25,000 acres, creating a gap of over 10,000 acres. This shortage highlights the challenges in land supply, which is a major bottleneck for the manufacturing industry in the Pearl River Delta. There is an urgent need to shift land development from "incremental expansion" to "stock optimization."

4.2.2 Policy problems of land

Land policy issues relate to inefficient utilization, misalignment with objectives, and uneven resource distribution due to institutional arrangements. In the PRD region, these systemic deficiencies need urgent attention to support the transformation of the manufacturing industry and regional development. Targeted reforms should address four key aspects: development mode, development entities, development stock, and the development market. In the Pearl River Delta (PRD) region, the dualistic "state-owned-collective" land development model struggles to meet spatial optimization needs due to national mandates on land governance[23]. This model creates ambiguities in land ownership and use rights, leading to unclear responsibilities for users and misalignments between governance and economic operations. To address insufficient construction land targets and generate land grant revenues, local governments often control collective land rights from villages and communities, transferring land to enterprises for profit. These behaviors [24] very easy to breed local officials "opportunistic tendency". Village organizations, as controllers of collective land, often exhibit "short-termist" and "speculative tendencies," leading to opportunistic land development. To boost dividend income, they frequently attract high-energy-consuming and high-polluting enterprises, illegally converting agricultural land for construction. These actions

worsen the confusion between urban and rural land functions in the PRD region, raise land transaction costs, and create significant negative externalities. In the PRD region, industrial land is primarily collective, developed independently by village organizations with low-cost facilities, often leased to low-end manufacturers[25]. The limited availability of single-unit land and mixed industrial categories hinders industrial chain development, leading to underutilized land and frequent disputes, reflecting governance challenges. Additionally, the unsound land development mechanism faces pressures from declining external demand and rising manufacturing costs. [26] Stock land development differs from new construction land, as it often involves a complex interplay between the government, enterprises, and developers, leading to increased coordination challenges and disputes. The imperfections in the land development market hinder manufacturing growth and disrupt healthy competition. There is an urgent need to adjust China's land market model to enhance market vitality and ensure land resources effectively support economic development, avoiding a "path dependence" control trap. Industrial land grants are a key aspect of this development. [27] The inherent framework of industrial land grants in China, governed by the "People's Republic of China Interim Regulations on the Granting and Transfer of the Right to Use State-owned Land," limits the maximum term to 50 years. This mismatch with enterprise life cycles often leads to land being held idle after businesses close, resulting in inefficient land use and hindering industrial metabolism. The disparities in land use duration among manufacturing enterprises further highlight the inadequacy of the existing supply model, imposing excessive constraints on corporate behavior and contributing to resource waste and hindering industrial advancement.

5. Description and Analysis of Research Cases

This chapter explores the transformation of manufacturing enterprises influenced by land policy through two case studies: Zhongshan Torch Development Zone and Jiangmen Taishan Industrial Transfer Park. The Torch Development Zone represents "in-situ transformation and upgrading," while the Taishan Industrial Park focuses on "off-site transformation." By utilizing the "regime-behavior-path" framework, this chapter aims to provide theoretical insights into the manufacturing industry's transformation in the PRD and beyond.

5.1 Transformation Path of Manufacturing under the Influence of Land Policy

5.1.1 Case background

(1) Zhongshan Torch Development Zone

[28] In 2024, the Torch Hi-tech Zone reported a GDP of 57.372 billion yuan, growing 3.5% year-on-year, while industries above designated size increased by 2.9% and industrial investment rose by 11.8%. However, Zhongshan City faces challenges with land resources, as exploitation rates are high and inefficient. By the end of 2021, land development intensity approached 40%, with some areas exceeding 50%. Early development of factory buildings took up 112,000 acres, making up 33% of allocated industrial land. Consequently, the Torch Area struggles with land allocation imbalances, structural contradictions, and limited new construction land after over 30 years of development, leading to a disorganized industrial layout.[29] The Shabian Area, the oldest industrial zone in Torch Area, struggles with low manufacturing efficiency, with most industrial land yielding under 1 million yuan/mu. Factory buildings are typically 1-3 stories with a floor area ratio of 1.51, and there is a prevalence of enterprises characterized by "three highs and two lows." This has resulted in low value-added, low-tech industries concentrating in the Torch Development Zone, causing environmental issues like industrial wastewater and volatile organic compounds emissions. This disconnect between land resource utilization and industrial transformation has prompted the Torch Government to consider optimizing land policies to reshape the industrial structure.

(2) Taishan City Industrial Transfer Park

Taishan City Industrial Transfer Industrial Park, also known as Taishan City Industrial New Town, is located in northern Taishan City, near the downtown area. Covering 138 square kilometers, it serves as the industrial center and urban gateway of the city. Since the early 21st century, the Pearl River Delta's manufacturing industry has faced challenges such as limited land, rising labor costs, and transformation risks. [30] In the 2008 "Guidelines for the Regional Layout of Industrial Transfer in Guangdong Province," the government emphasized the urgent need for industrial transfer, outlining plans to move

industries from the Pearl River Delta (PRD) to eastern, western, and northern regions. Despite measures taken since then, regional development remains unbalanced; by 2022, the nine PRD cities contributed 80.7% of Guangdong's GDP, while the other areas accounted for under 20%. This disparity continues to affect coordination between core and non-core regions. Recently, Jiangmen City has been supported to lead industrial transfers as part of the province's plans for coordinated development. Taishan Industrial New Town is facilitating the migration of manufacturing from major cities like Guangzhou and Shenzhen, creating an efficient industrial chain. By 2024, it aims to host over 800 enterprises, with an industrial output exceeding 55 billion RMB.

5.1.2 Policy mechanisms

Amid industrial optimization and land scarcity in the Pearl River Delta (PRD), the design of the regime is crucial for effective industrial transformation and land allocation. The "14th Five-Year Plan" for Guangdong emphasizes two key goals: promoting high-end manufacturing development in the PRD to foster coordinated growth across the province, and encouraging innovative "enclave economy" strategies through cross-regional benefit-sharing mechanisms. The practices in Zhongshan and Taishan illustrate how policy differentiation drives enterprise behavior and leads to distinct transformation paths.

(1) Zhongshan Torch Development Zone

Against the backdrop of deep changes in the industrial structure, the government of Torch Development Zone in Zhongshan City has promoted structural reforms in the manufacturing industry through a series of regime innovations in land policies, and has continued to attract high-quality manufacturing industries to the park on the basis of transforming traditional inefficient manufacturing industries. Among them, the governance mode of "industrial areas reformation" integrating land policy and manufacturing transformation has become a highlight of Torch Development Zone in cracking the multiple structural conflicts intertwined with land and industry. The policy of "industrial areas reformation", as its name suggests, is the transformation of industry into industry. It usually refers to the transformation of the stock of inefficient industrial land into a new development space with high efficiency, high quality and high quality, and the nature of the transformed land is new industrial land (M0) or general industrial land plus new industrial land (M1+M0), including plant buildings, R&D buildings and other diversified property forms.

[31] In the Torch Development Zone, the "industrial areas reformation" policy faces two main challenges: integrating interests among various stakeholders and coordinating implementation. This policy involves government entities, transformation enterprises, collective economic organizations, and local residents, making it essential to balance public values and everyone's interests. To address this, the Torch District Government has implemented a "Management Committee + State-owned Enterprises" model, where the government facilitates project promotion and offers guidance. To tackle coordination issues, such as multiple property rights and interconnected transformations, the government has proposed a contiguous transformation plan. This plan emphasizes identifying industry types and construction standards, shortening project timelines, and ensuring cohesive land use. Additionally, the Torch District has optimized processes through "multi-planning" and parallel approvals, allowing companies like Zhongshan Deyouxin Intelligent Equipment Co., Ltd. to secure planning permissions and real estate rights in just 4 minutes.

(2) Taishan City Industrial Transfer Park

Taishan Industrial New City has effectively promoted the relocation of manufacturing industries from the core areas of the Pearl River Delta into the park through the construction of a multi-level innovative land policy oriented to undertaking transfer of "access + subsidies + guidance". First, the new industrial city investment documents highlight strict land supply requirements for manufacturing enterprises: a minimum investment of 3 million yuan per acre, land tax of at least 250,000 yuan per acre per year, a floor area ratio of at least 1.2, and alignment with the park's industrial planning, architectural style, and environmental standards. These measures aim to enhance industrial land use efficiency and transition from quantity to quality, reducing low-efficiency enterprises from occupying resources. Second, The "Taishan Industrial New Town Investment Project" offers preferential subsidies for enterprises renting factory buildings. Companies with an annual output tax of 150,000 yuan can receive a

monthly rent subsidy of RMB 2 per square meter for the first three years. Additionally, timely completion of factory construction can earn rewards of RMB 60-120 per square meter, depending on the building type and floors. These financial incentives aim to attract small and medium-sized enterprises, effectively lowering their initial investment costs. Third, The Industrial New Town focuses on clean energy, automobiles, and new materials as key industries, with electronic information equipment, classical furniture, and special equipment manufacturing as complementary sectors. Zhongnan Hi-Tech, part of Zhongnan Group (ranked 118th among China's top 500 companies), has invested 2.5 billion yuan in its construction. The Zhongnan Hi-Tech (Taishan) Intelligent Equipment Manufacturing Park serves as a hub for manufacturing, R&D, design, and corporate headquarters in the science and technology sector. The establishment of a sound industrial model minimizes resource waste from traditional investment promotion, fosters industrial clusters, enhances land and production efficiency, and strengthens enterprises' risk resilience. Taishan City Industrial New Town has developed a three-dimensional policy system integrating land supply, financial incentives, and industry guidance. This approach aligns with the industrial transfer in the Pearl River Delta, facilitating a smoother transition for manufacturing enterprises and solidifying Taishan's strategic position in the manufacturing sector.

5.1.3 Behavioral models

Land policy serves as an external factor for firms, offering both incentives and constraints. Actors seek social adaptability and legitimacy while maximizing interests, resulting in varied responses to land policy. In Zhongshan City's Torch Development Zone, the manufacturing industry emphasizes technological upgrading, while Taishan City Industrial New Town is seen as a "rational choice" for regional manufacturing transfer.

(1) Zhongshan Torch Development Zone

The land policy of "industrial areas reformation" in Zhongshan City's Torch Development Zone is encouraging enterprises to adapt their production and operations. This shift is marked by a focus on technological upgrading and industrial ecology. By 2023, over half of the 560 large enterprises in the area will have undergone digital transformation, particularly in advanced manufacturing, electronic information, and healthcare. The Xibanyu Innovation Industrial Park exemplifies this change, having replaced outdated facilities with a new 129,000-square-meter biomedical factory, increasing the plot ratio from 1.51 to 3.49. This transformation leads to lower operational costs and more efficient land use for industries. As land costs rise and usage standards increase, enterprises are achieving more efficient land use through digital and intelligent transformation, reducing the risk of relocation. To balance transformation stability and operational continuity, some companies are employing a "transforming while producing" strategy, minimizing losses during the transition. The "industrial areas reformation" policy pushes businesses to optimize their industrial structures. Small and medium-sized enterprises adopt an "up and down" operational model, handling R&D, production, and sales within a limited area, while larger companies utilize an "upstream and downstream" model. This spatial organization effectively reduces production and time costs and fosters collaboration in the manufacturing process. Zhongshan Hantong Laser Equipment Co., Ltd. is a key player in the United Speed Science Park, focusing on upgrading the industrial chain to be more high-end and intelligent. This policy-driven and technology-based approach aims to transform the manufacturing industry in the Torch Development Zone, addressing challenges like inefficient land use and imbalanced industrial structure, while striving for greater capacity and breakthroughs.

(2) Taishan City Industrial Transfer Park

Taishan City Industrial New Town, located in the non-core area of the Pearl River Delta, is tasked with absorbing low-end industries from the region's core. In recent years, its manufacturing sector has focused on cost-oriented and scale migration strategies. With rising labor costs-averaging RMB 55,324 in 2015 and increasing to RMB 82,783 by 2021-profit margins for enterprises have been squeezed, as reported by the China Statistical Yearbook.[33] In addition, the average listing price of industrial land in major cities in China increased by 13.6% in 2019 compared with 2012. As land resources in China have tightened and land costs have climbed in recent years, firms often relocate low-end manufacturing to lower-cost regions due to profit maximization[34]. Over half of

Chinese labor-intensive firms face challenges from rising labor and raw material costs, prompting many to move from core areas of the PRD to the east, west, and northern Guangdong. Taishan Industrial New City has emerged as a key relocation site, benefiting from cost advantages and fostering industrial agglomeration through supportive policies. Land prices in Taishan City are 1/3 to 1/4 of those in the core Pearl River Delta, averaging RMB 600/square meter, compared to RMB 1,500-2,500 in Guangzhou, Foshan, and Dongguan. This allows businesses to lower initial investments and secure more industrial space. Additionally, Taishan has ample developable hilly land, unlike the fragmented land in the core PRD area. Taishan City offers ample hilly land for development, unlike the fragmented areas in the Pearl River Delta. With over 15,000 acres designated for industrial development, the city is focusing on clustering industries such as auto parts, new metal materials, and intelligent agricultural machinery. This new approach emphasizes large-scale industrial concentration, supporting the Pearl River Delta's manufacturing ecosystem with adequate land supply. Guangdong Fuhua Heavy Industry Co., Ltd, the largest global producer of chassis components for commercial vehicles, relocated to Taishan Industrial New City in 2007. This move attracted numerous manufacturing industries along the industrial chain, thanks to Fuhua's advanced production technology and brand influence. By 2023, Taishan's auto parts industry cluster generated an output value of 22.562 billion yuan, with SMEs contributing 77.11%. The park not only attracts industries but also fosters collaboration among various sectors, creating a complete industrial ecosystem that enhances the local manufacturing industry's transformation and upgrading.

5.1.4 Path results

Torch Development Zone is focused on endogenous upgrading, enhancing local enterprises through improved production technology and intelligent transformation. In contrast, Taishan City leverages its low land and labor costs for exogenous industrial transformation and upgrading, guided by policy and location advantages.

(1) Zhongshan Torch Development Zone

The manufacturing industry in Zhongshan City's Torch Development Zone is evolving through an endogenous power model that maximizes limited space resources for high-end industrial growth. By reconfiguring industries and upgrading technology, the zone aims to enhance output efficiency and promote industrial clustering for high-quality economic growth. Since 2021, it has launched 76 projects focused on "industrial areas reformation."Efforts include dismantling old factories to create high-standard industrial parks, resulting in 4.2 million square meters of new industrial space. This has attracted approximately 20.8 billion yuan in investment and is projected to generate an additional 1.18 billion yuan in annual tax revenue, significantly transforming the region's industrial landscape. The focus is on improving land use efficiency, encouraging enterprises to prioritize output value per unit of land over plant size. To address land resource scarcity, improving land area ratios and output efficiency is crucial for better space utilization. Technological upgrades turn enterprises into value creators, enhancing land value and benefiting the local government financially. Ming Yang Intelligence, a top 500 company in China within the Torch Development Zone, contributed significantly to local tax revenue, paying 630 million yuan in enterprise income tax in 2021. The Energy High-end Equipment Manufacturing Park is an advanced facility built in four phases, featuring areas for intelligent electric power equipment, green materials, hydrogen equipment, and living support. This integration highlights scientific mechanisms, while Ming Yang Intelligence's development emphasizes technological upgrades and efficient space use under the "industrial areas reformation" policy.

(2) Taishan City Industrial Transfer Park

The development of Taishan City Industrial New Town focuses on transferring manufacturing capacities from the Pearl River Delta, aiming for industrial expansion and regional synergy. In 2024, the Taishan Municipal Government reported that the Taishan Transfer Industrial Park has expanded from 1.12 to 10 square kilometers., with an investment of $14.5 billion in 28 key projects across industries like metal materials, automotive, and high-end equipment, highlighting Taishan's robust industrial capacity. It can be seen that Taishan City has a strong capacity for spatial expansion and industrial acceptance. For regional synergy, due to the successive opening and operation of the Shenzhen-Zhongshan Corridor and Huangmaohai Bridge, the passage time between

the east and west coasts has been greatly shortened, which is conducive to the flow of production factors between the core and non-core regions of the Pearl River Delta, accelerating the pace of manufacturing spillover from the core region of the Pearl River Delta to the Taishan area. On this basis, in the role of location advantages, Taishan Industrial New City formed a "cross-regional economy + chain gathering" path of industrial acceptance. "cross-regional Economy + Chain Aggregation" completely breaks the original "low-cost" path of dependence by building a cross-regional enterprise cooperation model and creating a long-term industrial ecological chain relationship. Zhongshan can shift high-cost manufacturing projects to Taishan Industrial New City, freeing up space and maintaining local financial income. This benefits Taishan by attracting industrial parks and boosting local revenue through land appreciation. Overall, the approach of "cross-regional economy + chain aggregation" addresses capital outflow challenges, enhances regional advantages, and encourages diverse industrial layouts across regions. The development of the "cross-regional economy" in Taishan Industrial New Town faces challenges related to horizontal cooperation among construction parties and the government, particularly concerning tax sharing, management organization setup, and land approval. These issues have contributed to delays in industrial relocation.

5.1.5 Case summaries

In the end, The Torch Development Zone in Zhongshan City has successfully created a robust industrial space through its innovative "industrial areas reformation" policy. This initiative encourages enterprises to enhance their productivity using limited land, pushing them towards digitization and intelligence. As a result, the zone has achieved "in situ transformation and upgrading" for traditional manufacturing. Similarly, Taishan City Industrial New Town has established a multi-level land policy system focused on enhancing manufacturing quality. Its strategic location within the Pearl River Delta (PRD) region facilitates the orderly migration of manufacturing industries to western Guangdong Province. The new town capitalizes on scale effects and agglomeration efficiency to foster industrial collaboration and development in the region.

6. Conclusion of the Study and Construction of the Transformation Path

6.1 Conclusions of the Study

By constructing the analytical framework of "regime-behavior-path" and combining the case comparison between Zhongshan and Taishan, this paper integrates the land factor allocation into the spatial decision-making of enterprises, which makes up for the insufficiency of the research on the dynamic response of micro subjects under the influence of policies.

This paper draws the following conclusions: policy-driven is the key to the transformation of the manufacturing industry. Zhongshan Torch Development Zone's "industrial areas reformation" policy and Taishan City Industrial New Town "access + subsidies + guidance" as the representative of the land policy through the land access regime, land supply model, financial incentives and other measures to change the manufacturing enterprise behavior patterns and transformation path. The effective implementation of these policies relies on combining incentives and constraints that align with the life cycle of enterprises, industrial characteristics, and regional contexts. This approach serves as a reference for manufacturing upgrading policies in central and western regions. Incentive mechanisms, such as preferential land policies, encourage enterprise clustering in large-scale production parks, facilitating the flow of production factors. In contrast, constraint mechanisms push companies to upgrade technology, reduce land reliance, and optimize business structures. Ultimately, transformation and upgrading are influenced by factors like sunk costs and market expectations, leading enterprises to evaluate their risks and choose a rational path forward.

The study identified a mismatch between policy objectives and enterprise capabilities in land policy implementation. Differences in support and land policies between core and non-core regions of the PRD hinder timely industrial support and increase costs. Additionally, the economic downturn has forced many small enterprises to exit the market, raising risks for manufacturing in the region. To address these issues, the PRD must shift away from inherent land policies and instead transform land elements into tools that promote innovative productivity for manufacturing enterprises.

6.2 Transition Path Construction

6.2.1 Policy optimization pathways

[35] The implementation of land policy depends on enhancing market-oriented reforms, encouraging local governments to develop zones and industrial parks through investment and factor-driven methods, and facilitating land transfer to the industrial sector. To align with the Central Government's 2024 goals for improving land management and conservation, this section proposes a three-tiered synergistic mechanism for land policy that complements the necessary optimization paths.

(1) Strengthening regional synergy and industrial support

The manufacturing industries in the Pearl River Delta (PRD) region are interconnected, creating a cohesive manufacturing chain. To achieve regional synergy and support industrial growth, it is essential to overcome traditional land policy constraints and administrative barriers. Key actions include: 1. "Establishing a Regional Synergistic Industrial Development Fund": This government-led fund will promote industrial cooperation through various financial methods, including special bonds and bank loans. The goal is to attract social capital to key industries, reduce costs, and improve infrastructure in areas outside the core regions. 2. "Exploring Real Estate Investment Trusts (REITs)": This mechanism will help revitalize idle manufacturing assets through securitization, thereby lowering financing costs. For example, Guangzhou has initiated a pilot REIT fund that offers substantial subsidies to support the gradual relocation of the manufacturing industry from core areas to the outskirts of Guangdong.

(2) Consideration of the life cycle and size of the enterprise

[36] The enterprise life cycle theory indicates that companies at different stages exhibit distinct traits regarding financing, financial status, and innovation. To effectively implement land policies, targeted support for financial elements is essential, allowing businesses to capitalize on the policy's "window period". Firstly, we should create tailored rental subsidy standards based on the manufacturing industry's life cycle and scale. Start-up enterprises should receive high rental subsidies to reduce initial costs, while growth-stage businesses can benefit from gradually decreasing subsidies to encourage scaling. For mature enterprises, technical subsidies aligned with national strategies will promote further investment in research and development. Secondly, we need differentiated loan amounts and interest rate subsidies. Start-ups should have access to small, heavily subsidized loans to ease cash flow, while growth-stage companies can expand through moderate interest rate subsidies. The 2025 Guangdong Province plan states that interest rate subsidies will not exceed 35% of the bank lending rate, with total subsidized loans reaching up to 200 billion yuan annually. This will reduce financing costs and support technological upgrades for mature enterprises, linking interest subsidies to output benefits.

(3) Innovative land supply and management models

[37] There is a key relationship between the development of productive forces and land resource allocation. Advancements in these forces require changes in how land is distributed, and new allocation methods can further stimulate development. To innovate land supply and management amidst ongoing industrial and technological shifts, we should implement a flexible land leasing model that adapts the standard 50-year lease based on business lifecycle needs, allowing for flexible contract renewals and incentives for high-performing enterprises. Additionally, introducing an inter-term land pricing system can aid small and medium-sized enterprises by enabling installment payments and lowering initial costs. To optimize land use, we must reform industrial areas by identifying underperforming enterprises and land for transformation, focusing on tax and investment intensity to attract high-value businesses. Lastly, consider converting inefficient industrial land in urban areas for commercial or residential use to enhance manufacturing competitiveness.

6.2.2 Enterprise Transformation Path

The Pearl River Delta (PRD) accounts for around 80% of Guangdong Province's economic output, making it one of China's most dynamic regions[38]. Manufacturing enterprises should adapt to evolving land policies to enhance their structural transformation, focusing on optimizing resource allocation, spatial layout, and industrial development.

(1) Enhancing Digital and Intelligent Transformation Capabilities

The concept of new quality productivity signifies an important advancement in productivity evolution, propelled by

technological innovations and new production configurations. It emphasizes the necessity for high-quality development within the manufacturing sector, concentrating on boosting technological innovation and enabling upgrades through digitalization and intelligent systems. Historically, the Pearl River Delta (PRD) has relied heavily on labor-intensive industries, which has created challenges for industrial transformation and upgrading in the region.[40] Companies should embrace digital talent to lessen their dependence on traditional labor. At the same time, labor-intensive manufacturing industries need to work together with technology providers to facilitate digitization. This strategy will strengthen the real economy, optimize land utilization, and enhance output efficiency, while also looking for more growth opportunities under policy guidance.

(2) Reasonable formulation and implementation of industrial transfer strategies

[15] Industrial transfer involves reallocating resources and adjusting market labor divisions across different industrial chains and regions. [32] "cross-regional economy" as a typical benefit-sharing and counterpart support means, can break through the administrative region and geographical boundaries. In this context, large enterprises can build a cross-regional industrial platform to absorb more enterprises into their parks, thus realizing the rational allocation of resources between different regions.

(3) Enhancement of industry chain integration and synergy

Large and medium-sized manufacturing enterprises should collaborate with small and medium-sized ones to leverage their advantages. By creating a value chain focused on land, they can enhance research, procurement, production, and sales, aiming to maximize returns while minimizing costs. Industry chain integration is crucial for enhancing enterprises' risk resistance[39]. To achieve this, companies should leverage digital management to create a land information analysis platform. This platform will integrate land resources with the industrial chain, enabling timely warnings and prevention of risks related to land instability, ultimately increasing the resilience of the industrial chain.

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